

# Distributed training and rural health professions education

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# Distributed training and rural health professions education

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# Editorial: Distributed training and rural health professions education

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## KEYWORDS

distributed training, rural health, health professions education, social accountability, community engagement, rural career pathways, place based education, Longitudinal Integrated Clerkships (LICs)

## Editorial on the Research Topic

### Distributed training and rural health professions education

## Introduction

Since the early 20th century, most medical and other health professions education around the world has been predominantly based in large acute hospitals, known as teaching hospitals or academic health centers (1). In the latter half of the 20th century, there were moves to focus health professions education outside hospitals into the community, initially through Community Oriented Medical Education and subsequently Community Based Medical Education (2). During the same timeframe, population trends and changes in health service delivery contributed to increasing inequities for people living in remote and rural communities, particularly in access to healthcare (3). By the early 21st century, social accountability and community engagement were recognized as transformative trends in health professions education (HPE), aiming to ensure equitable access to high-quality healthcare delivered by well-trained professionals (4, 5). The 2010 *Lancet* Commission on Education of Health Professionals for the 21st Century recommended that academic institutions build strong relations with communities to provide a context for education programs focused on achieving health equity (6).

Fifteen years later, HPE is still predominantly based in large city teaching hospitals (7) and many remote and rural communities experience challenges accessing healthcare with shortages of skilled health workforce a major contributing factor (8). There have however been efforts internationally to ensure HPE takes place across a wide distribution of healthcare sites, including rural areas (9). In this context, *Frontiers in Medicine* initiated a Research Topic on Distributed Training and Rural Health Professions Education. This Research Topic attracted 18 manuscripts that are published in this Research Topic drawn from around the world, including three from low- and middle-income countries (LMIC), three articles from Europe, five papers from North America and seven

articles from Australia. These 18 publications consist of: nine Original Research articles; two Brief Research Reports; three Curriculum, Instruction and Pedagogy papers; two Scoping/Systematic Literature Reviews; two Perspectives; and one Community Case Study. Ten of the articles focus on undergraduate HPE with three articles on postgraduate training, three research papers, and two articles that focus on community capacity building. Major themes that emerged from the articles are set out in the following sections.

## Fostering rural community capability

In post-conflict Colombia, [Lombo-Cacedo et al.](#) report on the success of a community-based intervention aimed at strengthening the competencies of informal caregivers in remote rural communities. This model of distributed training was found to be empowering and community building, with caregivers gaining not only knowledge and skills, but also enhanced self-efficacy and status in the community.

Scotland has developed Community Training Hubs in the remote, rural and island context toward addressing recruitment and retention challenges in the primary care workforce, particularly general practitioners, advanced nurse practitioners, pharmacists and practice nurses. In their Brief Research Report, [Munoz et al.](#) present the development of their proposed evaluation framework designed to demonstrate the effectiveness of the Hub strategy in attracting and retaining talent, as well as reducing social disparities and promoting the growth of a sustainable health workforce.

## Building place based education and research

With a focus on social accountability, [Fuller, Beattie, McGrail et al.](#)' scoping literature review identified 138 articles on place-based preregistration HPE, with 50 unique HPE programs (predominantly medicine, nursing and midwifery) from 12 countries. Place-based programs were characterized by three common features closely aligned with social accountability: widening access to HPE; comprehensive program design; and a community-engaged approach.

Turning to research, [Schmidt et al.](#) in Australia undertook a focused Systematic Review in the form of a realist synthesis that demonstrated rural workplace-based research training is effective, but not sufficient to build and maintain rural health research capacity. Addressing both structural and individual factors is needed to build rural health research capacity and generate real-world health research to drive meaningful improvements in rural health. These findings are echoed by [Welton et al.](#) in Canada whose Perspective presents the case for rural health research to be undertaken in rural communities, by rural communities, for rural communities.

## Immersive community engaged education including Longitudinal Integrated Clerkships

The majority of articles in this Research Topic highlight the importance of prolonged place-based undergraduate HPE and postgraduate training that occurs predominantly in remote and rural community settings.

Rural family practice based Longitudinal Integrated Clerkships (LICs) are well-established examples of immersion whereby students are living in a rural community and learning their core clinical medicine from the family practice, community perspective ([10, 11](#)). In Canada, [Kelly et al.](#) explored the students' experience of LICs. They found that, beyond continuity of relationships with preceptors and patients, factors such as personal relationships, community connections, learning in a resource-strained environment, geographical isolation, and other socio-political dynamics, impacted the LIC learner experiences of continuity and community integration. The Scottish Graduate Entry Medicine (ScotGEM) program features a LIC as students' principal clinical year in rural general practice ([Graham et al.](#)). There are signs that ScotGEM graduates are more likely to choose rural careers and primary care than graduates from other Scottish medical programs.

The length and the depth of immersion were shown to contribute to impact. In Australia, [Harvey, Ali et al.](#) found that, when compared to 1 year, graduates of 3 years of rural immersion were significantly more likely to practice in remote, rural or regional areas. The South African experience of rural homestays highlighted the value of deeper immersion whereby students live with local families during their 7-week rural placement. [Gaede](#) found that, in addition to place-based educational value, the homestays showed a strong potential for humanizing the professional development of students, underpinned by active authentic relationships between students and community members.

## Scalable distributed postgraduate training

In the Philippines, [Espina et al.](#)' Community Case Study presents the design and implementation of the Sorsogon Province-wide Practice-Based Family and Community Residency Training Program a distributed, *in-situ* model co-developed by the Sorsogon Provincial Government and the Philippine Academy of Family Physicians. Over 4 years, the program has matured to achieve full accreditation status and has successfully prepared its trainees to lead primary care delivery in resource-constrained, community-based settings. This case highlights the feasibility of scaling practice-based residency training models in LMICs through strong local governance, policy support, and community-responsive curriculum design.

The Australian Remote Vocational Training Scheme (RVTS) provides a scalable approach to rural general practice training that utilizes distance education and remote supervision. [Giddings et al.](#) report that RVTS enables trainees to stay in their rural, remote

and Indigenous communities while working toward specialist certification as a general practitioner. Also in Australia, [Seidu et al.](#) explored Additional Skills Training (AST) for rural generalist practice and found that AST is a highly valued by GPs involved in the program who were intrinsically motivated to participate. However, to ensure its sustainability, wider recognition of the value, better visibility, and better alignment with community needs are required.

## Rural educational innovations

Curriculum innovations are a major feature of ScotGEM ([Graham et al.](#)), specifically: the Generalist Clinical Mentor (GCM) role; the year-long GP based LIC; and the Agents of Change (AoC) course. The GCM role involves employing clinical generalists in a multi-dimensional clinical-academic role providing mentorship, teaching and clinical services within university and affiliated clinical teaching practice settings. ScotGEM's underlying social accountability ethos led to the inclusion of AoC to help students develop the skills, knowledge and mindsets to drive positive change in diverse healthcare systems throughout their medical careers.

In Canada, [Perez et al.](#) present peer-led learning as an effective innovation whereby a rural background student organized a rural day-long educational excursion to their own community. They found that: informal teaching facilitated learning; trust in their peer enabled students to receive information more favorably; and students gained a better understanding of rural life and medical practice. Another Canadian innovation is Living Library story telling that was developed to provide students with better understanding of rural life and practice through narratives. [Perez Malhi et al.](#) found that the stories allowed students: to walk in a rural professional's shoes, enabling them to see "rural" in a new light; and to self-reflect and gain a sense of personal growth.

## Rural career pathways

Medical schools in Croatia largely continue the 20th century model of medical education with a lack of curricula content on rural medicine or specialized training for rural practice. [Mrduljaš-Dujić et al.](#) explored the perceptions of first and final year medical students and found that final year students felt insufficiently prepared for rural practice, although rural background students showed more interest in practicing outside the main cities.

The Alabama Rural Health Leaders Pipeline (ARHLP) developed over 25 years, specifically to support rural students, including from the Black Belt, through an education pathway into and through medical school toward a career in rural primary care. [Wheat](#) reports that, compared to peers in traditional medical education, ARHLP graduates more frequently chose family medicine specialty and rural Alabama practice with no difference in academic performance, although few graduates are practicing in the Black Belt.

In Australia, two universities cooperated to introduce an end-to-end rural medical pathway with a place-based curriculum and

distributed medical education (DME) model. Harvey, Van Schaik et al. report on the practical aspects of developing and delivering this pathway with the expectation that the program will foster long-term professional and personal ties to rural communities and prove to be a scalable and evidence-based model for addressing rural medical workforce shortages.

Another Australian rural medical pathway is reported by [Fuller, Beattie, Versace et al.](#) in the form of the place-based Rural Training Stream (RTS) including a rural LIC that was established (2022). The RTS involves recruitment of students from the medical school's designated rural footprint and supporting these students through local DME to graduation. Baseline findings suggest that RTS graduates may be more likely to stay in the rural footprint for up to 2 years, however subsequent attrition suggests the need to continue the pathway into and beyond postgraduate training.

## Conclusion

This Research Topic of articles adds value to the published literature specifically providing further evidence of the advantages of place-based, immersive community engaged education, cradle-to-grave facilitated rural career pathways, distributed postgraduate training for rural practice, and community engagement in rural health research, HPE and health service delivery (12). Drawn from eight countries in five continents, the articles confirm that, despite obvious differences between countries, remote rural communities across international borders face similar challenges and opportunities to improve healthcare and HPE. Despite this global breadth, contributions from LMICs were limited, underscoring barriers such as publication fees and English-language dominance. Addressing this gap is essential if the global discourse on distributed HPE is to be truly inclusive.

Although many distributed HPE programs are well-established, there still is a need for more data on long-term outcomes to establish what common features that are most likely to lead to long term rural health workforce stability. In addition, there is a need for greater training in all specialties in rural areas to sustain a fit-for-purpose workforce in larger rural and regional centers.

People living in remote rural communities and their healthcare providers are experts on themselves, so it is important to respect and value this expertise through co-creation, co-development, co-delivery and co-evaluation of education, training, research and health service delivery. Guided by social accountability and community engagement, this "start local" approach employs a strengths-based framework to enhance rural community capacity building, toward ensuring people in remote rural communities have access to high-quality healthcare delivered by locally trained health professionals (13).

## Author contributions

RS: Writing – original draft, Writing – review & editing. JW: Writing – review & editing. MA: Writing – review & editing. LV: Writing – review & editing. JM: Writing – review & editing.

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# Challenging perceptions about rural practice using narratives: a living library approach in medical education

Grace Perez<sup>1\*</sup>, Rebecca Malhi<sup>1</sup>, Kamiko Bressler<sup>2</sup>,  
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**Introduction:** The shortage of physicians in rural Canada is a continuing challenge. Canadian medical schools have adapted strategies to increase the supply of rural physicians. This study appraises the effectiveness of the living library (also called Human Library®) in medical education, as an avenue for medical and pre-medical students to engage in dialogue with rural health professionals. Similar to a conventional library, readers check out books, except that “books” are human volunteers willing to share relevant personal experiences, and “readers” are the learners. The reading is the personal interaction between human books and students through narratives of experiences. The program “The Library of Life—Stories of Rural Medicine” (TLolL), was developed to provide students with better understanding of rural life and practice through narratives.

**Methods:** This is a mixed methods study, using pre- and post-event surveys. Statistical comparisons were done using Wilcoxon and McNemar’s tests. Thematic analysis was used to explore students’ expectations of TLolL and to describe their experience and key takeaways.

**Results:** Most of the participants were from an urban background, had low familiarity with rural medicine and only 44% would consider a rural career prior to TLolL. After TLolL, improvements were observed in: (i) envisioning rural medicine as career option ( $p = 0.009$ ), (ii) appreciation of rural living ( $p = 0.013$ ), (iii) need for rural physicians ( $p < 0.001$ ), and (iv) rural practice consideration ( $p = 0.001$ ). Themes from students’ motivations for participation were: (i) students’ curiosity, interest, and (ii) their willingness to engage in dialogue with the human books. Themes from the key takeaways were that TLolL allowed students: (i) to walk in a rural professional’s shoes, enabling them to see “rural” in a new light, and (ii) to self-reflect and gain a sense of personal growth.

**Conclusion:** Students made gains in attitudes and perceptions toward rural practice. Narratives have the power to challenge held beliefs around rural practice and life, and can encourage students to consider things that traditional medical teaching may not. TLolL can be an effective learning modality in medical education to provide information about rural medicine, in combination with learning opportunities such as rural block rotations and longitudinal clinical clerkship immersions.

## KEYWORDS

living library, library of life, human library, rural medicine, rural practice, attitudinal change, undergraduate medical education, pre-medical students

# 1 Introduction

This study explores the role of the Living Library approach in medical education. The Living Library concept (also known as Human Library®) was originally developed in Denmark in 2000 as a strategy to bring people together to challenge prejudice, with the program described as “a library of the people” (1). Its motto “to unjudge someone,” stemmed from a desire to overcome discrimination and remove stigma from social conditions such as homelessness, alternate lifestyles, disabilities, etc. (2). A Living Library offers a framework to bring people from different groups together and have respectful and meaningful dialogue. It mimics the format of a conventional library with readers borrowing books, except that the “books” are human volunteers willing to share relevant personal experiences, and “readers” are the participants (e.g., medical students) (3). The reading is the personal interaction between human books and readers through narratives of experiences and personal stories (4, 5).

With the persistent shortage of physicians, the provision of equitable healthcare services in rural and remote communities in Canada is an ongoing challenge, putting additional strain on the Canadian healthcare system (6). Using Statistics Canada’s definition of “rural” and “small town,” about 19% of Canada’s population is rural (7). Recent data from Canadian Institute for Health Information (CIHI) indicated 96,020 physicians present in Canada, representing 247 physicians per 100,000 population, but only 8% of family physicians and 2% of specialists are in rural practice (8). Less than 10 years previously, 14% of family physicians were in rural Canada (9). This downtrend has reduced rural access to family physicians and widened the disparity in rural–urban health outcomes (10).

Canadian medical schools have employed strategies to increase the likelihood of physicians entering rural practice (11). These include admissions policies, rural-oriented medical curriculum, rural practice learning experiences, faculty values and attitudes, advanced procedural skills training and rural student recruitment (12). Rural student recruitment is based on extensive research demonstrating that those who have social attachments to their rural origins are most likely to practice in rural settings (13–17). A study of graduates from a Canadian medical school determined that having rural educational experiences on the continuum from high school through medical residency were associated with rural practice intention (18) and further substantiated by the recent synthesis of factors associated with successful recruitment and retaining of doctors in rural areas (19, 20). While rural upbringing is the most important predictor for rural practice consideration (21), the numbers of medical students from rural areas are not sufficient to eliminate the shortage of rural physicians. Studies have revealed that sociodemographic characteristics of Canadian medical students are not representative of the general population (22, 23) with only 6.4% of learners having grown up in a rural area compared with 18.7% of the Canadian population (24) and it is further compounded by a steady decline in enrolment of medical students with rural origins (25). Thus, a substantial portion of physician supply for rural Canada will come from urban areas (26, 27). Research showed that incoming medical students from urban and rural areas differ in their perceptions of rural life and practice and expression of practice intention (28). Likewise, an evaluation of factors affecting future practice decisions of urban-reared medical learners revealed that most know little of rural life and their perceptions of rural medicine often relied on generalizations and stereotypes (27, 29). This is concerning because misconceptions and

negative beliefs about rural medicine may dissuade urban-origin students from considering rotations in non-metropolitan locations or from eventual rural practice (3). In addition, feeling prepared for small-town living has been found to be a stronger indicator of physician retention than feeling prepared for rural practice (30). Hence, it is important that urban-origin learners are provided opportunities to gain an appreciation of rural life and learn more about rural practice, to encourage a robust pipeline of students who will consider future rural practice.

The authors of this paper are from a department of a medical school in Western Canada, aiming to provide rural educational opportunities and transformational experiences to encourage rural healthcare interest among medical students. Rural learning experiences include rotation-based clerkship in rural settings, longitudinal clinical rural immersions and the use of rural physicians as teachers and mentors. To better prepare the learners, the authors needed to find ways of making students consider things that traditional medical teaching may not, especially regarding perspectives about rural life and rural medical practice. The Living Library model was repurposed in a medical education context through their department program “The Library of Life—Stories of Rural Medicine” (TLLoL), to create an avenue for students to interact with rural healthcare professionals and other professionals with rural interests (3). This concept has been increasingly adapted and proven valuable in university settings and health disciplines, including diversity training and intercultural education (31), reducing prejudice in healthcare delivery (32), promoting mental health literacy and recovery (33, 34), reframing attitudes in higher education (2), and developing cultural awareness and sensitivity among occupational therapy students (35). The authors hypothesized that listening to narratives from rural physicians and other health professionals would provide learners with personal connection and valid information that may encourage participation in their department’s rural training opportunities, help change perceptions about rural life and foster more favorable attitudes toward rural medical practice.

## 2 Methods

### 2.1 Event format

The authors organized three TLLoL events. At each event, rural physicians and other professionals involved in rural medicine were recruited to discuss their career and personal experiences in rural communities with medical learners. Due to Covid-19 restrictions, the first event in 2020 was held online. By 2022, most of public health restrictions were lifted and two in-person TLLoL offerings were held in 2022 and 2023. Each in-person TLLoL followed a 3-rotations format, each rotation lasting 30 min: 15 min for books’ narratives, 10 min for interactive questions-and-answers portion and 5 min for transition. The Conjoint Health Research Ethics Board (CHREB) of the University of Calgary approved this research project.

### 2.2 Participants

#### 2.2.1 Human books

Family physicians and other professionals in rural practice and those with rural interests were recruited to be the human books.

Persons with relevant and engaging stories and experiences were selected and asked to present narratives of their experiences on some aspects of their work and rural life. TLoL has 25 human books in catalog. Books varied by community location, type of practice and sociodemographic background including age, gender, length of practice, ethnicity, and completion of medical training from both international and Canadian medical schools. At each TLoL session, 9 human books were available to present their stories. Some books have participated at multiple TLoL events.

### 2.2.2 Readers

The “readers” are medical students and pre-medical students from disciplines such as Nursing, Health Sciences, and other allied health programs who were invited to register. The authors advertised the event using posters and reached out to departments with similar rural interests for support spreading the word. Students who wished to participate as “readers” were asked to register by completing an online registration form. After registration, the “readers” were randomly allocated as equally as possible to the books.

## 2.3 Measures—mixed methods

During the registration process, a Qualtrics survey (Qualtrics 2020) was used to collect data on students’ level of familiarity and interest in rural practice. The survey collected demographic information (gender, nationality, age, rural origin, program of study and year in the program) and the students’ reasons and expectations for participating. After TLoL, the students completed another survey about their TLoL experience. To evaluate the impact on attitudes and perceptions to rural life and practice data were collected that will enable before-and-after comparisons. Pre- and post-TLoL data were linked by creating unique identifiers for each student, based on 3 items: (i) last 2 letters of their mother’s first name, (ii) year graduated from high school, and (iii) first 3 letters of their birth month.

The questions were presented slightly differently between the pre- and post-event surveys as a strategy to mitigate potential “response-shift bias,” which is a limitation of pre- and post-test designs (36, 37). Another strategy is methodological triangulation which was employed in this mixed methods study, by collecting both quantitative data and qualitative insights, so that the limitations from each method may be transcended by comparing findings from different perspectives (38, 39).

### 2.3.1 Quantitative data about attitudes and perceptions

The students were asked to use 5-point Likert-type scales to rate their familiarity with rural medicine (1 = *not familiar at all* to 5 = *extremely familiar*), and their agreement to statements about aspects of rural medicine (1 = *strongly disagree*, 2 = *disagree*, 3 = *not sure*, 4 = *agree*, 5 = *strongly agree*): as potential career option, scope of practice, rural life and work, interest in rural healthcare, and need for rural doctors. The related statements were phrased slightly differently in the pre- and post-TLoL surveys. Statements before TLoL were: (i) *rural medicine would be a good fit for someone like me*, (ii) *the wide scope of practice in rural medicine makes for an interesting career path*, (iii) *there are benefits to practicing in a rural or remote community* (iv) *I’m interested in learning more about opportunities for*

*rural medical practice*, and (v) *it would matter to consider a consider practicing medicine in a rural community*. Post-TLoL the statements were: (i) *medical practice in a rural community would be a suitable career option for me*, (ii) *having a broad scope of practice would be an interesting career*, (iii) *performing a variety of skill sets would be appealing and rewarding*, (iv) *I would like more opportunities to connect with people in rural practice*, and (v) *I feel that rural physicians play a vital role in the community*. For future practice consideration, the students were asked whether “they could see themselves engaged in a similar rural practice” measured on a 3-point scale (*no*, *not sure*, *yes*).

To evaluate TLoL as a learning modality students were asked to rate their experience based on the following attributes using the same 5-point agreement scale as above:

- a *It was a great venue to have personal contact with people in rural practice*
- b *I enjoyed hearing about the life and career experiences of the human books*
- c *It is a good way to learn more about the nature of rural medical practice*
- d *It offered more insight about the lifestyle benefits in a rural community*
- e *It made me learn more about myself and my interests*
- f *It gave me an appreciation of the wide scope of practice in rural medicine*
- g *It gave me a better sense of how rewarding rural medicine can be*
- h *Overall, the library of life was a positive experience for me.*

All statistical analyses of the quantitative data were conducted using SPSS statistical software (IBM SPSS version 29). A nonparametric test, Wilcoxon test for paired observations, was employed to compare the related statements before and after TLoL. For rural practice consideration, which was measured categorically, McNemar’s test for change was used. To describe the acceptability of TLoL as a learning modality, the responses were summarized using counts and percentages. The statistical significance was set at the 5% level of error probability.

### 2.3.2 Qualitative data about motivations, expectations, and key takeaways

Qualitative data were collected to characterize the motivations and expectations of students for attending TLoL through open-ended questions. Before TLoL, the questions were: “*what made you decide to participate in the event*” and “*what are you hoping to get out of attending*.” The responses were blended for both questions and the authors decided to combine the data for each participant to represent factors that influenced students’ participation (motivations and expectations). After the TLoL, data collected to understand students’ thoughts, attitudes, and perceptions used the questions: “*what were the take-home messages*” and “*reasons why or not they could see themselves engaged in a similar rural practice*.” The post-TLoL responses also had related patterns and concepts, responses to represent key takeaways and outcomes of TLoL were merged at the individual level, similarly to the pre-session data.

To derive a rich description of students’ thoughts and TLoL experiences, and what they gained from participation, thematic analysis was performed with conceptual coding (40–43). The analysis

followed similar steps used by qualitative researchers working in the area of living library (33, 35): (1) familiarization with the data, where authors (GP, KB, MM) involved in the qualitative analysis read and re-read the responses to develop familiarity with what students are saying; (2) after familiarizing with the text, the authors separately identified meaningful words or phrases that form concepts or patterns (codes), and (3) authors reviewed the codes together to define common themes, (4) authors discussed to reach consensus, with a third author adjudicating as needed, and established a coding scheme, (5) results were then recoded using this coding scheme, and (6) review of themes and selection of quotes to reflect the themes.

Authors KB and MM coded the themes for pre-event data on motivations and expectations and determined relevant concepts and tabulated their frequencies. Post-event, GP and KB coded the responses for takeaways and outcomes from TLoL, while GP and MM worked on the overall TLoL experience. The authors aimed to reduce potential bias by having three people go through of steps 1 to 5 in determining the themes.

## 3 Results

### 3.1 Demographic profile of student “readers”

Data were only collected for the two in-person TLoL events. Student demographic characteristics are summarized in Table 1. There were 43 and 49 students in 2022 and 2023, respectively. Of the 92 total students, 74 (80%) gave their consent and provided usable data. Of 49 post-TLoL responses, 44 (90%) could be matched with a pre-survey response. The authors attributed the discrepancy to the fact that some registered students were no-shows, and that there were non-registered walk-ins who did not complete the pre-survey.

Most (82%) students were 18–25 years old, 81% were female, with 66% graduated from high school in a metropolitan area and only 20% completed high school in a rural area. Regardless of high school location, only 20% consider themselves raised rurally and 6 students were not sure. The students were ethnically diverse and also represented Indigenous and immigrant populations. Almost one-third (31%) of students were in Doctor of Medicine program, while the rest were pre-medical students from other programs: Health Sciences (28%), Biological Sciences (7%), Neurosciences (8%), Nursing (1%), and other Sciences (24%). More than half (62%) were in the first 2 years of study in their program.

## 3.2 Quantitative data analysis

### 3.2.1 Familiarity and interest to learn about rural medicine

Majority (82%) of students have relatively low familiarity about rural medicine; of the 72 students, 41 (57%) reported being “just a little” or “not familiar at all” with rural medicine, and 18 (25%) said “somewhat familiar.” Only 13 students (18%) were “familiar” to “extremely familiar” (Figure 1). The mean score was 2.51 (SD = 1.035). On the other hand, 70 (97%) of students indicated interest to learn more about rural medical practice.

### 3.2.2 Attitudes and perceptions about rural medicine

Of the 49 students who completed the post-TLoL evaluation, 48 responded to the perceptions questions. The responses to attitudes and perceptions regarding rural medicine as future career option, scope of practice, rural life and work, interest in rural healthcare, and need for rural doctors, are summarized in Table 2. The authors grouped together “strongly disagree” and “disagree” responses and likewise combined the “strongly agree” and “agree” responses. The authors also considered the midpoint score “not sure” responses as non-favorable ratings.

Before TLoL, students gave the lowest ratings to “rural medicine would be a good fit for me” [ $n = 32$  (44%), mean = 3.49] and “it would matter to consider practicing medicine in a rural community” [ $n = 50$  (69%), mean = 3.96]. After TLoL, more favorable ratings were provided for “rural medical practice would be a suitable career option for me” [ $n = 28$  (58%), mean = 3.88] and “I feel rural physicians play a vital role in the community” [ $n = 46$  (96%), mean = 4.79].

Attitude and perception scores of students improved after TLoL, across all the statements evaluated. The improvements in scores were confirmed by Wilcoxon signed rank tests for paired observations, for three aspects: (i) envisioning rural medicine as future career option ( $p = 0.009$ ), (ii) appreciation of rural life and work ( $p = 0.013$ ), and (iii) recognizing the need for rural physicians ( $p < 0.001$ ) (Table 3).

### 3.2.3 Attitudes toward rural practice

Post-TLoL, students were asked whether “they could see themselves engaged in a similar rural medical practice,” measured as “no/not sure/yes,” but the responses received were only either “not sure” or “yes.” To assess a change in attitudes to rural practice, this was compared to a surrogate variable, “rural medicine would be a good fit for someone like me,” as this naturally connected to practice consideration. To harmonize the measurements, the “agree/strongly agree” responses were recoded as “yes,” and all other responses as “not sure” (Table 4). An improvement was found in the proportion of students that would consider rural practice after TLoL, i.e., 33/46 (72%) versus 32/72 (44%), and was confirmed statistically significant using McNemar’s test for change ( $p = 0.001$ ).

### 3.2.4 The library of life as learning modality

Most students (48/49 or 98%) said that their TLoL experience was positive overall and rated all attributes fairly high (Figure 2). Highest rated attributes (95% up) indicated that TLoL was: (i) a good way to have personal contact with people in rural practice, (ii) a good way to learn more about the nature of rural practice and (iii) where students enjoyed hearing about the life and career experiences of books. The last attribute “it made me learn more about myself and my interests” still scored relatively high (42/49 or 86%).

Students’ additional comments provided more insight into their experience with TLoL, such as:

- a “I grew up in a big city and thus have not really considered practicing in a rural area. Most of the rural physicians I met were people who grew up in small towns, therefore I understand why they would want to also practice in a small town. However, I wish there could have been more “books” who grew up in large cities that chose to practice in rural areas. I feel that would be an interesting perspective to listen to!” (S28)

TABLE 1 Demographic profile of students.

| Demographic characteristics        | 2022 |       | 2023 |       | All |       |
|------------------------------------|------|-------|------|-------|-----|-------|
|                                    | n    | %     | n    | %     | n   | %     |
| Students registered to attend      | 43   |       | 49   |       | 92  |       |
| Students providing data pre-event  | 35   | 100%  | 39   | 100%  | 74  | 100%  |
| Students providing data post-event | 20   | 57.1% | 29   | 74.4% | 49  | 66.2% |
| <b>Gender</b>                      |      |       |      |       |     |       |
| Male                               | 6    | 17.1% | 6    | 15.4% | 12  | 16.2% |
| Female                             | 28   | 80.0% | 32   | 82.1% | 60  | 81.1% |
| No data                            | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| <b>Age group</b>                   |      |       |      |       |     |       |
| 18–25 years                        | 33   | 94.3% | 28   | 71.8% | 61  | 82.4% |
| 26–30 years                        | 1    | 2.9%  | 8    | 20.5% | 9   | 12.2% |
| 31–35 years                        | 0    | 0.0%  | 2    | 5.1%  | 2   | 2.7%  |
| No data                            | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| <b>Ethnicity</b>                   |      |       |      |       |     |       |
| Caucasian/European/White           | 8    | 22.9% | 11   | 28.2% | 19  | 25.7% |
| Black/African                      | 3    | 8.6%  | 5    | 12.8% | 8   | 10.8% |
| Latin American/Hispanic            | 1    | 2.9%  | 0    | 0.0%  | 1   | 1.4%  |
| Middle Eastern/Arab/West Asian     | 5    | 14.3% | 6    | 15.4% | 11  | 14.9% |
| South Asian/East Indian            | 6    | 17.1% | 7    | 17.9% | 13  | 17.6% |
| Asian                              | 8    | 22.9% | 5    | 12.8% | 13  | 17.6% |
| Filipino/Pacific Islander          | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| Metis                              | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| Mixed ethnicity                    | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| No data                            | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| <b>High school location</b>        |      |       |      |       |     |       |
| Alberta—rural                      | 6    | 17.1% | 4    | 10.3% | 10  | 13.5% |
| Alberta—regional                   | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |
| Alberta—urban                      | 26   | 74.3% | 23   | 59.0% | 49  | 66.2% |
| Other province—rural               | 0    | 0.0%  | 4    | 10.3% | 4   | 5.4%  |
| Other province—regional            | 1    | 2.9%  | 2    | 5.1%  | 3   | 4.1%  |
| Other province—urban               | 0    | 0.0%  | 3    | 7.7%  | 3   | 4.1%  |
| Other country—rural                | 0    | 0.0%  | 1    | 2.6%  | 1   | 1.4%  |
| <b>Rural or non-rural origin</b>   |      |       |      |       |     |       |
| Rural                              | 5    | 14.3% | 10   | 25.6% | 15  | 20.3% |
| Non-rural                          | 28   | 80.0% | 25   | 64.1% | 53  | 71.6% |
| Not sure                           | 2    | 5.7%  | 4    | 10.3% | 6   | 8.1%  |
| <b>Program of study</b>            |      |       |      |       |     |       |
| Doctor of medicine                 | 8    | 22.9% | 15   | 38.5% | 23  | 31.1% |
| BS health sciences                 | 13   | 37.1% | 8    | 20.5% | 21  | 28.4% |
| BS biological sciences             | 2    | 5.7%  | 3    | 7.7%  | 5   | 6.8%  |
| BS neurosciences                   | 2    | 5.7%  | 4    | 10.3% | 6   | 8.1%  |
| BS nursing                         | 1    | 2.9%  | 0    | 0.0%  | 1   | 1.4%  |
| Other sciences                     | 9    | 25.7% | 9    | 23.1% | 18  | 24.3% |

(Continued)

TABLE 1 (Continued)

| Demographic characteristics | 2022 |       | 2023 |       | All |       |
|-----------------------------|------|-------|------|-------|-----|-------|
|                             | n    | %     | n    | %     | n   | %     |
| Program year                |      |       |      |       |     |       |
| Year 1                      | 12   | 34.3% | 21   | 53.8% | 33  | 44.6% |
| Year 2                      | 8    | 22.9% | 5    | 12.8% | 13  | 17.6% |
| Year 3                      | 7    | 20.0% | 7    | 17.9% | 14  | 18.9% |
| Year 4                      | 7    | 20.0% | 5    | 12.8% | 12  | 16.2% |
| Year 5                      | 1    | 2.9%  | 1    | 2.6%  | 2   | 2.7%  |

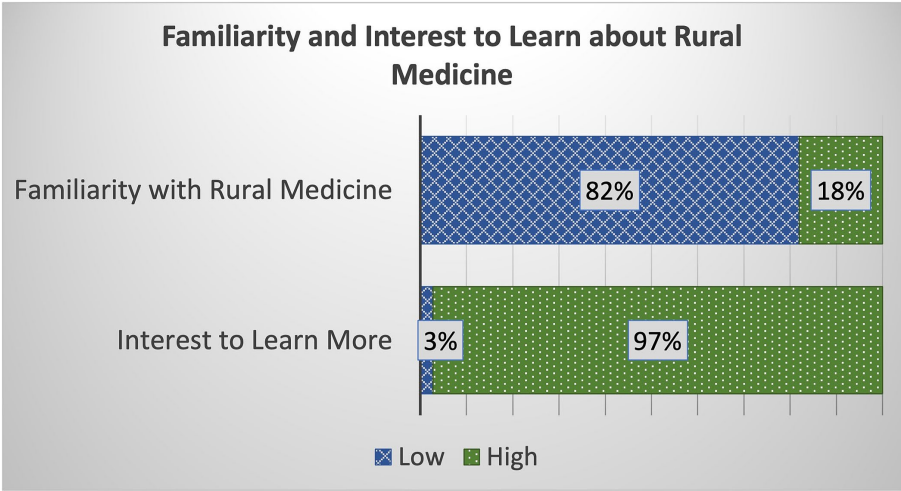


FIGURE 1  
Distribution of student responses about their familiarity with and interest to learn more about rural medicine. The graph shows that most students have relatively low familiarity with rural medicine but almost all indicated strong interest to learn more about the topic.

- b “I wish something in this regard was integrated into the medical school curriculum.” (S35)
- c “Being able to not only listen to but engage with the “books” and ask them questions was great to gain a better understanding of what rural medicine is like.” (S16)
- d “I would have never considered a career in rural medicine whereas now it is definitely something I’m considering. All of the books were incredible to hear from and we are all so open and encouraging. I think that overall this was a very rewarding event and would be worth it for anyone to attend, regardless of whether or not they have an initial interest in rural medicine.” (S60)
- e “Loved hearing perspectives from actual doctors. It is so much more impactful than reading a statement online and I loved that I got to ask questions.” (S2)

3.3 Qualitative data—thematic analysis

3.3.1 What made you decide to participate in TLol and what are you hoping to get out of it?

From 73 responses collected, thematic analysis found two overarching themes: (i) students’ decisions to participate and their expectations of TLol were aligned with the concept and purpose of

the original Human Library®, and (ii) students demonstrated an open-minded curiosity, interest, and willingness to engage with and learn from the human books.

3.3.1.1 Theme 1: students’ decisions to participate and their expectations of TLol were aligned with the concept and purpose of the original human library©

- Students were excited to hear about books’ personal experiences, challenges and struggles.
  - “I want to know more from folks who have tangible experiences. To get a better idea of lived experiences.” (S67)
  - “I am interested to hear about physicians’ experiences in rural medicine since I am considering this career path. I want to know whether people feel that practicing rural medicine made them better doctors. I am also interested in understanding some challenges about rural medicine.” (S42)
  - “I am hoping to gain a deeper understanding of the tribulations, joys, and realities of practicing rurally in Alberta.” (S68)
  - “I have always been interested in hearing people’s stories, and I believe it’s one of the most enriching ways to learn.” (S71)
  - “I’m really interested in individual stories and use other people’s stories and inspiration for how I should pursue my own goals.” (S73)

TABLE 2 Attitudes and perceptions of students about rural medicine.

| Attitudes and Perceptions about rural medicine                         | Strongly disagree/<br>Disagree |     | Not sure |     | Strongly agree/<br>Agree |     | Total |
|------------------------------------------------------------------------|--------------------------------|-----|----------|-----|--------------------------|-----|-------|
|                                                                        | n                              | %   | n        | %   | n                        | %   |       |
| Before TLol                                                            |                                |     |          |     |                          |     |       |
| Rural medicine would be a good fit for someone like me                 | 8                              | 12% | 32       | 44% | 32                       | 44% | 72    |
| The wide scope of practice makes for an interesting career path        | 4                              | 6%  | 6        | 8%  | 62                       | 86% | 72    |
| There are benefits to practicing in a rural or remote community        | 2                              | 3%  | 7        | 10% | 63                       | 88% | 72    |
| Interested to know more about opportunities for rural medical practice | 2                              | 3%  | 0        | 0%  | 70                       | 97% | 72    |
| It would matter to consider practicing medicine in a rural community   | 4                              | 6%  | 18       | 25% | 50                       | 69% | 72    |
| After TLol                                                             |                                |     |          |     |                          |     |       |
| Rural medical practice would be a suitable career option for me        | 1                              | 2%  | 19       | 40% | 28                       | 58% | 48    |
| Having a wide scope of practice would be an interesting career         | 2                              | 4%  | 3        | 6%  | 43                       | 90% | 48    |
| Performing a variety of skill sets would be appealing and rewarding    | 2                              | 4%  | 2        | 4%  | 44                       | 92% | 48    |
| Would like more opportunities to connect with people in rural practice | 1                              | 2%  | 2        | 4%  | 45                       | 94% | 48    |
| I feel that rural physicians play a vital role in the community        | 1                              | 2%  | 1        | 2%  | 46                       | 96% | 48    |

- Students wanted to meet people and make connections.
  - “The opportunity to engage with professionals in my field of interest and those studying in years ahead of me ... I hope to gain some knowledge and advice regarding the years ahead of me while simultaneously making connections and meeting new people with similar passions, goals, and career paths.” (S38)
  - “I want to meet more cool rural physicians... and hopefully getting new mentors.” (S9)
  - “I am also hoping to build or enter a network of rural physicians for future opportunities to shadow.” (S68)
  - “Make connections to further explore this area of medicine.” (S77)
- Students appreciated and welcomed the open and relaxed space of TLol.
  - “I am very interested in rural medicine and would love to learn more in a relaxed and open atmosphere.” (S76)
  - “I like the approach to the event that you can learn as much from people as you can a book. I also like that it is geared towards rural experiences.” (S68)
  - “I did not feel like I was being lectured at but rather having an open conversation so I felt like I was more engaged and learned more.” (S11)
- Students looked forward to engaging with books and have an open dialogue.
  - “Since I am a first year, RIME [Re-Imagining Medical Education] has done a good job of incorporating more story-telling from physicians and patients. The small taste of it I have had has left me wanting to learn more. I am going in with the hopes of learning more about life as a physician, especially in the rural context. I do not have any family or friends in the profession, so my knowledge was already quite limited... In essence, I hope to gain some more insight and wisdom about the field of medicine to inform my knowledge but more importantly, my practice.” (S71)
  - “I wanted to go deeper into tactical lessons and skills. Beyond the surface level especially as someone with rural experience already. I would have liked to gain tangible skills from this session. Or heard stronger opinions from the human books. I can appreciate

that they want to be sensitive and demonstrate awareness of the unknowns, but it would have been more beneficial to have gotten insight into some of their stronger beliefs or experiences.” (S96)

- “Diverse perspectives on rural medicine- the good and the bad. I would also love to hear from people who grew up in an urban setting and now practice rurally.” (S76)

### 3.3.1.2 Theme 2: students demonstrated an open-minded curiosity, interest, and willingness to engage with and learn from the books

- Students wanted to learn more about rural healthcare and valued the chance to discuss with rural practitioners.
  - “The chance to discuss challenges rural physicians face and learn more about Healthcare. A deeper understanding and appreciation for physicians, the Healthcare system, and current gaps.” (S11)
  - “I wanted to broaden my knowledge of the role of healthcare in different communities, and how it can be made more effective to serve the community as a whole. I’m very interested in sociology of healthcare. More insight on healthcare in different communities, and potential solutions to make healthcare more accessible for everyone.” (S21)
  - “I’m really interested in rural medicine and generalism and really do see myself practicing in that space. I’d love to talk more with rural generalists about their practices!” (S70)
- Students looked forward to hearing in different urban–rural perspectives, as most (80%) of our participants were from non-rural origins.
  - “Would be interesting to hear about different perspectives about working in a rural environment, especially as someone coming from a non-rural background.” (S4)
  - “Living in Calgary my whole life I’ve had no exposure to rural living or rural medicine. I have heard such wonderful things about rural medicine so far and want to continue to learn more about what rural medicine is all about. Further information about what it is like to work and live rurally (especially from

TABLE 3 Pre- and post-TLoL comparisons of attitudes and perceptions scores.

| Attitudes and Perceptions about rural medicine                                                    |      | N  | Mean | SD    | Median | Test statistic | P-value <sup>a</sup> |
|---------------------------------------------------------------------------------------------------|------|----|------|-------|--------|----------------|----------------------|
| Future career option: Rural medicine would be good fit for me                                     | Pre  | 47 | 3.49 | 0.856 | 3      | −2.604         | 0.009*               |
|                                                                                                   | Post | 48 | 3.88 | 0.959 | 4      |                |                      |
| Scope of practice: Having wide scope of practice would make for an interesting career             | Pre  | 47 | 4.15 | 0.884 | 4      | −1.079         | 0.072                |
|                                                                                                   | Post | 48 | 4.40 | 0.869 | 5      |                |                      |
| Rural life and work: There are benefits to living and practicing in a rural community             | Pre  | 47 | 4.11 | 0.729 | 4      | −2.497         | 0.013*               |
|                                                                                                   | Post | 48 | 4.42 | 0.846 | 5      |                |                      |
| Rural healthcare interest: Interested in opportunities to connect with people in rural practice   | Pre  | 47 | 4.45 | 0.717 | 5      | −1.069         | 0.285                |
|                                                                                                   | Post | 48 | 4.50 | 0.772 | 5      |                |                      |
| Need for rural doctors: Rural physicians have vital and important role within the rural community | Pre  | 47 | 3.98 | 0.872 | 4      | −4.238         | <0.001*              |
|                                                                                                   | Post | 48 | 4.79 | 0.683 | 5      |                |                      |

<sup>a</sup>p-values based on Wilcoxon Signed Rank Test for paired observations; 44 paired observations tested.  
\*Statistically significant.

TABLE 4 Pre- and post-TLoL comparisons of attitudes to rural practice.

| Attitudes toward rural practice                                | Not sure         |     | Yes |     | Total |
|----------------------------------------------------------------|------------------|-----|-----|-----|-------|
|                                                                | n                | %   | n   | %   |       |
| Pre: Rural medicine would be a good fit for someone like me    | 40               | 56% | 32  | 44% | 72    |
| Post: I can see myself in a similar rural medical practice     | 13               | 28% | 33  | 72% | 46    |
| McNemar's test for change test result (44 paired observations) | p-value = 0.001* |     |     |     |       |

\*Statistically significant.

some of the rural docs who were not original from small towns)." (S77)

- "While I have experience living in rural BC [British Columbia], I do not in Alberta and I am trying to gain a better idea of what that might be like." (S68)

- Students participated for personal advancement reasons, as encouraged by friends and other groups with similar rural interest

- "I decided to participate in the Human Library event as part of the enrichment aspect of the Pathways to Medicine program. I am hoping to make connections and learn more about the unique experiences of rural medicine." (S16)
- "A better understanding of rural medicine and the multifaceted role of a rural physician." (S4)
- "As I am planning a career in medicine, I was directed to this event with the help of the pathways to medicine scholarship to gain insight into rural medicine and explore more options than what I am currently aiming for." (S24)
- "Highlights of the main characteristics of the presenters careers and see if they are things I value/want to have in my life. Also understanding that if I do not practice rurally, how to support rural colleagues." (S69)

- Students looked forward to seek professional advice and guidance from the books, especially about what it takes to be a rural professional, as they consider their career options.

- "Unsure of what I want to do or where I want to work so trying to get more information and advice." (S69)
- "I wanted to get an insight into the lives and journeys of professionals as well as receive some advice on what I can do through my own journey." (S34)

- "I hope to gain more knowledge and guidance about pursuing rural medicine, as well as network with incredible individuals." (S72)
- "Learn about the experience of being a doctor working in rural and less serviced areas in Alberta. I hope to gain better insight as to what it means to be a rural physician." (S24)
- "Understanding a practicing physician's continued motivations in medicine, how they navigate uncertainty, professional and personal boundaries, what qualities and actions they consider to be a good doctor." (S73)

3.3.2 What were the take-home messages, and could you see yourself in a similar rural practice?

From 47 responses, thematic analysis revealed two overarching themes: (i) TLoL enabled students to see the "rural" context in a new and different light, and (ii) TLoL allowed students to self-reflect and to gain a sense of personal growth and recognize own individual capacities and interests.

3.3.2.1 Theme 1: TLoL allowed the students to walk in a rural professional's shoes thereby enabling them to see "rural" in a new and different light

- Students heard inspiring and motivating insights about rural medical practice.
- "I like to build relationships and the lifestyle benefits afforded by smaller communities are appealing. I feel inspired to provide care for people in a rural setting." (S41)
- "At lot of the messages were inspirational in motivating me to pursue this career and secondly, the appeal of rural medicine was

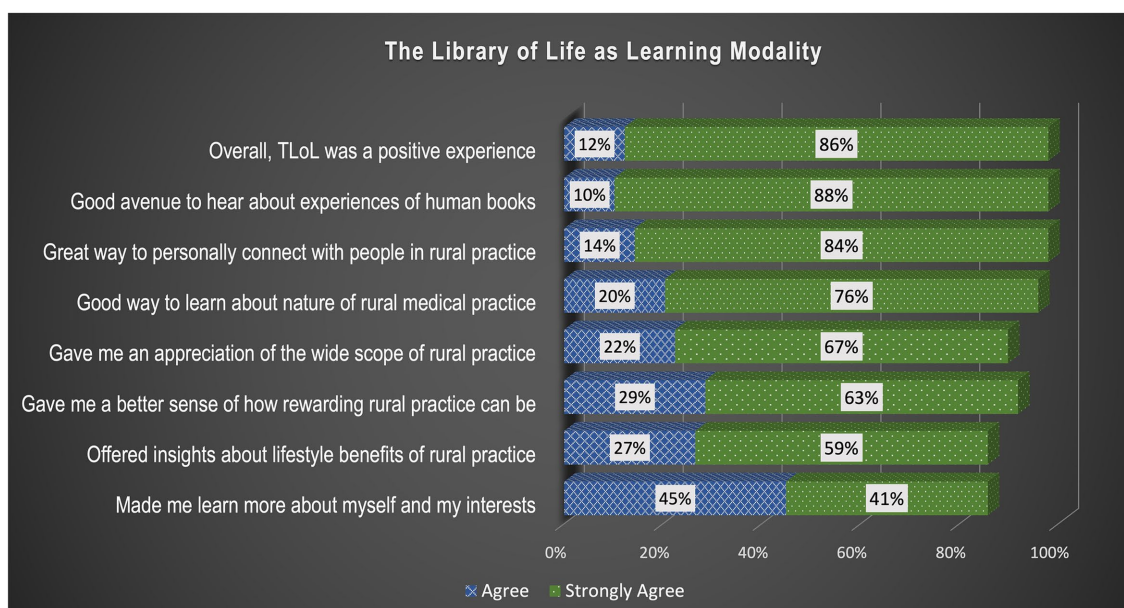


FIGURE 2

Distribution of student responses about their experience with TLol. The graph depicts that almost all students provided high ratings to the attributes of TLol, substantiating the convincing acceptability of TLol as a learning modality.

*reinforced due to the diversity of practicing it that was shared. Rural medicine is definitely appealing!*" (S38)

- "Learned about the value and struggle rural doctors undergo. Very inspirational and motivational. I'd love to provide more aid to those in rural areas who do not receive enough healthcare." (S52)
- Students found the diversity and wide scope of practice in rural practice highly appealing.
  - "I think that the diversity of opportunity working as a doctor in rural medicine really stood out to me. There is so much you can do in rural medicine and you can tailor this career to suit your interests and needs as evidenced by the broad range of the "books" experiences." (S16)
  - "The diversity of the practice is very interesting. To be able to use a varied skill could be challenging but it will keep a doctor on his toes and could be satisfying. I am inspired by the stories of the books." (S38)
- Students learned about opportunities and flexible lifestyle that make a rural career fulfilling.
  - "Rural medicine has a lot of different opportunities and is flexible in terms of what you want to pursue. Rural practice is not only important for a remote community, but it can also offer many different opportunities and flexibility with your career. I like the idea of being able to do a variety of skills. It can be a very rewarding career." (S37)
  - "That rural medicine is a good fulfilling career. Yes, because I want to have a more meaningful as a physician." (S85)
  - "That rural medicine offers many diverse opportunities for physicians to practise, and there's a very wide scope of possibilities within rural family medicine that can suit your own particular lifestyle and goals." (S60)
  - "There is a lot more to rural medicine than I initially thought. Rural medicine can be diverse and interesting and you get to practice a wide variety of skills. I did not realize that a rural

*career offers so much flexibility. I think it can be challenging but at the same time very rewarding and fulfilling."* (S42)

- "There are varied opportunities that could bring a flexible lifestyle and build relationships within the community." (S34)
- Students gained a better appreciation of the importance of rural physicians.
  - "I think that rural physicians are very important in a rural community." (S29)
  - "Rural medicine is under-looked .... but it is vital to keep communities healthy." (S15)
  - "I have still a long way to go so I could not say for sure what I want to do right now, but I think that being a rural doctor with a diverse practice could be interesting. Not only that, there is a huge need for rural doctors. So rural doctors are important." (S2)
  - "Rural physicians play an important role and this could be very rewarding in many aspects - professionally, socially, financially." (S20)

### 3.3.2.2 Theme 2: TLol allowed students to self-reflect and gain a sense of personal growth

- Students got to know their own individual capacities and interests, and potentially rural medicine.
  - "Considering rural medicine as career. I gained new insights, which fueled my passion for medicine in rural practices." (S87)
  - "Rural primary care is more personal than what we see in cities, there's more outlets for creativity and initiative in rural medicine. Dr. Sarah's story was interesting because I always wondered if... Would be feasible as a visible minority women." (S59)
  - "As an Indigenous person, I am interested in practising rural medicine and providing health services in reserves where there typically is lack of access and funding." (S60)
  - "I never thought I would consider rural medicine but now I see that it could be something I am interested in." (S11)

- "To embrace your passions and be okay with the uncertainty. Absolutely." (S67)
- "My interests align with rural medical practice." (S41)
- "Choose a field that deserves you and do not be afraid to say no to some opportunities." (S8)
- For some students, TLoL made them see that rural practice may not be realistic for them.
  - "Life is not linear. This event has given me a better understanding of the scope of practice of a rural doctor. While it is fascinating, I feel it could be challenging and a bit scary, especially if you are isolated. I do not think I would be suited for this lifestyle, unless I am truly prepared for it." (S19)
  - "Thanks to this event, I learned about rural medicine and what it takes to be a rural doctor. I'm not sure I'm made of the right stuff and have a practice where you are self-sufficient and self-reliant. It is such a huge responsibility. Proper training and preparation is necessary." (S30)
  - "I recognized that there are many paths to medicine and practicing in rural communities can be rewarding. I think it is important that people in rural communities also receive good health care. I grew up in a big city and thus have not really considered practicing in a rural area." (S28)
  - "Rural Medicine Doctors are able to develop and utilize a wide breadth of skills. I do not know much about rural medicine. I agree that rural communities need good doctors to provide medical care for them. It is admirable and inspiring that rural doctors can develop and can use a wide variety of skills. I'm not sure of I'm good enough to be one." (S27)
  - "Rural medicine offers a lot more than what I expected. Being from Calgary, I'm not sure how well rural medicine would integrate with my goals." (S53)
- Students understood better the value of connections and relationships in the community.
  - "Advocacy is huge in rural medicine. I saw people who had similar hesitation about going rural but figured it out." (S74)
  - "Rural medicine is where you can feel connected to your patients and can have a stronger and longer lasting impact on their lives. I feel that close connection to patients is important." (S89)
  - "Connection to patients in rural communities. I 100% want to be in a rural community. The community aspect is so important to me." (S66)
  - "Despite rural health care constantly being looked up from the deficits point of view, there are a number of assets that rural health care can provide. I would like to be a trusted member of a community who can have a positive impact on community members." (S96)
  - "I want to have a great diversity of practice and love the idea of being a pillar in my community." (S70)
- Students gained deeper insight on the resilience and self-reliance of rural doctors in their practice.
  - "For me resilience, passion about our careers, and being open minded. I think words are powerful, and hearing some of the stories and even reassurances has changed my lens on rural medicine." (S71)
  - "Hearing about all these resilient stories was truly eye-opening. Every single one of these successful "books" had a fluctuating, up and down bumpy road, and I feel inspired to never give up if there's passion." (S41)

- "Do not forget to be resilient and even if you want to start over and reinvent yourself, that is okay." (S34)

## 4 Discussion

The goal of this study was to determine whether TLoL is an effective learning strategy in medical education for changing the perceptions of learners about rural life and rural practice. After completing three TLoL events, sufficient quantitative and qualitative data about the students seem to support the research inquiry. The data showed that only 20% of the students are from a rural background, which is consistent with recent research (24) showing that Canadian medical students are more likely to have urban upbringing. This potentially reflects why the data also indicated that the students have low familiarity with rural medicine, with only 18% expressing familiarity with rural practice. Despite this, it is encouraging that almost all indicated a keen willingness to learn more about rural practice. The pre-TLoL qualitative data demonstrated that students were not only curious about rural medicine but were also eager to make connections to the human books, to engage with them in open dialogue and to hear about their personal experiences, challenges and struggles. Additionally, students looked to seek professional advice and guidance from the books, especially about what it takes to be a rural healthcare professional.

The statistical analysis of quantitative data revealed significant improvements in attitudes and perceptions scores from pre- to post-TLoL experience. This suggests that TLoL has a meaningful impact on changing students' attitudes and perceptions about rural medicine. Positive changes were observed in terms of students' attitudes about rural medicine as a potential future career option, appreciation of rural life and work, and recognition of the need for and importance of rural physicians. In particular, TLoL showed positive effect on rural practice consideration, with a marked improvement from 44% to 72% of students indicating they could potentially see themselves engaged in a similar rural medical practice.

This is reinforced by the qualitative findings and summarized by two overarching themes. The first main theme was that TLoL allowed the students to walk in a rural professional's shoes thereby enabling students to appreciate "rural" under a fresh and newfound light. Inspired by the books' motivating stories and experiences, the students gained valuable insights about rural medical practice and found the diversity and wide scope of practice in rural practice highly appealing. Further, students learned that the diversity and flexible lifestyle are what makes a rural career fulfilling and rewarding. Seen under this new light, they were able to discern the important and vital role of the rural physician. The second main theme was that TLoL allowed students to self-reflect and gain a sense of personal growth. Students got to know their own individual capacities and interests, and potentially rural medicine; they gained deeper insight on the resilience and self-reliance of rural doctors in their practice and the value of building relationships with patients and within the community. However, this self-reflection can also lead students to comprehend that rural practice may not be realistic for them. These themes describe the elements that influence the mechanism of the change in perception and attitude toward rural practice.

The change in attitude toward rural practice can be likened to a change in behavioral intention (e.g., the willingness to communicate

and cultivate a relationship with, and cater support for an underserved community), which is believed as one of the most difficult to effect change among attitudinal factors (44). The finding suggests that students made gains in self-perceived knowledge about rural medicine and in attitudes toward rural practice through the self-reflection and personal connections offered by TLoL. Thus, the results show the potential power of narratives to change human perceptions. The findings are consistent with other research demonstrating the impact of experiential learning offered by the living library approach in various healthcare professions (32–35). As such, educators and learning institutions are increasingly using the living library concept as an alternative learning modality.

The living library is not only a novel but also a flexible approach in medical education (3). The logistics of TLoL differed between the online and in-person formats. The online TLoL allowed for the interactions between human books and students to be recorded, for the books' stories to be viewed and shared with other people long after the event was done. On the other hand, the in-person TLoL allowed for direct eye-contact and face-to-face interaction, which facilitated deeper and more personal connection between human books and students, giving the in-person TLoL slightly more edge over virtual format. During in-person TLoL, both students and human books relished the chance to meet new people and network, enjoy the refreshments and just mingle. Further, students took the chance to ask the human books for career advice and guidance and to seek answers to their own questions. While both formats have advantages and challenges, these demonstrated the versatility of TLoL.

The authors are from a medical school that offers both culturally immersive rural block rotations and the longer longitudinal clinical clerkship experiences to medical students. TLoL presents students with a glimpse of what to expect in rural living and can encourage a healthy interest and foster positive attitudes toward rural experiences and to consider these rural learning opportunities. One student said that during their TLoL experience they did not feel like they were being lectured at but rather merely having an open conversation, so they felt more engaged and learned more. Another student proposed that something like this (TLoL) be integrated into the medical school curriculum. This suggests that students found TLoL a safe space for engagement and learning. The culturally safe space and opportunity for self-reflection are the essential attributes that may make living libraries effective. When carefully planned and curated with relevant books, TLoL can be a suitable learning modality in medical education, to challenge attitudes and perceptions, in areas where there may be knowledge gap, such as rural medical practice.

## 4.1 Limitations

The results of this study represent data from students from one medical school in Canada. While the authors advertised our TLoL offerings well in advance, participation may have been conditional on students' availability at the time of TLoL, i.e., only available students were able to attend. Likewise, students who may have an inherent interest in rural medicine may have been enticed to take part. Different sets of human books participated at each of the three TLoL offerings held. Each human book had their own individual story and storytelling style. Student "readers" were assigned randomly to three human books each, and each student was able to engage with a different set of

human books. There were no data collected that will allow comparison of experiences of TLoL conducted virtually and as an in-person event. The results were not adjusted by event offering or by specific human books that students engaged with. No demographic groupings were considered or compared in the analysis. Therefore caution is needed in interpreting the results.

## 5 Conclusion

The study findings confirm that most students going into medicine are urban-origin and have little familiarity with rural life and rural practice. While the majority of students initially would not consider rural medicine, the results show that the use of narratives and storytelling can challenge held beliefs around rural practice and life, consistent with the original aims of the Human Library®. Through TLoL, students may be encouraged to consider things that traditional medical teaching may not offer. It is difficult to change perceptions and attitudes, but narratives can have the power to create change. The students gained a better understanding of rural practice and rural life, the situation of the books, and different beliefs in general, and received answers to their own questions and doubts. TLoL is akin to an experiential learning space and can be an effective learning modality in medical education to provide information and inspiration to learners to consider a career in rural medicine. This approach can be used in conjunction with other rural educational learning opportunities such as rural block rotations and longitudinal clinical clerkship immersions to enhance learning. The results suggest that narratives may help to facilitate and foster more favorable attitudes toward rural medical practice among the students. Implications for future research may include investigations into the actual behaviors following practice intention of students and impact of TLoL for the longer term. However, longitudinal studies can be much more challenging to conduct.

## Data availability statement

The datasets presented in this study can be found in online repositories. The datasets can be found in the Open Science Framework repository [DOI: [10.17605/OSF.IO/5FCMY](https://doi.org/10.17605/OSF.IO/5FCMY)].

## Ethics statement

The studies involving humans were approved by the University of Calgary Conjoint Health Research Ethics Board (CHREB). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

GP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. RM: Conceptualization, Funding acquisition, Investigation, Methodology, Writing – review & editing. KB: Formal analysis, Writing – review &

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Attitudes of medical students in Croatia toward rural medicine education and practice

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**Introduction:** Recruiting and retaining doctors in rural areas is challenging. In Croatia, medical school curricula lack content on rural medicine and specialized training for rural practice. This study explores the opinions and attitudes of first- and sixth-year medical students in all four medical schools in Croatia regarding working in rural areas.

**Methods:** An online questionnaire was administered to Croatian medical students in their first and final years between January 2022 and February 2023. Responses were obtained from 690 participants from the Universities of Osijek, Rijeka, Split, and Zagreb. The cross-sectional study included 13 questions, with 5 on socio-demographic data. Data were analyzed using descriptive statistics and non-parametric tests (chi-square) to assess group differences.

**Results:** Compared to first-year students, final-year students feel less prepared by their education for rural practice ( $\chi^2 = 84.287$ ;  $P = 0.000$ ) but are more interested in working in rural areas ( $\chi^2 = 26.810$ ;  $P = 0.000$ ). Most students believe rural doctors need additional financial incentives, with this belief significantly stronger among final-year students ( $\chi^2 = 14.192$ ;  $P = 0.000$ ). Both groups agree that rural doctors face poor working conditions ( $\chi^2 = 1.524$ ;  $P = 0.217$ ). No statistically significant differences were found regarding job interest outside city centers ( $\chi^2 = 2.041$ ;  $P = 0.564$ ) or choosing rural medical practice ( $\chi^2 = 4.795$ ;  $P = 0.187$ ) among medical students from the Universities of Osijek, Rijeka, Split, and Zagreb. Students from rural settlements were more often interested in jobs outside the city center (72.1%) compared to those from smaller towns (60.6%), [ $\chi^2(1) = 5.142$ ,  $p = 0.023$ ] and larger cities (44.1%), [ $\chi^2(1) = 28.978$ ,  $p = 0.000$ ].

**Conclusion:** Although Croatian medical students show interest in working in rural areas, their education lacks sufficient preparation for the unique challenges of rural practice. They view the current conditions for rural doctors as inadequate and believe that additional financial incentives are necessary. Interest in rural practice is consistent across medical faculties in Croatia, with students living in rural areas showing a higher interest in working there.

## KEYWORDS

rural medicine, family doctor, family medicine, rural curriculum, medical students

# 1 Introduction

Access to adequate medical care is a fundamental human right, as established by the United Nations Charter of 1948. Implementing primary health care stands as one of the most significant systemic and ideological health reforms of modern times, resulting in more efficient and equitable healthcare systems in countries where it is well-developed (1). The World Health Organization highlights the challenges in recruiting and retaining doctors in rural areas, emphasizing that the availability of health workers is crucial for the health of rural populations (2, 3).

Rural areas, characterized by diverse cultures, economic challenges, and traditions, require special consideration in medical education (4, 5). Providing healthcare education in rural settings demands a distinct educational approach, equipping medical students with specific skills and diagnostic-therapeutic procedures tailored to these communities (6). Physicians in rural settings face numerous challenges, often with limited resources and minimal social support (7, 8). Rural areas are often faced with a lack of diagnostic equipment and medical supplies, as well as access to specialists (9, 10). Distance from rural areas makes large medical centers difficult to access, especially when combined with scarce public transportation (10–12). Rural areas can also have poorer access to healthcare due to geographical attributes; areas could be inaccessible due to terrain and houses can be scattered far apart (11). The demographics of rural areas are also problematic because rural areas tend to have an older population (11, 13). Positive predictors for working in rural areas include growing up in such environments and having part of one's education conducted there. Conversely, negative predictors encompass lack of employment opportunities for partners/spouses, inadequate opportunities for children's development, perceived infrastructure deficits, heavy workloads, social isolation, and limited professional development (14–17). Personal experience and exposure to rural work environments with positive, friendly relationships with patients further motivate students. These insights can guide educators and policymakers in structuring effective educational experiences and motivating young doctors (18).

Integrating rural clinical experiences into medical curricula is essential for the education of Twenty first-century medical professionals (19). Educating medical students in rural settings, where they assume more inclusive roles compared to urban education, has demonstrated higher levels of satisfaction, knowledge, skills, attitudes, and readiness to assume the role of a physician (18, 20, 21). This decentralized education model benefits both students and rural health units. While it requires significant effort and resources from educational institutions, health institutions, and students and their mentors, it provides students with broader education, opportunities for specialization, increased self-confidence, and a more complex professional identity. It also enhances the likelihood of students continuing to work in rural settings (18, 20–23).

Croatia has four medical faculties located in its largest cities: Rijeka and Split along the coast, and Zagreb and Osijek inland. Family Medicine is a required course in the sixth year of the Integrated Medicine program at all four schools, incorporating lectures, seminars, and practical exercises. While Osijek emphasizes lectures, Zagreb focuses on hands-on exercises, and Split prioritizes

seminars, none of the curricula specifically address rural medicine, despite Split offering some rural practice opportunities on islands. However, the importance of family medicine in Croatia is also evident in the curricula of medical faculties, where a large number of hours in family medicine courses are dedicated to practical training in the offices of family physicians (24–27).

Medical education in Croatia spans 6 years (28). Upon graduation, newly qualified doctors typically work as substitutes for family physicians or in emergency medicine while awaiting their specialization. During this interim period, they have the opportunity to choose between rural and urban locations for their work assignments. One possible explanation for Croatian medical students' interest in rural practice is the point-based system used when applying for specialization. This system evaluates candidates based on academic performance, scientific publications, awards, work experience, and a job interview (29). Notably, work experience in rural areas—defined as regions with a development index below 100%—is weighted twice as highly as experience in urban settings. This incentivizes rural practice by offering a clear career advantage (27, 29). In Croatia, however, the criteria for defining rural medical practice primarily focus on the population size of a settlement, its distance from the nearest hospital, and the accessibility of healthcare services. Rural areas of the Republic of Croatia, which make up more than 90% of its land area and are home to approximately 47% of the total population. Taking into account some data from the literature, rural settlements were defined with fewer than 5,000 inhabitants (30, 31).

In the Croatian healthcare system, patients can consult their family physician directly, without needing a referral, although appointments may sometimes be required (32). If necessary, family physicians, as gate keepers, provide referrals to hospital specialists. Hospitals are predominantly located in larger urban centers, whereas family physicians are distributed across both urban and rural areas (33, 34). However, more remote areas face a shortage of healthcare providers. In particular, unmet medical needs due to geographical distance in Croatia were higher than in any other EU Member State (0.7% of the population, with an EU average of 0.1 %), and unmet needs were higher among older people (35).

We hypothesized that attitudes of first-year and final-year medical students to work in rural areas would differ due to their experience training in the medical field. These experiences likely influence their interest in specific career paths, including rural medicine (36–38). This study aimed to explore whether preferences for rural medicine vary between students at these two stages of medical education.

## 1.1 Hypotheses

1. There are differences in the attitudes of first-year and final-year medical students toward working in rural areas. Final year students will have more positive attitudes toward working in rural areas.
2. There is a difference in considering the choice of rural medical practice among students from different faculties.

3. There is a difference in the choice of rural medical practice among students from different places of origin. Students from rural areas are more likely to consider working in rural areas.

The aim of this study is to explore the opinions and attitudes of first- and sixth-year medical students regarding working in rural areas, as well as to identify potential differences in these attitudes among the various faculties. The purpose is to understand medical students' intent to go rural and what could influence this to happen.

## 2 Materials and methods

A cross-sectional research design was used in this study. The research was conducted in the period from January 2022 to February 2023. A web-based survey was used to collect data and the survey link was sent to first and sixth year undergraduate medical students of the Universities of Split, Rijeka, Osijek, and Zagreb ( $N = 2,472$ ) via e mail. Responses were obtained from 690 participants. The authors did not send reminders to potential participants.

Participants completed the questionnaire by clicking the relevant link.

The overall response rate was 27.91 %. Based on the online sample size calculation for this response rate ( $95\% \text{ CI} \pm 5\%$ ) from a total population of 2,472, the minimum required sample size is 286 (39).

Online questionnaire consisted of 12 questions created through Google Forms. The questionnaire consisted of a part that includes socio-demographic data (five questions) and seven questions related to rural medicine.

Most of the participants were female, which is in line with the ratio of men to women in the population of medical students in Croatia(40).The age of the participants ranged between 17 and 31 years, with an average age of 22 years ( $M = 22.03$ ;  $SD = 2.815$ ). The intention was to collect their place of origin and settlements which are categorized based on population size: those with fewer than 5,000 inhabitants are classified as rural, those with populations between 5,000 and 20,000 are considered small towns, and those with populations exceeding 20,000 are designated as larger cities. The structure of the sample is shown in Table 1.

This study was approved by the Ethics Committee of the University of Split, School of Medicine. Electronic informed consent was obtained from all participants prior to starting the research.

## 3 Results

The results of the research were processed by the statistical program SPSS for Windows for personal computers, version 23.0. In addition to basic descriptive statistics, appropriate non-parametric statistical procedures were also used. The chi-square test ( $\chi^2$ ) was used to test differences between groups. As a criterion of significance, a criterion of 5% risk of error was used. Based on the sample size formula for comparing two proportions (two-tailed) with a 95% confidence interval, the power of the sample size is 99.9% (41).

First, descriptive statistics are presented, followed by results addressing the research questions (Tables 2, 3).

**TABLE 1** Descriptive statistical indicators (frequencies and percentages) for demographic variables ( $N = 690$ ).

| Variable                 |                         | f   | %    |
|--------------------------|-------------------------|-----|------|
| Gender                   | Male                    | 181 | 26.2 |
|                          | Female                  | 509 | 73.8 |
| Settlement you come from | Rural                   | 136 | 19.7 |
|                          | Small town              | 264 | 38.3 |
|                          | Bigger city             | 290 | 42.0 |
| University               | Osijek                  | 57  | 8.3  |
|                          | Rijeka                  | 162 | 23.5 |
|                          | Split                   | 181 | 26.2 |
|                          | Zagreb                  | 290 | 42.0 |
| Year of study            | 1 <sup>st</sup> (first) | 323 | 46.8 |
|                          | 6 <sup>th</sup> (sixth) | 367 | 53.2 |

The first problem of this research was to examine whether there is a difference in attitudes toward working in rural areas between first-year and sixth-year (final year) medical students. To address this issue, we calculated the chi-square test between the group of first-year and final-year medical students (Table 4).

A significantly higher percentage of sixth-year medical students, compared to first-year students, view family medicine as a potential career choice ( $P = 0.007$ ).

First-year medical students are significantly more likely than final-year students to believe that the undergraduate program equips them with the knowledge and skills needed to work in rural areas ( $P = 0.000$ ).

Among first-year medical students, a significantly lower proportion has considered working in rural areas compared to their final-year counterparts ( $P = 0.000$ ).

A significantly higher proportion of final-year students, unlike their first-year counterparts, believe that rural doctors should receive additional financial incentives compared to urban doctors ( $P = 0.000$ ).

The difference in interest between first-year and final-year students in working outside of major urban centers suggests a trend where a greater number of final-year students are inclined to seek employment in these areas compared to first-year students ( $P = 0.051$ ).

Most first-year and final-year students believe that rural doctors face poor working conditions ( $P = 0.217$ ).

The second objective of this research was to investigate differences between faculties regarding the choice of medical practice in rural areas. To achieve this, we conducted a chi-square test among groups of students from various faculties, analyzing variables related to their interest in working in rural areas (Table 5).

There is no statistically significant difference in job interest outside city centers ( $\chi^2 = 2.041$ ;  $P = 0.564$ ) or in considering rural medical practice ( $\chi^2 = 4.795$ ;  $P = 0.187$ ) among medical students from the Universities of Osijek, Rijeka, Split, and Zagreb.

A statistically significant difference in the variables "job interest outside the (large) city center" and "considering working in

TABLE 2 Number and structure of participants (students) at each faculty.

| Medical faculties | Years of study (total number of students) |                 |       | Years of study (number of students participating in the research) |                 |              |
|-------------------|-------------------------------------------|-----------------|-------|-------------------------------------------------------------------|-----------------|--------------|
|                   | 1 <sup>st</sup>                           | 6 <sup>th</sup> | Total | 1 <sup>st</sup>                                                   | 6 <sup>th</sup> | Total        |
| Split             | 182                                       | 179             | 361   | 68 (37.36%)                                                       | 113 (63.13%)    | 181 (50.14%) |
| Rijeka            | 273                                       | 266             | 539   | 87 (31.87%)                                                       | 75 (28.2%)      | 162 (30.06%) |
| Zagreb            | 693                                       | 605             | 1,298 | 137 (19.77%)                                                      | 153 (25.29%)    | 290 (22.34%) |
| Osijek            | 144                                       | 130             | 274   | 31 (21.52%)                                                       | 26 (20%)        | 57 (20.8%)   |
| Total             | 1,292                                     | 1,180           | 2,472 | 323 (25%)                                                         | 367 (31.1%)     | 690 (27.91%) |

TABLE 3 Descriptive statistical indicators (frequencies and percentages) for all dependent variables measured in the study ( $N = 690$ ).

| Variable                                                                                                               |     | <i>f</i> | %    |
|------------------------------------------------------------------------------------------------------------------------|-----|----------|------|
| Would you consider family medicine among the medical professions you would choose as a career?                         | yes | 313      | 45.4 |
|                                                                                                                        | no  | 377      | 54.6 |
| Are you interested in a job outside of (a major) urban center?                                                         | yes | 386      | 55.9 |
|                                                                                                                        | no  | 304      | 44.1 |
| Do you believe that the undergraduate program provides the knowledge and skills necessary for working in a rural area? | yes | 308      | 44.6 |
|                                                                                                                        | no  | 382      | 55.4 |
| Have you considered working in rural areas?                                                                            | yes | 386      | 55.9 |
|                                                                                                                        | no  | 304      | 44.1 |
| Do you believe that rural doctors have good working conditions?                                                        | yes | 101      | 14.6 |
|                                                                                                                        | no  | 589      | 85.4 |
| Do you believe that the work of rural doctors should be financially incentivized compared to urban doctors?            | yes | 630      | 91.3 |
|                                                                                                                        | no  | 60       | 8.7  |

rural areas,” depending on the place of origin from which the students come (Table 6).

Students from rural settlements were more often interested in jobs outside the city center compared to those from smaller towns [ $\chi^2(1) = 5.142$ ,  $p = 0.023$ ] and larger towns [ $\chi^2(1) = 28.978$ ,  $p = 0.000$ ]. Additionally, students from smaller towns more often interested in jobs outside the city center compared to those from larger towns [ $\chi^2(1) = 15.015$ ,  $p = 0.000$ ].

Also, students from rural settlements more often consider working in rural areas compared to students from smaller towns [ $\chi^2(1) = 9.118$ ,  $p = 0.003$ ] and larger towns [ $\chi^2(1) = 8.871$ ,  $p = 0.003$ ]. No statistically significant difference was found between students living in smaller towns and those in larger cities [ $\chi^2(1) = 0.11$ ,  $p = 0.915$ ].

## 4 Discussion

Compared to other studies, the results of this research indicate a stronger interest among students working in family medicine and outside urban centers, including in rural areas (42–47) and,

given the gender structure of the sample and its comparison to the gender structure of the population of medical students in Croatia, this sample is representative (40). Other research findings show that students’ choice of a medical profession is influenced by various factors, including personal and sociodemographic aspects, as well as different training programs and strategies (48, 49). As students mature from their first to final year of medical school, their experiences and acquired knowledge seem to significantly shape their professional choices. Medical school does not immediately equip students to practice independently. Instead, it provides a broad foundation of knowledge and skills that must be integrated and refined over time. Graduate students’ interest in family and rural medicine is generally low (47, 50, 51) and there is a documented decline in interest from the first to the final year of study (48–55). The findings of the research however, are in contrast with existing literature, which is examined further in the discussion.

Responses to the first survey question, which explored students’ willingness to pursue a career as family physicians), indicated that final-year students exhibited a greater inclination toward this career path compared to first-year students. The reasons for this difference are multifaceted and not fully understood, but likely factors include work conditions and the generalist-specialist divide. Hospital work differs significantly from family practice work in several respects. Hospital physicians typically operate in large, dynamic teams and environments, which allows for greater social interaction, peer consultation, and knowledge sharing, but also introduces more social stress and potential workplace harassment (56–60). Conversely, family physicians often work in smaller teams, typically comprising a doctor and a nurse or technician, which can offer a more controlled and less stressful work environment. Hospital physicians also face longer and more unpredictable working hours, including on-call duties and night shifts (61). Additionally, while hospital physicians tend to specialize in specific medical areas, family physicians require a broad knowledge base. Students who initially aim for a specialty might discover a preference for the comprehensive scope of general practice, while others may become more committed to their chosen specialty. A specific point in medical education in Croatia which could influence this outcome is that students get extensive practice in family medicine, with some medical schools requiring their students to do part of their practice in island settlements (24–27).

Tying into the differences between hospital and family practice work, the second question explored students’ openness to working outside large medical centers. No significant difference was

**TABLE 4** Descriptive statistical indicators (frequencies and percentages) and the results of the chi-square test conducted between first-year ( $N = 323$ ) and final-year ( $N = 367$ ) medical students for all variables related to attitudes toward working in rural areas.

| Variable                                                                                                               |     | 1 <sup>st</sup> year | 6 <sup>th</sup> year | $\chi^2$ | $P$   |
|------------------------------------------------------------------------------------------------------------------------|-----|----------------------|----------------------|----------|-------|
| Would you consider family medicine among the medical professions you would choose as a career?                         | yes | 129                  | 184                  | 7.209    | 0.007 |
|                                                                                                                        |     | (39.9%)              | (50.1%)              |          |       |
|                                                                                                                        | no  | 194                  | 183                  |          |       |
|                                                                                                                        |     | (60.1%)              | (49.9%)              |          |       |
| Are you interested in a job outside of (a major) urban center?                                                         | yes | 168                  | 218                  | 3.805    | 0.051 |
|                                                                                                                        |     | (52.0%)              | (59.4%)              |          |       |
|                                                                                                                        | no  | 155                  | 149                  |          |       |
|                                                                                                                        |     | (48.0%)              | (40.6%)              |          |       |
| Do you believe that the undergraduate program provides the knowledge and skills necessary for working in a rural area? | yes | 204                  | 104                  | 84.287   | 0.000 |
|                                                                                                                        |     | (63.2%)              | (28.3%)              |          |       |
|                                                                                                                        | no  | 119                  | 263                  |          |       |
|                                                                                                                        |     | (36.8%)              | (71.7%)              |          |       |
| Have you considered working in rural areas?                                                                            | yes | 147                  | 239                  | 26.810   | 0.000 |
|                                                                                                                        |     | (45.5%)              | (65.1%)              |          |       |
|                                                                                                                        | no  | 176                  | 128                  |          |       |
|                                                                                                                        |     | (54.5%)              | (34.9%)              |          |       |
| Do you believe that rural doctors have good working conditions?                                                        | yes | 53                   | 48                   | 1.524    | 0.217 |
|                                                                                                                        |     | (16.4%)              | (13.1%)              |          |       |
|                                                                                                                        | no  | 270                  | 319                  |          |       |
|                                                                                                                        |     | (83.6%)              | (86.9%)              |          |       |
| Do you believe that the work of rural doctors should be financially incentivized compared to urban doctors?            | yes | 281                  | 349                  | 14.192   | 0.000 |
|                                                                                                                        |     | (87.0%)              | (95.1%)              |          |       |
|                                                                                                                        | no  | 42                   | 18                   |          |       |
|                                                                                                                        |     | (13.0%)              | (4.9%)               |          |       |

found between first-year and final-year students, with about half expressing openness to this idea. Hospitals, as the epicenters for complex patient care, allow physicians to engage with diagnostically and therapeutically challenging cases. Alternative career paths include general practice and private specialist clinics, with the latter offering more flexible working hours and often higher salaries, leading to a migration of physicians from hospitals to private clinics (62).

The third question, which showed the greatest difference between first-year and final-year students, examined their perceived readiness for rural practice upon graduation. While two-thirds of freshmen believed they would be adequately prepared, less than a third of final-year students agreed. This difference could partly be due to the recognition of the unique challenges rural environments present, such as limited support from the broader medical system and the greater difficulty of managing diagnostically uncertain cases which students would get the chance to see during their practice in island settlements. Moreover, the importance of hands-on experience becomes apparent during college; while medical school imparts essential skills, real-world experience is crucial for making sound clinical decisions (63).

As in many other countries, the curricula of medical faculties in Croatia do not have content related to rural medicine, nor special directions of education for working in rural areas (24–27). Educating students in a clinical environment has shown a higher level of satisfaction, knowledge, skills and attitudes among students, as well as a sense of readiness to assume the role of a doctor, stronger self-confidence and a more complex sense of professional identity (63). It could therefore be assumed that clinical exposure in rural environments would increase the students' attitude and willingness to work in rural areas (22, 23).

A near-universal opinion among students, regardless of their year, was that rural physicians face poor working conditions. This sentiment is not unique to Croatian students but is shared internationally (22, 23, 43, 45, 64). Several studies have examined if this truly is the case and have come out with complex results. The idea of working hours first comes up, as many physicians think that their rural colleagues have to work longer hours. Studies support this hypothesis, showing that rural physicians work on average 4 h longer than their city counterparts (65, 66). Patients in rural centers can be more medical challenging; they are on average older than those in the city, and have more disease complications

TABLE 5 Descriptive statistics (frequencies and percentages) and chi-square test results for groups of students studying in Osijek (*N* = 57), Rijeka (*N* = 162), Split (*N* = 181), and Zagreb (*N* = 290) regarding their interest in working in rural areas.

| Variable                                             |     | Osijek  | Rijeka  | Split   | Zagreb  | $\chi^2$ | <i>p</i> |
|------------------------------------------------------|-----|---------|---------|---------|---------|----------|----------|
| Are you interested in a job outside the city center? | yes | 36      | 94      | 97      | 159     | 2.041    | 0.564    |
|                                                      |     | (63.2%) | (58.0%) | (53.6%) | (54.8%) |          |          |
|                                                      | no  | 21      | 68      | 84      | 131     |          |          |
|                                                      |     | (36.8%) | (42.0%) | (46.4%) | (45.2%) |          |          |
| Have you considered working in rural areas?          | yes | 35      | 82      | 96      | 173     | 4.795    | 0.187    |
|                                                      |     | (61.4%) | (50.6%) | (53.0%) | (59.7%) |          |          |
|                                                      | no  | 22      | 80      | 85      | 117     |          |          |
|                                                      |     | (38.6%) | (49.4%) | (47.0%) | (40.3%) |          |          |

TABLE 6 Descriptive statistics (frequencies and percentages) and chi-square test results for groups of students living in rural settlements (*N* = 136), smaller towns (*N* = 264), and larger towns (*N* = 290) regarding their interest in working in rural areas.

| Variable                                                 |     | Rural settlement (Village) | Smaller town | Larger town | $\chi^2$ | <i>p</i> |
|----------------------------------------------------------|-----|----------------------------|--------------|-------------|----------|----------|
| Are you interested in a job outside a large city center? | yes | 98                         | 160          | 128         | 33.058   | 0.000    |
|                                                          |     | 72.1%                      | 60.6%        | 44.1%       |          |          |
|                                                          | no  | 38                         | 104          | 162         |          |          |
|                                                          |     | 27.9%                      | 39.4%        | 55.9%       |          |          |
| Have you considered working in rural areas?              | yes | 93                         | 139          | 154         | 10.647   | 0.005    |
|                                                          |     | 68.4%                      | 52.7%        | 53.1%       |          |          |
|                                                          | no  | 43                         | 125          | 136         |          |          |
|                                                          |     | 31.6%                      | 47.3%        | 46.9%       |          |          |

due to postponing doctor visits because of the distance to the hospital (13). Whether rural family physicians provide a wider service profile to their patients is uncertain, with certain studies showing no difference with urban counterparts (65), while others show a wider service profile as well as more medical equipment use in rural practices (67). Despite these challenges, rural family physicians in America do not show a lower job satisfaction nor a higher burnout rate (68).

Financial compensation for rural physicians was supported by a majority of students from both groups, with more final-year students endorsing this view. It could be argued that due to longer working hours, more complex patients and lack of availability to the rest of the medical system, rural physicians should be paid more than their rural counterparts (13, 66, 67). Government programs rarely cite this as the reason they give financial incentives to rural physicians, but rather do it to attract doctors to underdeveloped areas. Poorer working conditions are not usually among the top reasons physicians, especially young doctors, avoid moving to rural centers; rather, they usually cite less opportunities for their family, be it work, school or entertainment (18).

An intriguing discovery was that the aspiration of students to work outside major city centers and in rural areas was consistent across the four universities studied. However, this desire varied based on the population size of the students' hometowns. Students from rural backgrounds were more inclined to work in rural areas compared to those from urban centers. This indicates that the inclination to work in rural areas is not influenced by the geographical location of the universities (which were distributed in urban centers across different regions of the country) but is

instead linked to the students' backgrounds. These findings align with similar studies published in this field (17, 18).

Despite believing they are not prepared, not well compensated and will work in inadequate conditions, final year students still show more willingness to work in rural areas. A potential reason for the interest expressed by students in Croatia in working in rural areas, as previously mentioned, may be the point-based system for work experience used in applications for specialization. Further studies in this area could be valuable to establish what factors draw students to work in rural areas, especially in light of the three main findings of this research: student's rural background, financial incentives and improved working conditions. Other papers in this area suggest that financial incentives alone may not suffice to attract physicians to rural areas; improving rural infrastructure and creating more opportunities for employment and community development, together with enabling contact with rural medicine during medical school, might prove more effective in addressing the shortage (14–17).

## 5 Conclusion

Croatian medical students express interest in working in rural areas; however, their education does not adequately prepare them for this practice. Final-year students are more willing to become family physicians and work in rural areas despite believing that medical school does not adequately prepare a student for rural work. Students originally from rural settlements are especially interested in working in rural areas in the future.

Additionally, they believe that current working conditions for rural doctors are inadequate and that these professionals should receive further incentives.

## 5.1 Implication

The results of this research provide a compelling argument for enhancing medical school curricula by incorporating rural medicine content and strengthening the practical components of rural medical education in Croatia. As a pilot study, it provides preliminary insights into students' attitudes toward family practice and rural medicine. Future research could take a longitudinal approach to track how these attitudes evolve over time. Additionally, studies exploring students' perceptions of their rural education, along with intervention studies evaluating changes to the curriculum, would be valuable.

## 5.2 Strengths and limitations of the study

The findings from this research have practical implications for the educational program, particularly in terms of increasing the focus on rural medicine.

However, it is important to acknowledge the limitations of this study. The research was conducted online, which raises the possibility that the participants who chose to take part may differ from the general population of medical students. This is a limitation because online participants may have distinct characteristics, such as greater access to technology or different levels of motivation, potentially introducing selection bias and limiting the generalizability of the findings to the broader population of medical students. Another limitation is the study's cross-sectional design which limits the ability to make causal relations between the changes students go through (educational, personal or maturational) and their opinions on rural and family medicine.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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## Ethics statement

This study was approved by the Ethics Committee of the University of Split, School of Medicine. Electronic informed consent was obtained from all participants prior to starting the research.

## Author contributions

NM-D: Conceptualization, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing. IR: Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. NM: Investigation, Writing – original draft, Writing – review & editing. TV: Writing – original draft, Writing – review & editing. MB: Investigation, Methodology, Writing – original draft.

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# Designing the community training hub pilot as a model for multidisciplinary workforce development

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The Community Training Hub (Hub) Pilot aims to contribute towards addressing recruitment and retention challenges in Scotland's primary care workforce, with a particular applicability to the Remote, Rural and Island (RRI) context. A mixed methods evaluation framework has been designed to assess the effectiveness of the Hub multidisciplinary training across healthcare teams. The pilot involves General Practitioners (GPs), Advanced Nurse Practitioners (ANPs), Pharmacists, and Practice Nurses. This paper outlines the evaluation methodology, focusing on skill development, retention, and collaborative care. The paper argues for further evaluation of the Hub model to assess its potential as a model of distributed training and education to enhance workforce sustainability in rural healthcare.

## KEYWORDS

training, workforce, rural, evaluation, collaboration

## 1 Introduction

Scotland's National Health Service (NHS) operates within a publicly funded healthcare system, providing universal access to care, free at the point of delivery. This system is underpinned by the principle of equitable healthcare access, which poses unique challenges in geographically remote rural and island (RRI) areas due to low population density, geographic isolation, and higher healthcare delivery costs. Unlike healthcare systems reliant on private insurance, Scotland's NHS must allocate resources to meet the needs of diverse population within a constrained budget, which can amplify the impact of workforce shortages and access barriers in RRI settings.

RRI regions in Scotland face several persistent healthcare challenges, including workforce shortages, an ageing population, and increasing patient complexity. Stakeholders participating in range of qualitative interviews around primary and secondary care in R&R Scotland identified "R&R recruitment and retention" as the top priority (1). The recruitment and retention of healthcare professionals in RRI primary care settings has been a significant challenge across many countries (2). Another key issue is ensuring that small and often disparate teams receive the amount and level of training and education that they need to feel prepared for rural practice which can include increased generalist skills, given the high numbers of patient contacts and particularly ageing populations with high co-morbidities (3, 4).

These challenges require innovative solutions to improve accessibility, quality, and sustainability. Recognising these issues, the Scottish Government has implemented several policy measures to try and strengthen the healthcare workforce. For example, the Transforming Roles programme, introduced in 2017, focused on advanced practice roles within nursing, midwifery, and health professions to optimise service delivery (5, 6).

Similarly, the 2018 Scottish General Medical Services (GMS) contract emphasises the GP's role as a "senior clinical decision maker" and "expert medical generalist" within extended multidisciplinary teams (MDTs) (6, 7) to enhance primary care delivery. However, RRI GPs encounter unique challenges, highlighting the need for tailored solutions to support these practitioners and address complex health inequities in rural settings.

Globally, rural, and remote healthcare faces common challenges, including recruitment and retention of skilled professionals, limited access to education and training, and disparities in healthcare outcomes. While the specifics vary by region, high-income countries like Scotland share common concerns with other nations, such as the need for distributed education models to address geographic barriers and sustain a resilient healthcare workforce. Initiatives, such as the Rural Training Track (RTT) in the United States and Continuing Medical Education (CME) initiatives in Canada and Australia have successfully improved rural workforce capacity through strong stakeholder collaboration (8, 9, 24). These efforts emphasise addressing challenges such as long distances and drive times to urban centres where in-person training is delivered and difficulties with finding appropriate staff cover to allow others to attend training. Harnessing digital health technologies means to deliver distributed education can help, therefore, meet the continuing professional development needs of RRI primary care practitioners (10, 11). The use of online training and other digital educational strategies have been shown to help increase access to training and education for R&R primary care practitioners. Moreover, increased support for RRI generalist training will translate into a greater percentage of the workforce possessing the skills required for R&R practice (12, 13).

A Community Training Hub (the Hub) Pilot has been designed in Scotland to improve workforce recruitment and retention through multidisciplinary training and education which would be accessible and relevant for RRI healthcare teams. The Hub pilot initiative was designed by a group of stakeholders through collaborative co-development with two practices serving R&R populations and one serving an urban population. The initial pilot phase aims to support General Practitioners (GPs), Advanced Nurse Practitioners (ANPs), Pharmacists, and Practice Nurses in their professional development. A Hub is defined as "any action taken to support the coordination of education, learning and development that focuses on planning and upskilling primary care and community health workforces" (14) with the goal of improving generalist and emergency care capacity in rural contexts (13).

Several studies emphasise the importance of stakeholder engagement in such training initiatives. Stakeholders, ranging from programme participants and trainers to policymakers and community leaders, have been seen to play a critical role in areas as diverse as routine data collection, evaluation, and shaping the effectiveness of programmes (15). Moreover, stakeholder engagement in the evaluation and collection of routine data for education and training initiatives is fundamental for ensuring the efficacy, relevance, and sustainability of these initiatives (16). Despite the existence of such strategies, there is limited comprehensive evidence on how to support the development and implementation of digital distributed education initiatives tailored specifically to the needs of RRI primary healthcare teams. Although the existing literature highlights the importance of interdisciplinary collaboration and the development of generalist skills

to address workforce shortages in these settings, this has not yet been fully adopted in most RRI primary healthcare setting.

The paper argues for further evaluation of the Hub model to assess its potential as a model of distributed education to enhance workforce sustainability in rural healthcare and outlines a methodology for doing this. It also details the collaborative approach to the development of a Hub pilot in Scotland and outlines the protocol for its evaluation. By improving collaboration and skill development, the Hub aims to address critical workforce sustainability issues. NHS England have successfully implemented a Hub model to enhance interprofessional training for the whole primary care team backed by substantial funding (17). We hope that our future evaluation results will prove useful to the development of R&R primary healthcare policy in Scotland and elsewhere.

## 2 Methods

### 2.1 Workshop design and stakeholder engagement

The Community Training Hub (CTH) pilot was developed through a collaborative and participatory approach. Two virtual workshops (March and May 2024) engaged stakeholders, including GPs, Advanced Nurse Practitioners (ANPs), pharmacists, practice managers and practice nurses, to design the Hub. These workshops were held via Microsoft Teams, which served as the primary platform for engaging stakeholders in designing the Hub and building its evaluation framework. Each workshop lasted 2 h and included structured activities such as brief presentations, group discussions, and brainstorming sessions.

The workshops were attended by 23 participants: 11 in the first workshop and 12 in the second. Attendees comprised staff from NHS Education for Scotland (18, 19), the National Centre for Remote and Rural Health and Care (NC), and representatives from five GP practices located in urban, remote, and rural settings. Participants were eligible if they were healthcare trainers aged 18 or above, working in remote or rural GP training practices, and able to participate in the CTH activities. Stakeholders included GPs, Advanced Nurse Practitioners (ANPs), pharmacists, practice managers, and practice nurses.

Discussions during the workshops explored existing approaches to training, challenges in workforce development, educational and professional support needs, and potential contributions of GP practices to the CTH pilot. A key focus was on identifying gaps and barriers in training and exploring strategies for workforce sustainability, such as adopting a Train-The-Trainer (TTT) model and standardizing multidisciplinary training (20).

### 2.2 Data collection

Data were gathered through a combination of detailed notetaking, workshop recordings, and subsequent verbatim transcriptions. These methods ensured a comprehensive and accurate capture of discussions, allowing for an in-depth analysis of stakeholder perspectives. The workshop discussions were reflexive and interpretative, providing insights into both practical and theoretical considerations for the CTH

pilot as a recruitment and retention strategy. Stakeholders engaged in the workshops contributed perspectives informed by their varying levels of involvement with the CTH. Some participants provided practical insights based on their direct experiences with training and education, while others considered the pilot's potential application in broader contexts. These discussions shaped the evaluation framework, ensuring its relevance and applicability.

## 2.3 Data analysis

Thematic analysis of the workshop data was conducted using Braun and Clarke's six-step framework (21–23). This approach acknowledges the researchers' subjectivity and reflexivity while providing a structured interpretation of the data. The analysis involved:

1. *Data Familiarisation*: Reviewing recordings, transcripts, and notes to gain an in-depth understanding of the data.
2. *Code Generation*: Manually coding the dataset to identify meaningful segments of text.
3. *Theme*
4. *Identification*: Grouping codes into potential themes and iteratively refining these themes for coherence and accuracy.
5. *Reviewing Themes*: Ensuring that the identified themes accurately represented the dataset and provided meaningful insights.
6. *Defining Themes*: Clearly naming and defining the themes to reflect their significance within the context of the study.
7. *Reporting*: Integrating themes into a structured narrative supported by illustrative data extracts from the workshop discussions.

The thematic analysis was conducted by a single researcher, with periodic reviews to validate the interpretations and ensure consistency. No formal triangulation process was employed, but multiple reviews of the transcripts and researcher reflexivity contributed to the reliability of the analysis.

## 2.4 Evaluation framework

A realist evaluation model was chosen to assess the CTH pilot due to its ability to account for the complexity of healthcare systems. The realist approach focuses on understanding what works, for whom, in what contexts, and why. The decision to adopt this model was informed by the pilot's objectives to evaluate not only participant satisfaction and knowledge acquisition but also the practical application of training in real-world scenarios and its impact on workforce sustainability. A logic model links training activities to short- and long-term impacts, including workforce retention and improved clinical capacity.

## 3 Results

The Hub Pilot workshops revealed key themes that shaped the design and implementation of the project. These themes informed both the training model and the evaluation framework.

## 3.1 Stakeholder feedback

The workshops underscored the importance of flexible staffing, particularly in R&R settings where diverse employment contracts and workloads can hinder training efforts. Participants emphasised the need for multidisciplinary collaboration and the creation of a standardised competency framework for ANPs to ensure consistency in care delivery across practices.

### 3.1.1 Themes

#### 3.1.1.1 Identified

- *Support for Diversity*: Practices highlighted the importance of Multi-Disciplinary Teams (MDTs) and training approaches that accommodate the unique needs of their patient populations.
- *Flexible Staffing*: Participants noted that the scheduling of tutorials and clinical support for ANP trainees posed a challenge due to varied employment contracts. Addressing these barriers was seen as critical to improving retention and skill development.
- *Growth Opportunities*: The workshops identified the potential for the Hub to enable growth through team-based, interdisciplinary training that builds both clinical and collaborative skills.
- *Purpose-Driven Coalition*: A consistent theme was the need for standardisation in ANP training and the importance of national frameworks to guide competency development and improve workforce retention.

Participants expressed their uncertainties around what task was and was not appropriate practice in terms providing support for ANPs. There was a call for clear and nationally agreed standard.

*"For the individual, which is not necessarily ideal, you are trying to set up a community training hub with sort of standards, but a lot of it is about, you know, individual learning needs and for different practitioners and the speed that they come on. I do not think it's a one-size fits all."* (GP).

*"So, I suppose I wonder if there's a standardised training material for nursing or you know whoever you are training that can be used you know consistently, I do not know how it works, but you know we do some inhouse tutorials using people's knowledge like my expertise..."* (GP Trainer).

*"I was just going to suggest like a standardised competency framework that is across the whole like a national thing for specifically for kind of primary care, so that we are not, they are not being dictated to by boards etc., and are kind of formalised, whether that's advanced nurse practitioners, advanced pharmacists, advanced paramedic practitioners, these kind of routes and it could incorporate maybe the first, I do not know year of the GP training."* (ANP).

One participant expressed excitement at the term "standardised," highlighting the agreement among all participants, and said: *"I think all of us from the four different areas are sort of... the word standardised seems to be sort of recurrently repeated, and I think that's definitely something that we have experienced you know..., and so, you know I suppose that [standardisation] would help all of us."* (GP Trainer)

## 3.2 Outcomes

### 3.2.1 Collaborative MS teams space

The earlier workshops facilitated the creation of a centralised digital space, using Microsoft Teams. The practices agreed on the importance of the collation of resources to see what was being used and to allow an opportunity to start standardising training and educational content across the practices thereby supporting the training and education of the MDTs. In addition, this Microsoft Team's channel could be used as community space and to give an opportunity to primary care practitioners for peer support/education/discussions, that they might not otherwise have had the opportunity to do so. The MS Teams space provides an environment for knowledge exchange and practitioners to ask questions. This has an aim of addressing issues in primary care that can be particularly acute in remote and rural locations, such as professional isolation and lack of peer support.

### 3.2.2 The Hub in Turas

The Hub is in development and hosted on Turas; Turas is the national, digital learning management environment developed by NHS Education for Scotland to support health and care professionals working in the public sector. All staff within the three primary care practices involved in the pilot have access to Turas. The Hub will therefore be a repository for knowledge exchange, education, and training resources, to support practitioners to provide safe and effective primary care provision in RRI communities. Working collaboratively the design of the Hub in Turas was undertaken by staff working in the National Centre for Remote and Rural Health and Social Care incorporating the four pillars of practice identified by NES (undated) - clinical practice; facilitation of learning; leadership; and evidence - research and development. These basic principles and values are consistent among the professional groups involved in the pilot; in addition, specific training and education resources that are aimed across these professional groups have been collated as well as those with a specific remote and rural focus. Collation of the resources has been led by one of the Advanced Nurse Practitioners across the three practices who was supported by the practices involved. This collation of resources by the ANP was then returned to the National Centre staff using the MS Teams space as shown below to be uploaded to Turas. Feedback on the design, layout, and resources themselves was collated using MS Office forms during development.

### 3.2.3 Stakeholder-informed evaluation framework

The workshops also facilitated the creation of an agreed evaluation framework. Implementation of this framework will help address the lack of evidence on digital Hubs as a distributed education initiative for RRI workforce.

It was agreed that the evaluation of the Hub Pilot would employ a concurrent explanatory mixed methods design, integrating quantitative and qualitative data to evaluate training effectiveness. The evaluation framework developed is grounded in the principles of realist evaluation, i.e., focusing on interactions between context, mechanisms, and outcomes.

#### 3.2.3.1 Quantitative data collection

Structured surveys and assessments will gather data on participants' demographics, pre- and post- training knowledge, skills development, retention rates, and economic contributions.

#### 3.2.3.2 Quantitative key performance indicators (KPIs)

To assess the effectiveness of the Hub Pilot, a range of quantitative metrics were selected to measure participant engagement, knowledge acquisition, and workforce retention. These KPIs provide valuable insight into how well the multidisciplinary training has impacted professional development and long-term retention of healthcare professionals in RRI settings:

- Number of training sessions and attendance rates.
- Pre and post training knowledge assessments.
- Retention rates of trained healthcare professionals.

#### 3.2.3.3 Qualitative data collection

In-depth interviews and focus groups will explore participant experiences, stakeholder engagement, and adaptability of the Hub pilot.

##### 3.2.3.3.1 Qualitative themes

In addition to quantitative metrics, qualitative data will be collected through interviews and focus groups. Thematic analysis of these sessions will involve predefined and emergent coding; predefined themes relating to perceived effectiveness of the Hub, stakeholder engagement, and programme adaptability to local needs. Emergent codes will also offer a deeper understanding of participant experiences:

- Perceived effectiveness of the Hub.
- Stakeholder collaboration.
- Programme adaptability to community needs.
- Emergent themes.

#### 3.2.3.4 Integration of data

Quantitative and qualitative data will be integrated for cross-validation, ensuring a comprehensive evaluation of the pilot's impact on professional development and workforce retention.

#### 3.2.3.5 Evaluation logic model

The following logic model outlines the key resources, activities, outputs, and impacts for the Hub Pilot. It serves as a roadmap, showing how the inputs of the pilot lead to both short- and long-term outcomes. The model was developed with stakeholder input to ensure the pilot meets the specific needs of R&R PC teams and ultimately improves workforce retention and clinical capacity.

| Resources/Inputs                                                                                             | Activities                                                                                                     | Outputs                                                                                               | Outcomes                                                                                                                                                                                                                                                                                                    | Impacts                                                                |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| NES/NC: Hub platform, expertise, funding, network.<br>HUB Testers: Trainers, materials, resources, trainees. | Conduct training for MDTs.<br>Workshops, collaborative core training plans.<br>Develop learning opportunities. | Expanded training.<br>Refined learning schedule.<br>Increased identification of retention challenges. | <i>Short-Term:</i> MDTs engaged<br><i>Mid-Term:</i> MDT knowledge growth<br><i>Long-Term:</i> Nationwide training support through centralised platform; workforce development through long-term creation of career growth opportunities by fostering skill advancement and continuous learning initiatives. | Improved workforce retention and clinical capacity in R&R PC services. |

The MDTs will participate in regular training within their practice and other training organised through the hub whiles using available resources independently for their professional development. Their engagement will be crucial for the success of the pilot, requiring active

evaluation includes metrics related to collaboration and partnerships, reflecting the importance of cross-disciplinary cooperation in R&R primary care settings. The table below outlines the key KPIs across different professional groups involved in the Hub Pilot:

| Profession  | Training delivery KPIs                                                                                  | Engagement and satisfaction KPIs                                                        | Impact on knowledge and skills KPIs.                                                            | Collaboration and partnerships KPIs                                                                      |
|-------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Doctors     | Number of Clinical Training Sessions and CME* Credits specific to R&R PC*.                              | Attendance Rate and Satisfaction Scores.                                                | Pre- and Post-Training Assessment Scores and Practical Skill Demonstration.                     | Partnerships with Educational Institutions and Joint Courses.                                            |
| Nurses      | Number of Nursing Training Sessions, CEUs* specific to R&R PC.                                          | Engagement Levels and Feedback Scores.                                                  | Knowledge Gain Metrics and Clinical Competency Skills.                                          | Collaborative Training Initiatives and Partnership Impact.                                               |
| Pharmacists | Number of Pharmacist Training and Certification Opportunities specific to R&R PC.                       | Participation Metrics and Survey Results.                                               | Pre- and Post-Training Assessment Scores and Credentialling or Certification Achievement Rates. | Partnership with Pharmacy Schools and Collaborative Sessions.                                            |
| ANPs        | Number of Advanced Practice Sessions and Certification Opportunities specific to R&R PC.                | Attendance Metrics and Satisfaction Ratings.                                            | Advanced Skills Assessment and Certification Achievement Rates.                                 | Advanced Practice Collaborations and Joint Certification Courses.                                        |
| MDT         | Total Training Sessions Conducted in R&R PC. Diversity of Training Courses in R&R PC. Attendance Rates. | Participation Rate and Satisfaction Survey Results. Team Dynamics Qualitative Feedback. | Assessment Scores, Application of Skills and Collaborative Case Studies.                        | Number of collaborative sessions, partnerships with educational institutions and joint training courses. |

\*CME, Continuing Medical Education; CEUs, Continuing Education Units; PC, Primary Care.

involvement from all participating MDTs. The MDTs are expected to grow both in terms of expertise and coordination of patient care. This will involve targeted skill development through ongoing training and cross-functional collaboration, allowing MDTs to take on new clinical pathways and expand their leadership roles. This, in turn, will result in increased retention and recruitment of the workforce.

### 3.2.3.6 KPIs across professional groups

The evaluation of the Community Training Hub Pilot utilises a comprehensive set of Key Performance Indicators (KPIs) to assess the effectiveness of multidisciplinary team (MDT) training across various healthcare professionals. These KPIs are designed to measure the impact of the training on knowledge acquisition, skill development, engagement, and overall workforce performance. Additionally, the

The plan is that the KPI data will be collected at three time points: T0 (at the start of the CTH pilot), T1 (at 12 weeks), and T2 (at 6 months), and T3 (at 9 months) using a one-group pre-test and repeated post-test design analysis methodology to determine the effectiveness of the CTH and track participants' journey through the CTH pilot. Likert-Type Scales will be explored for all the outcome assessments. The KPIs were created based on our expertise in programme evaluation and scoping of existing literature on educational interventions and the metrics that were most relevant to the different professional groups. The selected KPIs provide clear insights into the critical success factors for each professional group's performance. The core indicators for the evaluation would be Participant success rates, Retention rates post-training and Economic indicators (e.g., employment creation), and yes, the idea is to go back to the logic model to measure progress. That is, the number

and percent of participants who use the CTH platform to support their learning needs, who report that they have increased knowledge, learnt new skills to support patient care, who do not have the intention to leave their role following completion of the pilot are indicators of how well the CTH is doing with respect to the outcome.

The evaluation of the Hub Pilot is designed to capture a wide range of outcomes, from short-term improvements in communication and skills application to long-term impacts on workforce retention and patient care quality. The table below outlines the expected short, intermediate, and long-term outcomes for each professional group involved in the pilot, highlighting how the training contributes to workforce stability, improved team dynamics, and enhanced patient outcomes in remote and rural (R&R) primary care settings.

| Category                            | Short-term outcomes                                                                 | Intermediate outcomes                                                              | Long-term outcomes                                                               |
|-------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Doctors                             | Workforce Development, Health Outcome Correlation                                   | Team Performance Metrics, Patient Care Coordination                                | Recruitment and Retention Metrics, Workforce Development, Workforce Capacity     |
| Nurses                              | Retention Rates, Patient Care Quality                                               | Patient Satisfaction Scores                                                        | Retention and Patient Care Quality                                               |
| Pharmacists                         | Professional Growth, Medication Error Rates                                         | Team Performance Metrics, Patient Satisfaction Scores                              | Reduced Medication Errors, Professional Growth                                   |
| Advanced Nurse Practitioners (ANPs) | Workforce Stability, Certification Advanced Care Delivery                           | Patient Care Coordination, Improved Care Quality                                   | Retention and Job Satisfaction, Advanced Care Delivery                           |
| Multidisciplinary Team (MDT)        | Improved Communication, Role Clarity, Immediate Skill Application, Turnover by Role | Team Performance Metrics, Improved Patient Care Coordination, Patient Satisfaction | Workforce Stability, Sustainable MDT Practices, Improved Patient Health Outcomes |

## 4 Discussion

The Hub pilot represents an innovative approach to addressing workforce challenges in RRI healthcare by leveraging distributed education and multidisciplinary collaboration. Through stakeholder engagement, we have designed an associated evaluation framework. Through implementation of both, we aim to test the potential of the Hub as a scalable model for addressing the recruitment and retention challenges in R&R healthcare. By integrating tailored training into daily clinical practice, the HUB aims to foster skill development and a stronger sense of community among healthcare professionals, contributing to improved workforce stability.

The Hub pilot's design and evaluation directly address its primary aim: to create a scalable and sustainable model for multidisciplinary training that supports workforce development in RRI settings. By engaging stakeholders, including GPs, Advanced Nurse Practitioners (ANPs), pharmacists, and practice managers, the pilot sought to develop an inclusive framework that reflected the realities of rural healthcare delivery. The emphasis on stakeholder-driven co-design ensured that the Hub model aligned with the practical and theoretical needs of the healthcare teams involved.

Stakeholder engagement during the design phase revealed key themes that directly informed the Hub's structure. Stakeholders emphasised the need for flexible staffing, standardised training materials, and enhanced support for multidisciplinary teams, particularly ANPs. This is consistent with previous studies highlighting

the importance of tailored education models in rural contexts (10, 13). These findings align with global strategies that emphasise distributed education and stakeholder collaboration to address geographic barriers to training (8, 9). The engagement also reinforced the need for shared ownership of the training model, ensuring its relevance and sustainability in these settings.

The evaluation framework developed for the Hub pilot is grounded in realist principles, which will add depth to the assessment of training outcomes. Unlike traditional models that focus solely on participant satisfaction, the realist approach examines how specific contextual factors influence the success of the intervention. This focus on “what works, for whom, and in what contexts” provides actionable insights for scaling the Hub model to other settings.

The KPIs outlined in the evaluation framework provide a detailed and structured approach to monitoring the effectiveness of the Hub Pilot. These metrics will track key areas such as knowledge acquisition, skill development, and multidisciplinary collaboration. For example, the Training Delivery KPIs highlight the diverse range of sessions tailored to specific healthcare professionals, ensuring that the learning opportunities are both relevant and applicable across different roles within remote and rural (R&R) primary care. By including participation and engagement metrics, the KPIs also ensure that the training's reach and accessibility will be monitored, allowing for adjustments where necessary to maximise impact.

Collaboration and partnerships are central to achieving Hub success. By fostering connections between healthcare teams, educational institutions and other stakeholders, the Hub model may address resource constraints as often encountered in RRI settings. The hub's emphasis on collaborative care is particularly important in rural contexts, where multidisciplinary teamwork is essential for positive patient outcomes.

The projected outcomes of the Hub pilot demonstrate its potential impact on workforce retention and patient care quality. Short-term outcomes, such as improved communication and role clarity within multidisciplinary teams, are crucial for ensuring immediate practical application of skills gained through training. Over time, these improvements are expected to lead to more substantial impacts, including better patient care coordination, reduced workforce turnover, and increased capacity within RRI healthcare. By addressing both immediate and systemic challenges, the Hub model aligns with broader goals of healthcare equity and sustainability.

## 4.1 Implications for policy

The Hub Pilot also has significant implications for policy. If successful, it could serve as a scalable model for similar initiatives across Scotland and beyond. By leveraging digital platforms like Turas and in-person workshops, distributed education through a Hub model suggests distributed education could bridge geographic barriers and support ongoing professional development in remote settings. This would align with international models of rural healthcare training, such as Australia's Rural Training Track and Canada's CME programmes, which have shown long-term benefits for workforce sustainability.

Future research will be essential to fully understand the Hub pilot's impact. Longitudinal studies could explore how training interventions influence patient outcomes, workforce retention and healthcare system capacity over time. Additionally, further engagement with policymakers and healthcare providers will be crucial for scaling the HUB model and integrating it into national strategies for RRI healthcare improvement. While the study provides valuable insights, it is limited by its reliance on self-reported data from workshop participants, which may introduce bias. The absence of formal triangulation in the thematic analysis is another limitation that should be addressed in future studies.

## 5 Conclusion

From the viewpoint of the researchers, the Hub brings significant advantages in addressing a spectrum of challenges in RRI healthcare settings. It has the potential to help RRI areas with their ongoing challenges in attracting and retaining talent, as well as reduce social disparities and promote the growth of a sustainable health workforce which, in turn, could lead to equitable and quality health care delivery across RRI areas.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

Ethical approval was not required for the studies involving humans because not considered a research study. The studies were

conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

S-AM: Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing. AI: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. RE: Investigation, Writing – review & editing. TG: Conceptualization, Supervision, Writing – review & editing.

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## Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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# Peer-led learning: a novel approach to promote rural healthcare interest among medical students

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**Introduction:** A persistent maldistribution of medical workforce exists across Canada, with rural areas facing a greater physician shortage. Medical education can be instrumental to increase physicians in rural communities, and medical schools have adapted strategies to generate interest in rural careers among medical students. Many of these efforts occur within formal structured curriculum. This study appraises the effectiveness of peer-led learning (PLL) as a novel approach in rural medical education to provide students with a better understanding of rural life and rural medical practice.

**Methods:** This is mixed methods study using a survey and follow-up focus group discussion to evaluate a day-long educational experience organized and led by a medical student to their rural community. Quantitative data were summarized with descriptive statistics. Reflexive thematic analysis was conducted on qualitative insights to describe the students' experiences and perceptions about the educational rural day.

**Results:** Of 54 participants, 50 completed the survey and 13 consented for the follow-up focus group. Most (78%) were female, have non-rural origins (78%), with only 2 having Indigenous status. Majority (61%) have low familiarity with rural medicine. Trustworthiness scores for information about rural life and medical practice were higher for rural-origin peers and rural-origin faculty compared to other sources of information such as government websites, social media, and traditional media. Thematic analysis yielded three main themes: (i) informal teaching facilitated learning, (ii) trust in their peer enabled students to receive information more favorably, and (iii) students gained a better understanding of rural life and medical practice.

**Conclusion:** This study demonstrated that medical students engage differently with peer-led learning activities about rural medical curriculum versus a formal teaching environment. Medical students are cautious about promotional information regarding rural medical education from formal sources but are less skeptical when learning from peers. Information about the way of life and healthcare needs in rural communities may be perceived as more credible and valid if coming from a peer, and hence, is more likely to be received favorably. Thus, when promoting rural education and careers, medical schools should work with rural-origin students, whose messaging may be considered more trustworthy than traditional sources.

## KEYWORDS

rural medical education, peer-led learning, peer-assisted learning, undergraduate medical education, distributed medical education, distributed learning, rural healthcare, community engagement

## 1 Introduction

Globally, the medical workforce is suffering from a persistent geographic maldistribution with fewer doctors per head of population in rural communities compared to metropolitan areas (1, 2). Medical schools across Canada have made efforts to address the rural healthcare access crisis by working to generate interest in rural medicine among medical students (3–5). Many of these efforts occur within formal structured curriculum including clinical rotations, experiences, and clerkship placements in rural settings, inclusion of rural curriculum content in courses, and utilization of rural physicians as teachers and mentors (6, 7), as well as the recruitment of rural-origin students (8). Despite these efforts, medical student interest in Family Medicine rural careers continues to fall behind rural workforce needs. A recent report by the Canadian Resident Matching Service (CaRMS) revealed that the number of positions filled to Family Medicine residency training program was 85% for 2024 compared to 93% in 2014, marking the lowest first-round match rate in the past decade, which directly impacts the supply of family physicians for rural Canada (9). Notably, student recruitment from rural communities remains low and does not represent the Canadian population, with only 6.4% of medical students having a rural background compared to 18.7% of the population living in rural communities (10, 11). This may be partly due to the fact that medical schools use different policies and procedures to recruit rural and Indigenous students (2). Hence, most medical students are from urban locations and are unfamiliar with rural ways life and culture (12). Research has demonstrated that there is a difference in perceptions of rural life and rural medical practice depending on the student's prior experience with rural communities (13, 14). Sadly, rural medicine is vastly misunderstood among students from urban centers, who often base their perceptions of rural medicine on stereotypes (12). Misconceptions and negative views about rural careers are a concern as these may dissuade medical students from participating in rural learning experiences such as rural rotations and, crucially, from eventual rural practice (15). In addition, feeling prepared for small-town living is an equally important predictor of physician retention in a rural community, as feeling prepared for rural practice (16).

This study explores peer-led learning (PLL) as a novel approach in rural medical education to provide medical students with a better understanding of rural life and rural medical practice. Outside of formal medical education curriculum, other conventional strategies such as student interest groups focused on rural medicine (17, 18), and exposure of students to quality rural experiences such as rural mentorship programs (19) have showed more promising results. Educational research has shown that techniques utilizing social learning experiences and involvement of peers are more effective than solitary learning approaches (20–22). Instead of a predefined curriculum, PLL is an informal approach where students learn with and from each other through interactions as peers or fellow learners (23, 24). PLL has been described as “the acquisition of knowledge and skill through active helping and supporting among status equals and matched companions,” where peers help each other learn and they themselves also learn in the process (25). Another

study described the nature of PLL as “students learn a great deal by explaining ideas to others and by participating in activities in which they can learn from their peers” (26). Unlike structured curriculum, PLL is more adaptable, cooperative, and spontaneous. It utilizes various learning modalities including informal discussions, group activities, field excursions, and outdoor expeditions compared to more structured formats such as peer tutoring or task shadowing. The involvement of student peers in medical education has grown over time in many forms and contexts (25, 27), and its acceptability and advantages are well-established, including positive effects on academic performance, communication skills, and student satisfaction (28–34).

The authors of this study are from a department of a medical school in Western Canada, aiming to foster rural healthcare awareness and bolster interest by providing learners with educational opportunities and other rural experiences where students may gain an appreciation of rural life and learn more about rural practice. The goal is to encourage a robust pipeline of students who will consider future rural practice. Traditionally, learning experiences include the use of rural physicians as teachers and mentors, culturally immersive rural block rotations and longitudinal clinical rural clerkships. To better prepare medical learners, the authors seek innovative ways outside of conventional rural experiences to encourage students to consider things that traditional medical teaching may not. One such novel method used by the authors was adapting the living library concept as a learning modality to promote and facilitate interest in rural medical practice (15, 35). As another innovative approach, the authors have engaged with a student peer to help students gain fresh perspectives about rural life and rural medical practice. Under the guidance of a rural physician and member of faculty (LF), a medical student (AG) with a background in a rural farming community organized and led a day-long rural educational experience for their fellow students in their own community. The learning goals of the rural day experience were centered on understanding the lives of rural people and rural physicians with a view toward better caring for rural patients no matter what discipline or practice location the students eventually chose.

The objective of this research is to understand the impact on the learners of a rural day educational experience that is entirely peer-led and peer-organized. There is a paucity of research examining the impact of peer-led experiences on medical students' attitudes toward rural life and rural medical practice. The authors hypothesized that medical students may engage differently with peer-led activities versus formal institutional activities and that trust in the information presented and ability to understand the environment from a peer perspective may be impactful.

## 2 Methods

### 2.1 Description of the rural day educational experience

The student peer (AG) organized a rural day-long educational excursion to their community of origin. The rural day was publicized

to the entire first year medical class. Students signed up voluntarily for the rural day. The sign up and wait list was managed by the student leading the experience (AG). The organization of the day-long experience included a tour of a small-town hospital, meeting rural physicians and members of the community, and learning about the lives of farmers and what rural living looks like. Students were transported by bus from the medical school early in the morning. On their arrival, they broke into small groups for a tour of the community hospital and small group procedural skills stations (e.g., suturing, casting, intubation, IV starts, running codes, and laboratory skills), led by local physicians. After the small group sessions, the hospital's clinical nurse educator ran an interactive code simulation with all the students. Following the clinical learning sessions, students were provided lunch and met members of the community, including some members of the peer's friends and family. After the events at the hospital, the students travelled to the peer's family farm where they were given a tour of the farm, taught about agriculture, introduced to the farm animals, and exposed to various agricultural technologies. The students then listened to a panel focused on understanding rural communities and the people who live in them, followed by a locally sourced dinner at the farm.

## 2.2 Evaluation of the rural day educational experience

This is mixed methods study using a sequential design approach without a comparison group to understand the potential impact of the rural day experience. For the quantitative portion of the study, an online post-event survey (Qualtrics 2020) was used, and for the qualitative phase, a follow-up focus group discussion was conducted with semi-structured questionnaire. The study received ethics approval from the University of Calgary Conjoint Health Research Ethics Board in May 2024.

### 2.2.1 Post-event survey

After the rural day experience, the survey collected the participants' demographic information (gender, nationality, age, rural origin, program of study, and year in the program and the students' insights about the rural day experience). Data were also collected on students' familiarity with rural medicine and the level of trust students placed on various sources of information about rural life and rural medical practice. To examine their attitudes toward rural life and medical practice, we asked the students to use 5-point Likert-type scales to rate their familiarity with rural medicine (*1 = not familiar at all to 5 = extremely familiar*) and their agreement to statements about aspects of rural medicine (*1 = strongly disagree, 2 = disagree, 3 = not sure, 4 = agree, and 5 = strongly agree*): as potential career option, scope of practice, rural life and work, interest in rural healthcare, and need for rural doctors. To evaluate the value of different sources of information about reality of rural life and rural medical practice, we asked students to rank the trust they put of information they get from rural-origin peers, rural-origin faculty, academic institution or medical school, official information provided by rural communities such as town websites, social media, and traditional news media. Finally, the following open-ended questions was presented: "*how were you impacted by this peer-led experience?*," "*why was it important that this activity was peer-led?*," and "*how do peer-led experiences factor into medical school?*"

At the end of the survey, students were asked whether they might be willing to join a focus group to further explore student perceptions and attitudes around their experience of the peer-led activity.

### 2.2.2 Qualitative assessment

To explore the participants' perceptions about their experience, qualitative insights were collected through a focus group discussion using a semi-structured questionnaire, as well as a qualitative open-ended questions in the survey. The semi-structured focus group guide is attached as [Supplementary Appendix](#). An independent interviewer, with extensive experience in qualitative data collection and who was not part of the study team, facilitated the focus discussion via Zoom in May 2024. To ensure a conversational tone, the interview guide was applied flexibly. The focus group discussion lasted between 45 and 60 minutes. The responses were recorded through Zoom and transcribed verbatim by a professional transcription service, which removed any personally identifying information. For students who could not make it to the focus group discussion, they were invited to complete the semi-structured questionnaire on their own. There were five main questions as follows: (i) "*what made you participation in this rural day activity?*," (ii) "*how did it mean to you that the activity was organized by a fellow student?*," (iii) "*how would you describe the level of expertise shown by the fellow student for this activity?*," (iv) "*what was the impact on you or what takeaway messages did you get from this experience?*," and (v) "*how has this peer-led activity influenced your familiarity of the rural context?*"

## 2.3 Data processing and analysis

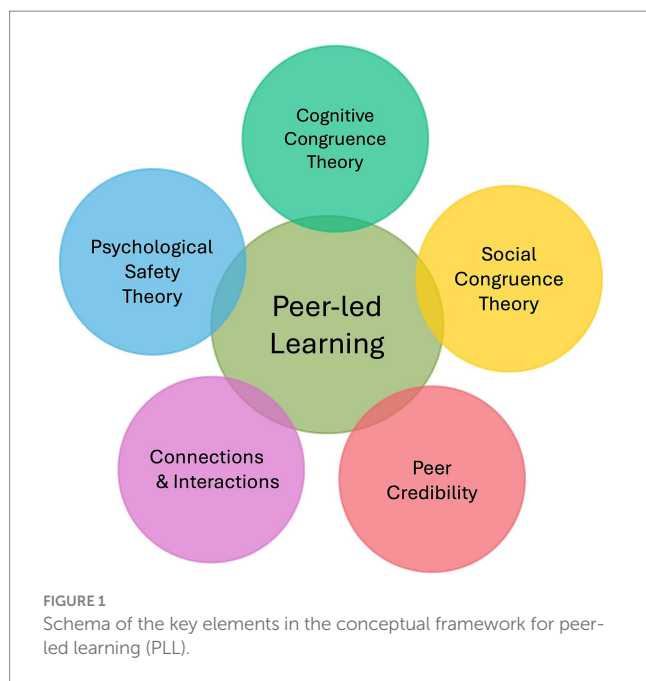
### 2.3.1 Conceptual framework

The theories applied to peer-led learning vary extensively. To evaluate the rural day experience and to understand its potential impacts, the authors followed the conceptual framework suggested by other researchers of peer-assisted learning in medical education in our analysis (28, 29, 33, 36–39). Through this framework, depicted in [Figure 1](#), the researchers posited that PLL happens when (i) *students and peer tutors share social congruence*, (ii) *students and peer tutors have comparable cognitive congruence*, (iii) *students feels a sense of psychological safety*, (iv) *peer tutors are considered to have credibility with the students*, and (v) *the connection and interactions in the group promote new learning*.

Social congruence implies same or similar socio-academic status between students and peer tutor, while cognitive congruence suggests that a relatively short knowledge distance exists between them (37). Psychological safety means feeling secure to speak up, voice concerns, or make mistakes without fear of repercussions (40).

### 2.3.2 Quantitative data analysis

Quantitative data from the online survey were cleaned before further analysis using SPSS (version 29.0). Participants' characteristic data were summarized using descriptive statistics. Attitude and perception scores were reported in terms of counts and percentages. Trustworthiness scores for the six sources of information for rural and rural medical practice were computed from the ranks provided by the students. The rank scores were reverse-coded using formula,  $trustworthiness = \max(rank) + 1 - actual(rank)$ , to reflect that an item ranked 1 would have the equivalent highest trustworthiness score of



6, while an item ranked 6 would have trustworthiness score of 1. Trustworthiness scores were also summarized using descriptive statistics and presented graphically as well.

### 2.3.3 Qualitative data analysis

Audio recordings were transcribed verbatim by a professional transcriptionist and de-identified replacing names with pseudonyms during the coding process. Transcripts were analyzed using a reflexive thematic analysis approach, following similar steps used by Braun and Clark (41) and other qualitative researchers (42–44): (1) familiarization with the data, where authors (GP and AJ) read and re-read the responses to develop familiarity with what students are saying; (2) after familiarizing with the text, the authors separately identified meaningful words or phrases that form concepts or patterns (codes), (3) authors reviewed the codes together to define common themes, (4) authors discussed to reach consensus, with a third author adjudicating as needed (AG), and established a coding scheme, (5) the results were then recoded using this coding scheme, and (6) review of themes and selection of quotes to reflect the themes. Due to the relatively small number of transcripts, the coding was done manually and the study team met periodically to discuss emergent patterns.

## 2.4 Study team's reflexivity and positionality

The research team consisted of two physicians (AJ and LF), a research staff (GP) with experience in mixed methods research and qualitative analysis, and medical student who is a novice researcher (AG). AJ is the associate dean for distributed teaching at the medical school, overseeing all distributed learning activities. LF is rural clerkship preceptor and works as a rural generalist physician from an Indigenous community. GP supports the various scholarship activities of the distributed teaching faculty, preceptors, and medical learners.

AG grew up in a rural farming community. The authors were guided in their reflexivity by the work of Crabtree and Miller (45) and were mindful of their own biases and assumptions that they bring to this research. As a bias-mitigation measure, the research team used an independent interviewer to facilitate the focus group discussion.

## 3 Results

### 3.1 Study participants

Of the 54 students that participated in the rural day activity, 50 completed the post-event survey and their demographic description is provided in Table 1. Most were women (78%), aged less than 25 years (70%), and from non-rural origins (78%). Nearly half said they have domestic partners, but none have children. There were only seven participants that indicated being raised in a rural community and only two have Indigenous status.

Thirteen students (26%) consented to be contacted for qualitative phase of the study. Of these 13 participants, 3 have rural origins while 10 have urban background. The authors planned to conduct separate focus groups for rural-origin and urban-origin students but could find a common time only for 7 participants from the urban-origin group for one focus group discussion. The 3 rural-origin students could not find a common time; however, 2 students still wished to participate and were provided the same questionnaire guide, used in the focus group, for completion on their own. In total, the qualitative data comprised of responses from multiple sources, i.e., 7 focus group participants, 2 questionnaire responses, and 50 text responses from the post-event survey. Across the multiple sources of data, the authors noted reaching a point of saturation as they encountered the same patterns and themes repeatedly during the analysis.

### 3.2 Quantitative data—descriptive statistics

Table 2 presents the students' attitudes about rural medical practice and life. The authors considered "not sure" responses as non-favorable. Almost all students (94%) indicated disagreement that rural and urban communities have equitable access to healthcare, and almost all (96%) said they were interested in the health and wellbeing of rural communities. However, while 94% acknowledged the lifestyle benefits of living in rural communities and 98% said that the wide scope of practice would make for an interesting career path, only 45% indicated that rural medical practice would be a suitable career option for them. Despite this relatively low interest, it is encouraging that 76% thought it would matter to consider a rural practice and 92% would like to know more about the opportunities for rural medical practice.

Table 3 shows the proportion of students by the ranking of trustworthiness of the different sources of information for rural life and rural medical practice, while Table 4 describes the trustworthiness scores. Majority of the students have low familiarity with rural medicine, with only 39% indicating they were moderately to extremely familiar and the rest (61%) have little or no familiarity (Figure 2).

For information regarding rural life, students tended to trust most their rural-origin peers (mean = 5.63, SD = 0.79), rural-origin faculty

TABLE 1 Demographic profile of student participants.

| Demographic profile                                      | <i>n</i> | %     |
|----------------------------------------------------------|----------|-------|
| Students who signed up for the activity                  | 55       |       |
| Students who participated in the activity                | 54       |       |
| Students who provided post-activity data                 | 50       | 100%  |
| Gender                                                   |          |       |
| Male                                                     | 10       | 20.0% |
| Female                                                   | 39       | 78.0% |
| Other                                                    | 1        | 2.0%  |
| Age group                                                |          |       |
| 18–25 years                                              | 35       | 70.0% |
| 26–30 years                                              | 10       | 20.0% |
| 31–35 years                                              | 4        | 8.0%  |
| 36–40 years                                              | 1        | 2.0%  |
| Ethnicity                                                |          |       |
| Caucasian/European/White                                 | 24       | 48.0% |
| Black/African                                            | 2        | 4.0%  |
| Latin American/Hispanic (e.g., Mexican, Chilean)         | 2        | 4.0%  |
| Middle Eastern/Arab/West Asian (e.g., Egyptian, Iranian) | 1        | 2.0%  |
| South Asian/East Indian (e.g., Pakistani, Sri Lankan)    | 8        | 16.0% |
| Asian (e.g., Chinese, Korean)                            | 9        | 18.0% |
| Filipino/Pacific Islander                                | 0        | 0.0%  |
| Metis                                                    | 1        | 2.0%  |
| Mixed ethnicity                                          | 2        | 4.0%  |
| No data                                                  | 1        | 2.0%  |
| Family status                                            |          |       |
| Single                                                   | 26       | 52.0% |
| Partnered without children                               | 23       | 46.0% |
| Partnered with children                                  | 0        | 0.0%  |
| No data                                                  | 1        | 2.0%  |
| Rural or non-rural origin                                |          |       |
| Rural                                                    | 7        | 14.0% |
| Non-rural                                                | 39       | 78.0% |
| Not sure                                                 | 3        | 6.0%  |
| No data                                                  | 1        | 2.0%  |
| Indigenous status                                        |          |       |
| Yes                                                      | 2        | 4.0%  |
| No                                                       | 47       | 94.0% |
| No data                                                  | 1        | 2.0%  |
| Career plans                                             |          |       |
| Family Physician                                         | 7        | 14.0% |
| Specialist Physician                                     | 27       | 54.0% |
| Not sure                                                 | 15       | 30.0% |
| No data                                                  | 1        | 2.0%  |
| Specialist areas of interest                             |          |       |
| Emergency Medicine                                       | 3        | 6.0%  |
| Family Medicine                                          | 7        | 14.0% |
| General Surgery                                          | 8        | 16.0% |
| Geriatrics                                               | 3        | 6.0%  |
| Internal Medicine                                        | 3        | 6.0%  |
| Neurology                                                | 3        | 6.0%  |
| Neurosurgery                                             | 3        | 6.0%  |
| Orthopedics                                              | 2        | 4.0%  |
| Obstetrics                                               | 1        | 2.0%  |
| Pathology                                                | 1        | 2.0%  |
| Pediatrics                                               | 1        | 2.0%  |
| Psychiatry                                               | 1        | 2.0%  |
| Radiology                                                | 1        | 2.0%  |

(mean = 5.02, SD = 0.57), and official information from town websites (mean = 3.65, SD = 1.14) (Figure 3). For information about rural medical practice, students put more trust in rural-origin faculty (mean = 5.48, SD = 0.58), rural-origin peers (mean = 4.94, SD = 1.08), and the academic institution (mean = 4.02, SD = 1.04) (Figure 4).

### 3.3 Qualitative data—thematic analysis

Three main overarching themes emerged from the thematic analysis of textual data, namely, (i) the informal teaching facilitated learning, (ii) the trust in the student peer enabled students to receive information more favorably, and (iii) the rural day experience promoted a better understanding of rural life and medical practice. Relevant sub-themes are discussed under each main theme, with supporting verbatim responses provided as applicable. The verbatim responses are identified by participant number and the corresponding source of data, i.e., either focus group (FG), post-survey (PS), or questionnaire responses (QR). For example, “QR Participant 1” denotes student 1 who responded through the self-administered questionnaire.

#### 3.3.1 Theme 1: the informal teaching facilitated learning

The participants felt the rural day experience was engaging and facilitated learning. The sub-themes indicated by the transcripts for facilitation of learning included the (i) fun and relaxed environment, (ii) common knowledge base between learners and student peer, (iii) high expertise of the student peer about rural life, and (iv) enthusiasm and supportive motivation provided by the student peer.

- i The fun and relaxed environment of the rural day activity was a key element in learning.

A lot of the participants come from urban backgrounds, and the day trip to a rural town was regarded as refreshing and relaxing, as well as a unique learning opportunity.

- *I really liked that [the day] was divided into kind of two parts, that we had the morning at the hospital learning skills, kind of doing things that we do in class and all that. But going beyond that, too. Like, a lot of those skills we have not learned yet, or might not learn while we are in pre-clerkship, but then having the afternoon on the farm, more relaxed, where we are able to talk to classmates that maybe we do not usually talk to, or even AG's family and friends. I really liked that separation because yes, kind of like someone else said, like, we are in class. We learn all these things and all that. So it's nice to have that separation of a more social, while still learning about rural life. (FG Participant 6)*
- *It was really insightful to hear from health care professionals practicing in Vulcan, and also to hear from farmers who live in the area. I really enjoyed the opportunity to practice procedural skills, learn about rural life, and further connect with classmates. I also really enjoyed the animal therapy that came with meeting all the animals on the farm! (PS Participant 40)*

- ii The common knowledge level between learners and peer facilitated learning.

TABLE 2 Attitudes and perceptions about rural medicine and the rural day experience.

| Attitudes and perceptions                                                                                            | Strongly disagree | Disagree | Not sure | Agree    | Strongly agree |
|----------------------------------------------------------------------------------------------------------------------|-------------------|----------|----------|----------|----------------|
| <b>Attitudes and perceptions toward rural medicine</b>                                                               |                   |          |          |          |                |
| I'm interested in the health and wellbeing of rural communities                                                      | (0%)              | (0%)     | 2 (4%)   | 20 (41%) | 27 (55%)       |
| Rural medical practice would be a suitable career option for me                                                      | 1 (2%)            | 5 (10%)  | 21 (43%) | 17 (35%) | 5 (10%)        |
| There are lifestyle benefits to practicing in a rural or remote community                                            | 1 (2%)            | (0%)     | 2 (4%)   | 22 (45%) | 24 (49%)       |
| The wide scope of practice would be an interesting career path                                                       | (0%)              | (0%)     | 1 (2%)   | 16 (33%) | 32 (65%)       |
| I am interested to know more about the opportunities for rural medical practice                                      | (0%)              | 1 (2%)   | 3 (6%)   | 28 (57%) | 17 (35%)       |
| It would matter to consider practicing medicine in a rural community                                                 | 1 (2%)            | 1 (2%)   | 10 (20%) | 20 (41%) | 17 (35%)       |
| Rural and urban communities have equitable access to healthcare                                                      | 14 (29%)          | 29 (59%) | 3 (6%)   | 1 (2%)   | 2 (4%)         |
| <b>Rural day experience</b>                                                                                          |                   |          |          |          |                |
| Peer-led events are an important way to learn about rural people and places                                          | 1 (2%)            | 0 (0%)   | 0 (0%)   | 9 (19%)  | 38 (79%)       |
| Input from rural-origin students would improve the quality of rural curriculum and experiences in the medical school | 1 (2%)            | 0 (0%)   | 3 (6%)   | 13 (27%) | 31 (65%)       |

TABLE 3 Sources of information ranked by trustworthiness.

| Trustworthiness of sources of information*                | Ranking (N = 48)** |          |          |          |          |          |
|-----------------------------------------------------------|--------------------|----------|----------|----------|----------|----------|
|                                                           | 1                  | 2        | 3        | 4        | 5        | 6        |
| <b>Source of information about rural life</b>             |                    |          |          |          |          |          |
| Rural-origin peers                                        | 36 (75%)           | 8 (17%)  | 3 (6%)   | (0%)     | 1 (2%)   | (0%)     |
| Rural-origin faculty                                      | 7 (15%)            | 36 (75%) | 4 (8%)   | 1 (2%)   | (0%)     | (0%)     |
| Academic institution/medical school                       | 1 (2%)             | 1 (2%)   | 9 (19%)  | 26 (54%) | 9 (19%)  | 2 (4%)   |
| Official information (e.g., town websites)                | 4 (8%)             | 2 (4%)   | 23 (48%) | 14 (29%) | 2 (4%)   | 3 (6%)   |
| Social media (twitter, etc.)                              | (0%)               | 1 (2%)   | 8 (17%)  | 1 (2%)   | 11 (23%) | 27 (56%) |
| Traditional media (news stories)                          | (0%)               | (0%)     | 1 (2%)   | 6 (12%)  | 25 (52%) | 16 (33%) |
| <b>Source of information about rural medical practice</b> |                    |          |          |          |          |          |
| Rural-origin peers                                        | 19 (40%)           | 13 (27%) | 11 (23%) | 4 (8%)   | 1 (2%)   | (0%)     |
| Rural-origin faculty                                      | 25 (52%)           | 21 (44%) | 2 (4%)   | (0%)     | (0%)     | (0%)     |
| Academic institution/medical school                       | 2 (4%)             | 14 (29%) | 20 (42%) | 8 (17%)  | 3 (6%)   | 1 (2%)   |
| Official information (e.g., town websites)                | 2 (4%)             | (0%)     | 10 (21%) | 30 (62%) | 4 (8%)   | 2 (4%)   |
| Social media (twitter, etc.)                              | (0%)               | (0%)     | 2 (4%)   | 4 (8%)   | 16 (33%) | 26 (54%) |
| Traditional media (news stories)                          | (0%)               | (0%)     | 3 (6%)   | 2 (4%)   | 24 (50%) | 19 (40%) |

\* The sources of information were ranked from 1 to 6, with 1 being highest and 6 being the lowest. Rank scores were reverse-coded to reflect that an item ranked 1 would have highest trustworthiness score of 6, while an item ranked 6 would have lowest trustworthiness score of 1. \*\* Of 50 participants in the survey, only 48 provided responses to the trustworthiness questions.

The participants noted that the learning was different because the student peer was their classmate and friend who knew what would benefit the students to learn.

- [AG] knew what would be attractive to us, and that really came forward in what she decided to showcase in the day... Just the fact that we have such different backgrounds, bringing that in, whether it's providing a different way to explain concepts or a different way of teaching the concepts, or "Maybe they did not touch on this part in lecture, but hey, I can provide this extra knowledge that might help you remember this better." I think there's definitely a lot of value in

that. And kind of like someone else said, I cannot see medical school without peer interaction and peer expertise. (FG Participant 1)

- I think, we obviously spend a lot of time with AG and ... she is a very well-organized person, so... she had put a lot of time and effort and it would be tailored to us. Like, I found the fact that she had, like, non-medical people on the panel, like, someone else to discuss, like, farmers and ranchers, like, that was very important. And she knew that that would something we'd find important because she knows us, and it was just, well – and I found that was, like, a personal touch that was different from just, like, doing procedural skills. (FG Participant 3)

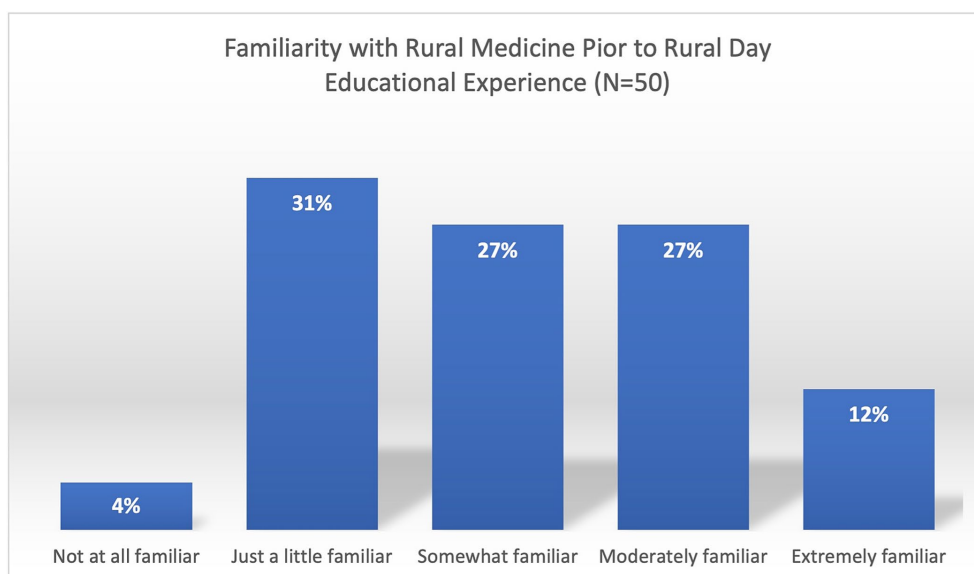


FIGURE 2

Familiarity with rural medicine prior to rural day educational experience, depicting that most students have low familiarity about rural medical practice.

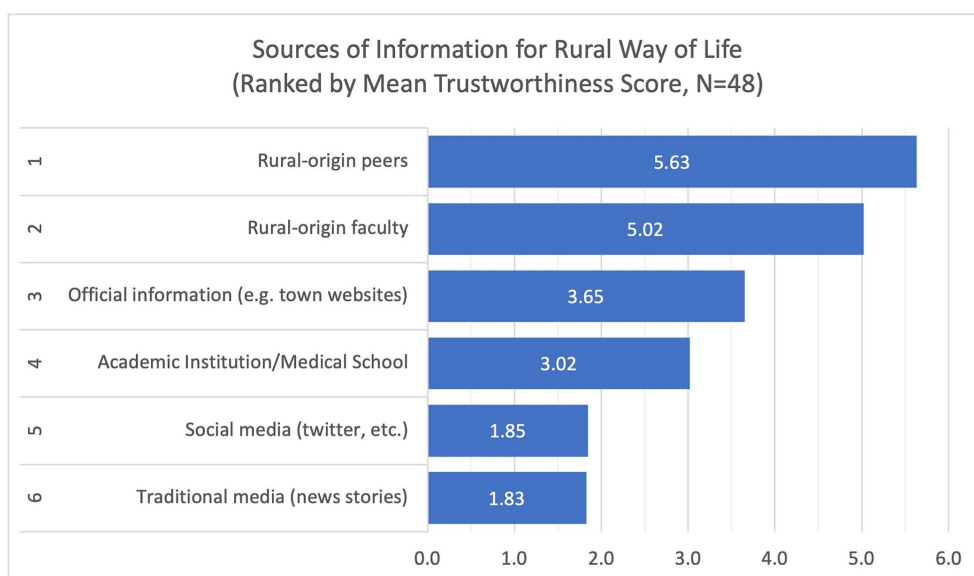


FIGURE 3

Trustworthiness scores of the sources of information about rural way of life, indicating high level of trust for rural-origin peers and rural-origin faculty.

- iii The peer has high contextual expertise about rural life and served as 'role model' to fellow learners.

The peer's rural background made the participants more receptive to their peer's experience about living in a rural community.

- *She's an expert in her lived experience, right? And a lot of it was so intimate to her upbringing [on the] farm. So I, you know, trust her, because this is, like, her reality, right? This is her life. So her, like, high expertise I guess. .... Like, just understanding people's context,*

*you know, where they come from, so where they are – you know, not that AG is representative of all rural people, right? But it's interesting, like someone said, the perspective she brings in class which are very valuable. It's amazing that we know a bit of the reason why she may see [those] or bring those, you know, perspectives on a medical issue or social issue that maybe someone else had not mentioned, you know. Someone who had the same upbringing would have thought. Like, seeing where somebody is raised and where they grew up. And then see how that pieces together. (FG Participant 5)*

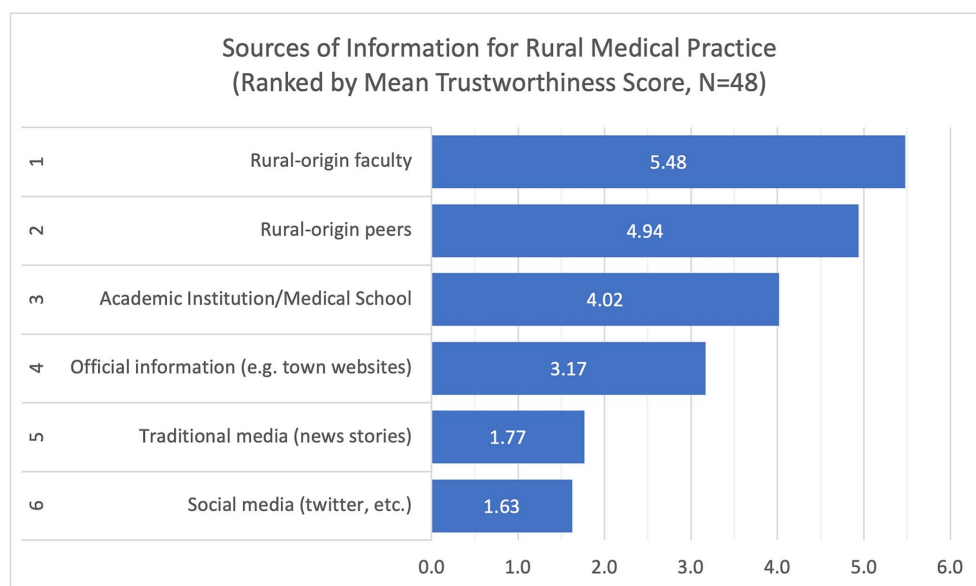


FIGURE 4

Trustworthiness scores of the sources of information about rural medical practice, indicating high level of trust for rural-origin peers and rural-origin faculty.

TABLE 4 Trustworthiness scores of the sources of information.

| Trustworthiness of sources of information*                | N** | Min | Max | Mean | SD   |
|-----------------------------------------------------------|-----|-----|-----|------|------|
| <b>Source of information about rural life</b>             |     |     |     |      |      |
| Rural-origin peers                                        | 48  | 2   | 6   | 5.63 | 0.79 |
| Rural-origin faculty                                      | 48  | 3   | 6   | 5.02 | 0.57 |
| Academic institution/medical school                       | 48  | 1   | 6   | 3.02 | 0.91 |
| Official information (e.g., town websites)                | 48  | 1   | 6   | 3.65 | 1.14 |
| Social media (twitter, etc.)                              | 48  | 1   | 5   | 1.85 | 1.20 |
| Traditional media (news stories)                          | 48  | 1   | 4   | 1.83 | 0.72 |
| <b>Source of information about rural medical practice</b> |     |     |     |      |      |
| Rural-origin peers                                        | 48  | 2   | 6   | 4.94 | 1.08 |
| Rural-origin faculty                                      | 48  | 4   | 6   | 5.48 | 0.58 |
| Academic institution/medical school                       | 48  | 1   | 6   | 4.02 | 1.04 |
| Official information (e.g., town websites)                | 48  | 1   | 6   | 3.17 | 0.91 |
| Social media (twitter, etc.)                              | 48  | 1   | 4   | 1.63 | 0.82 |
| Traditional media (news stories)                          | 48  | 1   | 4   | 1.77 | 0.81 |

\* The rank scores were reverse-coded to reflect that an item ranked 1 would have highest trustworthiness score of 6, while an item ranked 6 would have lowest trustworthiness score of 1. \*\* Of 50 participants in the survey, only 48 provided responses to the trustworthiness questions.

- *The learnings of this experience could still work without being peer led, but having it peer led provided an unique lens in seeing the community through the individual's eyes and in a way, made it more meaningful. It was the privilege of getting a into a major part of my peer's life and gained an appreciation of these experiences that are new to me, are the daily life my peer and rural folks. (PS Participant 22)*

iv The peer's enthusiasm and supportive behavior motivated students to participate.

Being friends and classmates, the participants appreciated the student peer's invitation and promotion of the rural day activity, which generated a positive response.

- *And she was just so happy about it, and so passionate about it, and that really rubs off. Like it's very – not that it becomes sterile when it's someone else doing it, but when it's someone in their community, like, she was just grinning ear-to-ear the whole time, and it was very infectious. So that was very, very sweet and meaningful. (FG Participant 3)*

- *I think a big aspect of my desire to participate was seeing how excited and passionate AG was about this event! Seeing her joy at the thought of having so many of us come learn where she's from and how great rural medicine can be really made me keen to participate. Along with this, getting a tour of a farm and meeting farm animals, plus getting to learn some new medical skills all made me super keen about the day! (QR Participant 1)*

### 3.3.2 Theme 2: the trust in the student peer enabled students to receive information more favorably

The student transcripts also suggested that participants felt safe in the open and trusting environment. The absence of skepticism made participants free to be themselves which facilitated learning. The sub-themes included (i) trust in the peer and absence of perceived hidden agenda, (ii) non-judgmental space, (iii) existing interpersonal connection between students and peer, and (iv) student peer being a bridge between students and the community.

- The students did not feel pressured about any hidden agenda.

The participants indicated that their peer did not make them feel as skeptical, in contrast to some information from the medical school, of selling the idea of practicing rurally, to the point it feels “being disproportionately shoved down their throats.”

- *It made me very open and trusting instantly, I did not feel as skeptical or guarded. Most of the information via the UME has felt like it was presented with rose colored glasses and like rural was being disproportionately shoved down my throat. I had initially come into medicine wanting to practice rural and after the UME propaganda block 1 was rebelling against it and really not keen for it. AG's event felt very real, I felt like we were having very honest conversations with real people who were not trying to fool/convince us of one thing or another. The experience was truly just an experience where we could explore and ask genuine questions rather than feeling like an off putting recruitment event. (PS Participant 34)*
- *When someone you know and trust provides you with information, I think it makes it a lot easier to have full faith in what they have to say because you value their opinion and know that they are reliable. Institutions can definitely be reliable as well, but when a peer can share their lived experience with you, it makes it more personable (QR Participant 1).*

- The students valued the non-judgmental space.

The participants felt free to be themselves and express their perspectives without fear of ridicule.

- *But the one nice thing about it being a peer is that she understands that, and she understands the best ways to – like, you know, not “convince” people, but have people choose to live rurally and work rurally and spend time rurally is to show rather than tell. And I think that that really makes a big difference, because she understands, like – she understands the nuance in it too, right? Like, there are so many of us that will end up in urban centers for a variety of reasons, and she's not going to shame or*

*diminish that. Instead she wants to show that, you know, “OK, maybe you will not live there, but gee, why do not you locum?” (FG Participant 3)*

- *I think she's also given us no reasons not to trust her, and all the reasons to trust her. (FG Participant 7)*

- The existing interpersonal connection between students and peer enhanced the learning.

The social connection to the student peer promoted personal growth and self-discovery among the participants.

- *I guess the big difference would be because we have so much in common with AG because we are students and we know her in that way. And we are also friends with her. So that already is different than learning about something from a professor from the school, there's, like, a power imbalance, where there's a lot of distance, like, understandably there needs to be professional distance, right? So that is already, I think, it flavors how we, you know, receive information. (FG Participant 5)*
- *Because it was peer-led, I felt like I could connect to the experience better, because I could step into the shoes of my peer and experience what their day-to-day life is like. I think as well, they had better insights on how to lead the day to make sure that it was smooth and insightful. (PS Participant 30)*

- The student peer served as a bridge between students and the community, facilitating effective knowledge transfer.

The student peer was a sociocultural ambassador for the community, and the participants felt welcomed into the community.

- *Having a peer lead this experience felt a lot more organic, like we were invited into the community and I also could see the pride the healthcare providers and community members had in being able to share with us, via our classmate. (PS Participant 27)*
- *But because they had a relationship with AG and we had a relationship with AG, that kind of bridged it. And then that was all part of it. That the community cares for each other because they know each other, and because then they knew why we were coming, that made it better for us. (FG Participant 6)*

### 3.3.3 Theme 3: the rural day experience promoted a better understanding of rural life and medical practice among the students

The transcripts indicated that students gained a better appreciation of living in a rural community, the importance of relationships and getting to know people as “persons,” and how interesting a rural medical practice can be. The sub-themes included (i) appreciation of the community and rural life, (ii) appreciation of the community members as persons, and (iii) appreciation of what rural medical practice can look like.

- The students understood how relationships and connectivity are integral to rural life.

- *It was so special to see AG's community and how big a role they have in her life as well as the broader Vulcan community. The issues shared by the various members of the evening panel gave a broad view of the community from a healthcare lens but also from the lens of issues that are important to the community and how that intersects with health and wellbeing. Having a peer-led experience gave us a tangible tie into what rural life looks like. (PS Participant 16)*
  - *Compared to other organized activities by the school, I think it was the relationship all of the people and town had with AG that made a big difference. The bonds formed between these individuals was very apparent and heartwarming to see ... I think what made the biggest difference was how the town and AG really showed us how great being part of a close-knit community can be. (QR Participant 1)*
- ii The students gained a sense of the community members as "persons" by allowing them to put a name to a face.
- *As someone who grew up in an urban setting, this experience was amazing in terms of furthering the very little knowledge I had of rural living and rural medicine. I think to best treat patients whether in an urban or rural setting, it is important to understand their background and personal circumstances and even though I'll never have the same experiences as someone who has grown up or spent a lot of time in a rural community, I hope I'll be able to better understand these patients through some of what I learned. (PS Participant 41)*
  - *I think for me, it really was the sense of community that I felt while at the rural day. Like, you say, "Oh, I met Such-and-such," and they know who you are talking about. Whereas in an urban setting you say, "Oh, I've shadowed this doctor," and they have no idea who that is. And so really just not only in terms of the hospital itself, but just the community too, and how many people showed up, and how many people knew each other was just really cool to see, and is definitely very different than what I've grown up with in an urban setting where you are just, like, another face, but to them you are actually a person. (FG Participant 1)*
- iii The students had the opportunity to see what rural medical practice can look like.

The participants had a chance to experience "rural" and helped their understanding of rural life and medical practice.

- *I think you brought up a good point with just, yes, hearing more about the work that they do, and how much land they have, and even the cost of some of the things they have to pay for, really just provides perspective so that if we see those patients in clinic it's, like, "OK, well we know that it's calving season. They need to get back to the farm to do that. So how do we manage that?" really just provides kind of that different perspective that we can then take into consideration when treating patients that are from a rural community, and do have a farm to go back to. (FG Participant 1)*

- *I also think it's really nice to see the spectrum of rural medicine. ... And I think it's just very cool to see the breadth, and then also how you might be able to fit into a different site, because they are quite different. They offer different things, like, in terms of, like, how you can practice, where you can practice, how you can best [suit] the community and what your community looks like. I think that's always real nice to see different things (FG Participant 7)*
- *Rural medicine can be extremely exciting and full of huge variety! Living/working within a small, closely bonded community appears to be a very positive experience. (QR Participant 1)*

## 4 Discussion

The training of medical students represents a continuously evolving field, with the involvement of peers as tutors increasingly adapted in medical education. In this study, a student peer organized and led fellow medical students for a rural day experience in their community of origin to meet with members of the rural community and rural medical practitioners. The objective of the research was to understand the potential impacts of this peer-led rural day experience among medical students. Most of the participants in this study were from urban areas with only 14% from a rural background and only approximately one-third of participants familiar with rural medical practice. This is consistent with literature that most Canadian medical students are from urban origin and thus would have low familiarity with rural life (11, 12). After the rural day experience, the findings showed that a high number of students were interested in the health and wellbeing of rural communities and indicated that it matters to encourage medical students to consider rural careers, with almost all expressing appreciation for the wide scope of practice involved in rural practice. While only 45% indicated they would consider a rural career, 92% would like to know more about the opportunities for rural medical practice.

This study also found that medical students have more trust in the information when presented from a peer perspective. The results indicated that the students regarded relevant information about rural life and living in a small town as most trustworthy when coming from rural-origin peers. For information about rural medical practice, the students put more trust in rural-origin faculty and rural-origin peers than their academic institution. This is consistent with the literature on social learning theory that peer tutors have high credibility and can influence learning (36).

Analysis of qualitative responses revealed three main themes. The first main theme was that the informal teaching facilitated learning. One sub-theme was the low level of formality of the peer-led rural day enabled a non-judgmental experience for the students and the students reveled in the fun and relaxed environment of the rural day. The lack of pressure normally associated with formal teaching can lead to increased comfort to ask questions, share ideas, and explore solutions to issues, which are fundamental aspects of the learning process. This non-formal environment allowed for concordance and balance of active involvement and enjoyment (28). A second prominent sub-theme was the common knowledge level and close educational distance between the learners facilitated learning as the student peer understood and presented information at the level where

the students are. One student described that student peer knew what would be attractive to the students and worked around that on how to showcase the rural day experience; hence, this sub-theme aligns easily with the cognitive congruence theory of the conceptual framework (39). Closely related to the comparable knowledge sub-theme was that the peer has high contextual expertise about rural life and served as 'role model' to fellow learners (29). Another student observed that the student peer had the lived rural experience and understanding of rural context and this adds value to perspectives coming only from someone who would have the same rural upbringing. Similarly, these insights are consistent with Loda et al.'s cognitive congruence theory (39).

The second main theme was that the trust in the student peer enabled students to receive information more favorably. The foremost sub-theme was about how the students did not feel wary of any hidden agendas during the rural day experience. As one student stated, because they knew and trusted the peer, it made it a lot easier to have full faith in what the peer had to say and considered the information reliable. The learners also indicated that their peer did not make them feel as skeptical in contrast to the agenda-driven information from the medical school. Instead, the learners felt like they were just being given honest information needed to make an informed career choice. Another insight broached was that the experience felt like having very honest conversations with real people who were not trying to fool or convince students about rural careers so much so that it felt like the priorities hit the bullseye. These insights conform closely with the existing literature on social congruence theory that peer tutors are considered to have credibility with the students (36).

The second sub-theme was that the students felt safe in the open and non-judgmental environment. The lack of perceived judgment made the students feel less guarded and more secure to speak up and ask questions without fear of ridicule, especially for students who were unfamiliar with rural life and medical practice. Moreover, even students who were not considering a rural career were not shamed or made to feel awkward or defensive. These insights coincide fittingly with the psychological safety learning concept (40, 46).

The third sub-theme was the existing interpersonal connection between the learners and the peer contributed to the learning by eliminating professional distance. One student expressed that the absence of power imbalance flavored how information was received as students may have felt less intimidated. One student also said that because the rural day was peer-led, they felt like they connected to the experience better and that they could step into the shoes of their peer and experience what their day-to-day life is like. This finding is consistent with the importance of seeing the peer at the interpersonal level (38, 39), in that being of the same status or socio-academic standing, the learners felt comfortable with their peer and the rural experience to voice concerns and share opinions. This concept fits well with the social congruence theory of the conceptual learning framework (39).

The fourth and noteworthy sub-theme was that the student peer served as a bridge between participants and the community. The student peer's relationship both with their community and with their fellow students facilitated effective knowledge transfer. Students noted that because it was peer-led, the experience felt more genuine and organic and like they were being invited, as opposed to being recruited, into the community and that made them feel immediately at ease. One student further elaborated that because of the relationship the student peer had with the community, the community gave full support and buy-in to the event and as such it made it so much better

for the participants. These insights from this sub-theme affirm the learning concept that the connection and interactions in the group promote new learning (33).

The third main theme was that the peer-led rural day experience promoted a better understanding of rural life and medical practice. The first sub-theme was the appreciation and understanding of rural life. One student conveyed that having a peer-led experience gave them a tangible tie into what rural life looks like, what healthcare concerns the community face, and the challenges to the health and wellbeing of the community. Moreover, as the second sub-theme, the students not only gained an appreciation of what living in a small town looks like, but the experience allowed them to see community members as "persons." With this understanding, the students were subsequently able to gain a sense of what a rural medical practice could look like, which was the third sub-theme. One student even expressed an appreciation of the wide scope of practice that rural doctors have and how rural practice can be an exciting and fulfilling career. These insights relate well to two learning concepts in the framework that peer tutors are considered to have credibility with the students (36) and that the connection and interactions in the group promote new learning (33).

The results of this study are justifiably consistent with the learning theories that make up the conceptual framework for peer-led learning. The peer-led rural day experience allowed for student reflection and students are often better able to reflect on and explore ideas when there are no teachers or institutional authority around to influence them (26). The students regarded the chance to learn from a peer to be important and a huge advantage. The triangulation of the quantitative results and qualitative insights provides convincing evidence that involvement of a student peer in a learning activity such as this rural day experience can effectively deliver the rural medical education curriculum. One student noted that their idea of rural medicine changed because of this rural day experience. The findings further support previous evidence that the involvement of student peers in medical education benefits learners, the academic institution, and even the peers themselves (29, 33, 34, 47).

## 4.1 Limitations

The sample size was limited by the passenger capacity of the chartered bus transport which could sit 55 passengers at most. The students who were acquainted well with the student peer may have been convinced to attend. Similarly, students who may have an inherent interest in rural medicine may have been persuaded to take part. There were more female than male students and more students who grew up in metropolitan areas than those raised rurally. No statistical comparisons between demographic groups were performed. Therefore, caution is needed in interpreting the results.

The study findings may have been influenced by some potential biases from the participants, such as recall bias, social desirability bias and the influence of peers during the focus group, and sponsor bias, which may have limited negative comments, despite the independent interviewer.

The sustainability of the peer-led model relies on the self-identification of rural learners interested in acting as champions. The Canadian rural context may not be applicable to other international settings. This version of peer-led information involves costs to the

medical program which may not always be available. The types of peer-led activities and information sharing will necessarily vary depending on the peers involved, their own context, community of origin, and experiences.

## 4.2 What this study adds

This study reveals important findings about the involvement of peers in rural medical education that social learning experiences can help facilitate knowledge transfer, that students have higher trust in information coming from peers, and that peer-led experiences can help provide a better appreciation of rural life and medical practice. Medical training programs should consider how they can best present information on rural healthcare and rural careers to learners. Learners are cautious when this information comes from official sources, viewing it as agenda-driven. Input from rural-origin students could improve the quality of rural curriculum and experiences in the medical school.

Partnering with rural-origin medical students to provide information offers a potential pathway to deliver information to students in a more effective way. This study highlights the importance of peer-led information for current generation medical students. Medical schools can consider partnering with medical students with lived experience to best communicate around knowledge topics and issues that may otherwise appear agenda-driven. The importance of lived experience and novel ways of communicating with medical students about rural careers is consistent with other research by the our research group (35). While the context of this study was a specific peer-led rural experience, the findings of this study could be applied to a variety of challenging topics and could be a focus of further study.

## 5 Conclusion

This study demonstrated that medical students engage differently with peer-led activities versus a formal teaching environment, substantiating that PLL can be effectively utilized to deliver rural medical curriculum. Medical students are cautious about promotional information regarding rural medical education from formal sources but are less skeptical when learning from peers. Peer-led rural experiences are an effective way for medical students to learn about both rural medical careers and rural life. Information about the way of life and healthcare needs in rural communities may be perceived as more credible and valid if coming from a peer, and hence, is more likely to be received favorably. Thus, when promoting rural education and careers, medical schools should work with rural-origin students, whose messaging may be considered more trustworthy than traditional sources.

## Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: The datasets generated and analyzed for this study can be found in the Open Science Framework repository, with URL <https://DOI.org/10.17605/OSF.IO/W6ABE>.

## Ethics statement

The studies involving humans were approved by University of Calgary Conjoined Health Research Ethics Board, with approval certificate number REB24-0360. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because the participants completed a survey. At the beginning of the survey, the authors explained the purpose of the research and that the students check/click a button to indicate their consent and continue with the survey. If they clicked on the "I agree," this indicated their consent. At the end of the survey, the authors asked if the participants were willing to participate in a follow-up focus group. If they said "yes," they were asked to provide their name and contact email and phone number. This indicated their consent to participate in the focus group.

## Author contributions

GP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. AG: Conceptualization, Formal analysis, Methodology, Writing – review & editing. LF: Conceptualization, Investigation, Writing – review & editing. AJ: Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1566472/full#supplementary-material>

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# Retention of doctors in remote, rural and First Nations communities using distributed general practice education: a scalable solution

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The value of distributed training of the medical workforce is well documented. Australia's Remote Vocational Training Scheme (RVTS) provides a scalable approach to specialist training in general practice that utilizes distance education and remote supervision. RVTS enables trainees to stay in their rural, remote and First Nations communities while working toward specialist certification as a general practitioner. The program, which supports both international and domestically trained graduates through tailored supervision and education, has operated across Australia for 25 years. Trainees are supported both professionally and socially over 4 years. An independent evaluation (2023–24) demonstrated a 78% completion rate among participants who remained in the same rural or remote practice for an average of 5.2 years. Two years after completing the program, 49% were still working in the community where their training commenced, well above documented retention benchmarks for these settings. High levels of participant satisfaction were reported, ranging from 88 to 100% across various indicators. The evaluation found that the program supports retention by eliciting five participant responses: comfort, confidence, competence, belonging, and bonding. Engagement and connection between participants are maintained through accessible technology, real-time support, virtual small-group learning, and twice-yearly in-person workshops. Despite the program's focus on high-need areas, it is cost-effective compared to similar rural training schemes. The experience of RVTS can inform other countries seeking to enhance rural workforce retention, particularly for underserved populations and migrant healthcare workers. The adaptable structure of the program aligns with the global development goals of the World Health Organization.

## KEYWORDS

remote supervision, professional support, general practice, distance education, workforce retention, health equity, First Nations, rural health

## 1 Introduction

Evidence supports the value of distributed training of the medical workforce. It can improve service delivery and patient satisfaction at the training sites, increase opportunities for clinical teaching at rural locations and provide economic benefits to rural regions (1–5). However, most of the evidence is based on medical schools using face-to-face modes of supervision and teaching involving rural immersion across a broad region. There are fewer examples of distributed general practice training that use remotely delivered distance education and supervision to train continuously in the same rural or remote location. In this perspective, we seek to describe Australia's Remote Vocational Training Scheme (RVTS program), which has been operating in

Australia for 25 years (6). It uses distance education and remote supervision to assist non-specialist doctors already working in remote, rural and First Nations communities to stay in the same community while they train to become General Practitioners (GPs) (6). In doing so it targets workforce retention and service continuity while extending opportunities for trainees to complete their GP qualifications.

Australia's national health insurance scheme, Medicare, requires general practitioners to hold formal specialist certification in general practice. Exemptions to this requirement exist in designated areas of workforce shortage, predominantly located in rural and remote regions. Under these provisions, many medical practitioners including both domestic and doctors trained overseas who are not yet certified as specialist GPs in Australia, often take up general practice roles in rural

areas, where they can access different programs that provide appropriate supervision. One of these programs, which also provides GP training in eligible locations, is the RVTS (see Box 1).

We draw on evidence from an independent evaluation of the RVTS program, conducted in 2023–24, to describe the program's design and its achievements (6). We then explore how the program could serve as a model for other countries considering similar initiatives, while also addressing some of the potential challenges associated with broader adoption.

## 2 RVTS design and delivery

RVTS Ltd. is an independent training provider responsible for the national delivery of the RVTS program (6). The RVTS selects non-specialist doctors who are supported in their progression toward specialist qualifications in general practice and rural generalist medicine. The curriculum and specialist certifications are accredited by the Australian Medical Council through two independent medical colleges concerned with the specialty of general practice, the Royal Australian College of General Practitioners (RACGP) and the Australian College of Rural and Remote Medicine (ACRRM). The RVTS is an accredited provider for the Colleges and addresses all the same training standards of specialist GP training, through a flexible delivery model. What sets RVTS apart from other GP training programs in Australia is its focus on keeping trainees working in the rural and remote communities where they are based. As such, it is primarily a workforce retention program which uses education support to help non-specialist doctors achieve GP specialist qualifications in Australia. Unlike most other specialist training programs, RVTS requires participants to remain in the same location for most of the training (6). RVTS-eligible practices are in towns with populations of 15,000 or fewer, or within Aboriginal Medical Services that support rural First Nations communities. Many of these sites are small, underserved communities facing persistent workforce shortages and high staff turnover, often relying on locum tenens to maintain service delivery (17). General practitioner turnover is particularly high in these communities, with an average retention of approximately 2 years, incurring an estimated cost of A\$74,000 per departing GP (18). Halving turnover and reducing reliance on locum services in remote areas could yield annual savings of up to A\$32 million in one state alone (19) and enhance access to high-quality, relationship-based care (20) with lower all-cause mortality (21).

The communities targeted by the RVTS often place a high value on hosting GP trainees but face significant barriers to doing so. These include limited supervisory capacity and challenges in attracting suitable trainees (22, 23). Although these communities may have limited clinical resources, they often offer valuable opportunities for extended scope of practice, enabling rich learning opportunities to support progression toward specialist qualifications in general practice (22, 24). The RVTS program also works with other agencies to help communities with the highest needs to access non-specialist doctors who will stay, supported with high quality remote supervision and distance education (33). This helps the community to gain from a trainee who is embedded in a co-learning community of practice, progressively developing skills as part of specialist training, while remaining employed in the same

### Box 1 Australia's health context.

Australia is vast, spanning more than 7.7 million square kilometers. It encompasses a wide range of geographical diversity, including temperate areas, tropical rainforests, coastal environments, arid areas, and deserts (7).

The population exceeds 26 million, with approximately 72% residing in major cities, primarily located along the eastern coast. The remaining 28% live outside the major cities, spread across more than 12,300 rural localities covering 99.3% of Australia's land area (8). First Nations people represent 3.8% of the overall population but account for a significantly higher proportion in many remote and rural locations (9). Inland areas are sparsely populated. Access to healthcare outside of major centers can be challenging, complicated by distance and health workforce shortages.

Australia is a parliamentary democracy that is a federation of 6 states and two territories with three tiers of government: Federal, State/territory and Local. The federal government is responsible for national issues such as foreign policy and defense as well as the universal health scheme Medicare. States and Territories deliver services such as education, police, and public hospitals, while local governments look after municipal and community-based services. The federal system allows for regional variations to respond to local needs (10).

The healthcare system includes both public and privately funded services. Medicare is a universal public insurance scheme that provides free or subsidized access to general practice and specialist services outside of public hospitals. Public hospitals provide free inpatient care and are funded by the states (11). Rural and Remote populations with lower access to services utilize proportionately less Medicare funds (12).

Australian Medical School training takes 5–6 years for undergraduates and 4 years for post-graduate courses (13). This is followed by a one-year internship, then a residency, and finally, specialty training. General practice is delivered in accordance with the training standards of either the Royal Australian College of General Practitioners or the Australian College of Rural and Remote Medicine, spanning 3 or 4 years, leading to registration as a specialist general practitioner. The Australian Government funds trainees in the Australian General Practice Training Program (AGPT) and RVTS (14, 15).

In 2025, 1,504 trainees commenced in the AGPT and 32 in RVTS, while a further 100 commenced in a specific rural generalist pathway (16). Workforce maldistribution impacts rural and remote health outcomes. The Australian Government addresses the problem by supporting rural training pathways such as RVTS, offering financial incentives for rural practice, and expanding telehealth services.

community (25). This in turn delivers a more stable, skilled and locally engaged workforce which is critical for high quality care for rural and First Nations communities (25).

The program is led from a regional location (Albury, New South Wales) and was conceptualized by a team of experienced rural GPs and rural generalists informed by the insights of a pilot project in its early stages. It has grown gradually since it commenced in 2000, targeting the enrolment of 32 trainees annually (6). Currently this quota consists of 22 trainees in general practice or rural generalist medicine based in general practices in small and medium rural towns of 15,000 population or less, and 10 working in rural Aboriginal Medical Services, serving First Nations communities.

The program works hard to engage suitable candidates in the distributed locations. This involves regularly liaising with communities, the state and territory governments, rural workforce agencies, medical colleges and other programs, to facilitate engagement. The selection process seeks to offer places to trainees who are likely to be safe and able to reflect and learn effectively while continuing their practice and training under a remote supervision and distance education mode of delivery.

Most participants are International Medical Graduates (IMGs) (6). Australia mandates this group to work in rural areas for up to 10 years upon arrival to help to fill rural workforce shortages and Australia has increasing reliance on this group with greater rurality (26, 27). IMGs bring diverse credentials and prior clinical experiences, which can add significant value to primary healthcare in rural and First Nations communities (6). RVTS' requirements of staying in the same practice while completing specialist training aligns with preferences of many IMGs who often seek stability after experiencing frequent relocation, changes in employers and inconsistent supervision (28).

With ongoing participation contingent on remaining in the same location, the RVTS is purposefully designed as an end-to-end vocational training program based in a single location. It includes tools, resources and processes to support and develop skilled GPs who are retained in that location. While the RVTS program delivers education and training remotely, its strategic focus on retention also means that it gives strong attention to the wider professional and social supports trainees need to remain resilient and continue working in this context. This includes matters such as career coaching, real-time support and help with risk mitigation around issues in the practice. The nature and depth of this support is significant given the pressures trainees face when working and living in remote, rural and First Nations communities, including the idea that urban practice is superior, so-called geographical narcissism (29).

The RVTS mostly supports community-based training outside of hospital settings. Supervisors and medical educators are qualified GPs and rural generalists, experienced in small rural practices, based in locations distant to the trainees but generally in the same region. They commonly support up to two trainees continuously over the course of the program. Each participant is paired with a consistent supervisor and medical educator. Regular in-person visits are undertaken for direct observation, supplementing the online learning and feedback (30). Having been in operation for 25 years, the RVTS program has recruited many past trainees (who make up around 30% of its current supervision cohort) as the next generation of medical educators and supervisors. This group comes with strong experience, commitment and empathy for the training body. They also align with the goals of the program making it comfortable for trainees to reach out for advice (30).

The remote supervision and distance education is delivered using simple, adaptable, off-the-shelf technology systems, of both voice and video, through one-on-one and small group learning (30). Regular supervision meetings occur at pre-set frequencies and can be increased via phone, email and face-to-face visits according to participant needs so there is confidence that help is there when it is needed. RVTS participants also receive additional explicit layered teaching and supervision to build the skills required for remote, rural and First Nations communities, without assuming any prior knowledge (30). This includes support for communication, culturally responsive care, healthcare systems and relevant skills. This approach helps to standardize foundational skills, to create a safe environment for asking a wide range of questions and to ensure participants feel confident and competent to practice safely in rural and remote Australia. Trainees also access a suite of online educational resources that can be tailored or scaled to meet individual trainee needs (30). Additionally, peer engagement is fostered through a WhatsApp group and twice-yearly multi-day face-to-face workshops, with families funded to attend. These gatherings help to cultivate a strong sense of belonging and bonding among trainees and their families. As trainees work in more remote areas, they become part of a community of practice that respects and values the work of rural and remote doctors and their importance to the health of rural communities. This experience supports their sense of being valued and recognized, culminating in Australian specialist qualifications in general practice or rural generalist medicine. More information about the RVTS training model is available online (30).

### 3 The benefits of remote supervision and distance education

Building on four formative evaluations completed in 2001, 2003, 2005 and 2015, a 2023–24 independent evaluation led by the University of Queensland explored the RVTS program outcomes of candidate satisfaction, achievement of specialist certification and longer-term retention for all cohorts. The evaluation was undertaken with ethical approval (University of Queensland Human Research Ethics Committee; 2023/HE001926, 24 October 2023), and the results were reported in a series of five publications in 2024 (6, 25, 31–33). The results compared favorably with benchmarks which were established by a Project Reference Group and informed by the expectations of the program management team, and from expectations of satisfaction and retention shown for this context reflected in the broader literature. These benchmarks were had been set before commencing the evaluation (to reduce bias). The benchmarks, classified as high, medium and poor performance, specifically tailored for a GP training cohort, including IMGs, based in remote, rural and First Nations settings, reflecting the unique context in which the RVTS program operates.

At the time of the evaluation, RVTS had enrolled 506 participants. Since 2013, 82% of the enrolled group were IMGs, mostly from countries where English is not the primary language (6). The IMG cohort had a median total of 14 years clinical experience before commencing, while IMGs and domestic trainees had 5 and 6 years, respectively, working as registered medical practitioners before commencing training (6). The participants covered 350 communities, 83% of which were small rural (under 5,000 population) or remote towns and 15% were medium-sized rural towns of 5–15,000

population (6). Additionally, 65% of the communities were located inland, more than 50 km from the coast. At the time of the evaluation, 101 participants were still actively enrolled, 317 had completed the program, and 88 had withdrawn, giving a program completion and specialist certification rate of 78%. More information about participants is available elsewhere (6).

RVTS participants had worked for a mean of 1.6 years in the same practice before they joined the program (31). They participated in the program for a mean of 3.6 years (excluding those still active), resulting in a total mean of 5.2 years in the same practice location (31). This is approximately 3 times longer than the expected term of retention period for doctors in areas of this rurality (18). Within 2 years of completing the program, 49% of the participants remained in the same practice location, exceeding the high performing benchmark of 30% (31). The mean long-term annual retention rate was 33% in rural and remote regions, surpassing the high performing benchmark of 30 and 50% in all rural areas exceeding the high performing benchmark of 40% (31). These results exceeded the expected turnover rates of general practitioners in more remote areas, noting that IMG cohorts are also more challenging to retain. More information about retention outcomes is available (31). Annual satisfaction survey results demonstrated high-performing satisfaction levels ranging from 88 to 100% across various measures, exceeding the high performing benchmark of 75% (34).

The drivers of the strong satisfaction and retention outcomes were explored as part of a nested realist evaluation within the broader evaluation project (32). This articulated a theory about how the bundled interventions within the RVTS program stimulate five responses in participants: comfort, confidence, competence, belonging, and bonding. In turn, these responses addressed the professional and non-professional needs of participants to promote satisfaction and retention (32). The remote supervision and distance education mode of delivery helped these interventions reach the target audience in a cost-effective way. This suggests that remote learning and distance education systems should avoid being driven by technology but rather should be driven by purpose, which, in the case of the RVTS, has been GP workforce retention.

Unpublished data from the evaluation also identified the RVTS program as cost-effective. The true cost per RVTS participant per year (targeting rural and remote regions and First Nations communities) was comparable to the cost of other rural-focused GP training while noting that RVTS trains a higher proportion of IMG candidates who train in more distributed locations for longer than was observed for other rural training programs for general practice (16). The return on investment is enhanced by the gains in quality of GP-led care from the pre-, during, and post-program retention years for the three-to-four-year cost of supporting participants in the RVTS program.

## 4 Applying the learning to other countries

The RVTS program is relatively small in the whole scheme of GP training in Australia, however, there are no other GP pathways focused specifically on the retention of trainees in remote, rural and First Nations settings. As such, the RVTS holds a unique place in Australia's rural health workforce environment, a position reinforced by the positive evaluation findings. However, more broadly, the program has the potential to inform remote supervision and distance education for general practice workforce retention in similar contexts

in other countries. Some countries are already pursuing distributed GP training and could adapt some of the RVTS approach to enhance retention goals (35). Other countries may be considering developing something like the RVTS program (36). In either scenario, other countries and regions are welcome to explore partnerships with the RVTS for mentorship, advice and resource sharing. This partnership could be facilitated through groups like rural WONCA and primary healthcare training bodies in all World Health Organization regions, as an extension of their work on building rural pathways (37).

For many low- and middle-income countries, managing the costs and resources for sustaining rural training pathways are a major barrier to implementation (37). The cost of the RVTS program is primarily driven by the expenses associated with specialist general practice training in Australia, including supervision, assessments, training materials, and compliance with program accreditation requirements. Therefore, costs in other countries may vary depending on the type of qualifications pursued and the expenses related to delivering educational materials and processes via a remote model. Additional expenses include the cost of using accessible technology for communication between participants and staff, maintaining a secure database for storing trainee information, and providing educational materials. Additionally, there are staffing costs. Operationally, the RVTS program has established a central and virtual hub of around 35 part-time staff equivalent to 18 full-time positions. This includes program administration and management staff, supervisors and medical educators. Depending on the resources available to interested countries or communities, the face-to-face workshops that fund the travel and accommodation for participants and their families could be replaced with other strategies that are more affordable. Critically, it is important to consider whether alternative strategies could achieve the same impact of belonging and bonding as is achieved by the RVTS workshops, for a cohort of isolated trainees working in challenging conditions. The workshops are important for doctors and their families to feel socially valued, to build connections and take a much-needed break from their usual environment, to recharge socially (32).

Many of the tools, resources and processes used by the RVTS program could be adaptable and applicable to the education and technology architecture of other countries. For example, much of the communication across the network can happen by telephone email and free online chat sites. Nevertheless, the digital divide that some rural areas experience is an important consideration for planning remote supervision and distance education programs (38). Within the context of Australia's vast geography and dispersed remote and rural communities, basic communication technologies are considered suitable because they are common and familiar to RVTS participants.

The current RVTS program targets participants who are already working relatively independently and bring prior skills and clinical experience to their locations. However, given the program's high satisfaction rates, specialist certification and long-term retention outcomes, there is potential to learn from the program and explore how it might be refined or adapted for other medical trainees or health workers such as rural or remote nurses (39). One of the strengths of the RVTS program is that it includes cultural considerations and diversity within its design (adaptable to a wide range of doctors of different backgrounds) (39). If the RVTS program were to be adapted for less experienced trainees, it might require more intensive face-to-face support at the outset, along with more frequent face-to-face events throughout the year, such as four workshops instead of the current two. Expanding distributed education and remote supervision

models may become increasingly important when supervision capacity declines in more distributed locations (40).

RVTS is a mature program, and its published outcomes help reinforce confidence in its effectiveness. Since the RVTS targets non-specialist doctors already based in the communities of interest, with a primary focus on retention, its outcomes are not directly comparable to other distributed rural training, which involve rotations or short-term immersions into different communities (6). More specific and tailored program designs aimed at recruiting and retaining health workers already based in rural areas could be applied within rural policy and initiatives. This is directly linked to the potential community benefits of enhanced continuity of care, the presence of health workers who can support team building and contribute to broader quality improvement within health services (25). Promoting retention is particularly warranted in smaller rural, remote and First Nations communities, who are the most underserved and face high costs associated with workforce (17). By focusing on non-specialist doctors already based in rural areas, the RVTS program has naturally drawn a significant number of IMGs who are required to work in rural and remote settings. The RVTS model can inform the WHO Global Code of Practice on the International Recruitment of Health Personnel (41). This Code calls on countries to ethically support migrant workers by providing them with access to education and professional development to the same standards offered to the domestic workforce. However, many countries lack a practical model for extending education and professional support to this group, particularly if they are located in rural areas.

In summary, the RVTS is a mature, evidence-based program that employs distance education and remote supervision. It has been fully described and evaluated, demonstrating strong, long-term results. They highlight the importance of designing programs focused on retention in challenging contexts, emphasizing the need to address factors that support not only training but also the overall resilience of health workers. The RVTS program offers valuable insights for informing the development of rural health workforce policy and initiatives aimed at achieving distribution and retention of a skilled workforce to meet the needs of remote, rural and First Nations communities.

## Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: data is available on request to the authors subject to ethical approval. Requests to access these datasets should be directed to [giddings@rvts.org.au](mailto:giddings@rvts.org.au).

## Author contributions

PG: Conceptualization, Data curation, Formal analysis, Project administration, Resources, Validation, Visualization,

Writing – original draft, Writing – review & editing. BO'S: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MM: Conceptualization, Formal analysis, Investigation, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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## Conflict of interest

PG was employed by the company Remote Vocational Training Scheme Ltd.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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# Enablers and barriers of General Practitioner's choice of additional skills training: a mixed-methods study

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**Introduction:** Additional skills training (AST) is a prerequisite for rural generalist training in Australia, where Rural Generalists (RGs) undergo specialized training in a distinct discipline for a period of 12 months. This study investigated the perspectives of General Practitioners (GPs) regarding the factors influencing their selection of AST programs.

**Methods:** Using a sequential explanatory mixed methods approach, quantitative survey data and qualitative interview data were collected. Quantitative data was analyzed using frequencies, percentages, mean and standard deviations, while thematic analysis was employed for the qualitative data.

**Results:** A total of 106 respondents completed the survey, with 13 participating in interviews (supervisors  $n = 5$ ; registrars  $n = 8$ ). GPs perceived AST as beneficial in improving patient outcomes (57.5%) and enhancing patient satisfaction (49.1%). Intrinsic motivations for pursuing AST included personal interest, professional growth, and a desire to enhance patient care. However, funding challenges, burnout, and workload were identified as significant barriers to acquiring additional skills. Qualitative analysis identified six themes, three each related to facilitators (desire to work rurally, meeting workforce needs, and support networks) and barriers (work-life balance, mismatched expectations, and inadequate recognition of AST).

**Conclusion:** Additional skills training is a highly valued training program. Most of the GPs who were involved in the program were intrinsically motivated to participate. However, to ensure its sustainability, wider recognition of the value, better visibility, and better alignment with community needs are required.

## KEYWORDS

advanced skills training, Australia, General Practice, generalist, rural, remote

## Introduction

The Australian General Practice training model is a well-developed program focused on practical, in-practice teaching. Registrars gain experience in various relevant settings, training in an apprenticeship-style model where they see patients under graded supervision while contributing to the workforce (1). The services delivered by General Practitioners (GPs) including procedural services remains a major component of health delivery, especially for those living in rural and remote areas (2). Beyond procedural skills, GPs in rural areas increasingly utilize non-procedural skills, such as mental health and chronic disease management, to address local health needs (3). People living in rural and remote settings in Australia face significant challenges in accessing healthcare and have poorer health outcomes compared to their metropolitan counterparts (4–6). To address these disparities, initiatives have been introduced to enhance access to health and general practice, with rural communities depending on Rural Generalists (RGs) for comprehensive medical services (7).

A rural generalist, as defined by the National Rural Generalist Taskforce (8), is a medical practitioner trained and located in rural areas to ensure that the current and future healthcare needs of the communities they serve are sustainably and cost-effectively addressed. This includes providing general practice, emergency care, and necessary specialist components in hospital and community settings (8). In Australia, formal training for rural practice typically spans a minimum of 4 years (1). Advanced Specialized Training is provided by the Australian College of Rural and Remote Medicine to improve GPs' knowledge in either procedural or non-procedural skills, with a minimum duration of 12 months (9). Relatedly, the Royal Australian College of General Practitioners (RACGP) also offers 12 months of Additional Rural Skills training, equipping GPs with specialized skills to meet the needs of their communities (10). In this paper, Advanced Specialist Training and Additional Rural Skills Training are referred to as Additional Skills Training (AST). AST is a requirement for GPs in Australia, aiming to improve healthcare delivery in rural and remote areas (11). Posts funded by the Program are required to take place in rural, remote, or Modified Monash (MM) 2–7 areas, unless those areas do not offer the required training (12). AST includes specialties such as Aboriginal and Torres Strait Islander health, academic post, adult internal medicine, anesthesia, child health, emergency medicine, mental health, obstetrics, palliative care, surgery, and small town rural general practice (1). It enables GPs to expand their skills beyond traditional general practice training (8).

Currently, AST is supported through a collaborative approach involving the Australian Government Department of Health and Aged Care, ACCRM, RACGP, state and Northern Territory Health Departments, National Rural Generalist Pathway Coordination

Units, Local health networks, public health settings, RG registrars, GP registrars, and fellowed RGs and GPs (12). The program aims to increase support for RG and GP registrars and fellowed RGs and GPs in regional, rural, and remote Australia to develop additional skills, build a strong rural training network by increasing the number of highly skilled supervisors, and ensure rural communities have access to appropriately skilled healthcare providers (11, 13). There is widespread support for mental health and Aboriginal and Torres Strait Islander Health ASTs as priority areas, reflecting the consistent demand for these skills across rural Australia (12). However, AST programs are structured and function differently globally with a common goal of improving rural and remote health (13).

Despite a growing body of evidence on AST and its impacts, research on the enablers and barriers to training from the perspective of GPs remains limited. Existing studies have primarily focused on workload, work activities, experiences of support during AST (14), outcomes of AST (15), and the establishment and advancement of AST (16). Understanding the perspectives and needs of GPs trainees in AST programs is crucial to fostering a conducive learning environment responsive to the transformative lifelong learning (7). Achieving this objective requires continuous evaluation and monitoring of training and learning experiences. This study, therefore, seeks to address the following research questions:

- (1) What are the extrinsic and intrinsic factors that influence GPs' choice of AST?
- (2) What are GPs' perceptions of the enablers and barriers to the AST program?

The findings from this study will help identify the challenges and experiences GP face during their training and clinical practice and suggest possible measures to ameliorate such problems. This study will also help identify the extrinsic and intrinsic factors influencing GPs choice of AST.

## Materials and methods

### Ethics

Ethics approval was obtained from the James Cook University (JCU) Human Research Ethics Committee (HREC H9139). Prior to the data collection, respondents were provided with the necessary information about the study in both phases. Consent was obtained from all respondents, including consent to record the interviews.

### Study design

This study adopted a sequential explanatory mixed methods approach within the pragmatic paradigm (17, 18). The first phase of the study employed a cross-sectional quantitative study design. At this stage, quantitative data was collected on the extrinsic and intrinsic factors influencing GPs choice of AST. This data was analyzed to identify issues that warrant further exploration. In the second phase, a descriptive phenomenological study design was

**Abbreviations:** ACCHS, Aboriginal Community Controlled Health Service; AMG, Australia Medical Graduate; ARST, advanced rural skills training; AST, Additional Skills Training; FACRRM, Fellowship of the Australian College of Rural and Remote Medicine; FRACGP, Fellowship of the Royal Australian College of General Practitioners; FARGP, Fellowship in Advanced Rural General Practice; GP, General Practice; IMG, International Medical Graduate; RACGP-RG, Royal Australian College of General Practitioners-Rural Generalist; SD, standard deviation.

adopted to explore GPs' experiences of the enablers and barriers to their choice of AST program.

## Phase one: quantitative survey

A cross-sectional survey was conducted using questionnaires among GPs to answer research question one. The questionnaire was developed using Qualtrics. It comprised two sections: demographic and practice characteristics of respondents (e.g., age, gender, current practice setting and location) and questions regarding AST experiences and perspectives. Questions regarding participant perceptions of the AST program were on a 5-point Likert scale (SD = 1 to SA = 5) (e.g., The acquisition of AST is essential for providing comprehensive and specialized patient care, pursuing AST is primarily driven to better meet the needs of patients in underserved areas). The questionnaire was piloted among five experts involved in the program before the actual data collection. The survey was refined following the feedback from the experts and finalized before deployment.

General Practitioners were invited to participate in an online survey between September and October 2023. The inclusion criteria were: being a practicing GP with completion of AST in Australia, and willingness to participate in the study. Respondents were recruited via the General Practitioners and registrar's database. Emails were sent with the Qualtrics survey link to participants. To increase participation, respondents were asked to enter a draw to win one of five \$100 gift cards. The last question in the survey was used to recruit participants for the qualitative phase of the study. Additionally, to increase participation, posters were used to invite potential participants during the Rural Medicine Australia 2023 conference in Hobart, Tasmania. Finally, snowball sampling was also employed to invite participants who met the inclusion criteria.

## Quantitative data analysis

The quantitative data were analyzed using R version 4.3.0. Descriptive statistics, including frequencies and percentages, were calculated for categorical variables. For continuous variables, mean and standard deviation were used.

## Second phase: qualitative phase

The qualitative phase of the project employed descriptive phenomenology to explore the experiences of GPs within the AST program (19). Two participant groups were selected for this study through convenience and purposive sampling: Directors of Medical Services (DMS) and Fellows. Inclusion criteria mandated that participants had completed AST in Australia. DMS were invited from a list of contacts within one of the co-authors' professional networks (AH). Fellows were invited from a pool of participants who had completed the survey in the first phase of the project and had expressed interest in participating in an interview regarding their AST experience. Participants received compensation for their time in the form of a \$50 grocery store gift voucher and were entered into a draw for a chance to win a \$100 department store gift voucher.

## Qualitative data collection

The interviews were semi-structured, offering a framework for the discussion while allowing participants flexibility to elaborate on their AST experiences. Examples of interview questions included: What motivated you to pursue the AST program? How has the AST program impacted the recruitment and retention of healthcare professionals in your community? How does the program address the unique challenges facing rural clinical practice? Do you feel that the AST program has improved your ability to care for rural patients? A female research assistant (HM) received guidance from a senior researcher (EA) on the prescribed protocol and interview technique, as well as the interview guide. Neither EA nor HM had prior involvement in AST and held minimal preconceived notions about this training. EA conducted the initial interview, with HM present to observe and familiarize with the process. Subsequent interviews were conducted by HM. The interviews, conducted via video conferencing, took place between 29 September 2023, and 19 October 2023 until data saturation was reached, lasting between 20 and 45 min.

## Qualitative data analysis

The recorded interviews were transcribed verbatim using Otter AI and the transcription feature in Microsoft Teams. The transcripts underwent de-identification and were imported into NVivo version 20 (Lumivero, Colorado, United States). An inductive thematic approach, following Braun and Clarke's 6-step process (20) was adopted for data analysis. First, two research team members (HM and AS) meticulously cleaned the transcripts and familiarized themselves with the data. Second, generating initial codes was initially piloted by three authors (HM, AS, and EA). Once consistency was established, the remaining interviews were independently coded by either HM or AS. In the third stage, HM and AS categorized the various codes into themes, systematically gathering all relevant coded data extracts associated with the identified themes. In the fourth stage, the primary coders (HM and AS) met with senior researchers (EA and BMA) to review and refine the themes identified. These themes were then defined and renamed through group consensus among the research team. Finally, verbatim representative quotes from participants were selected to support each theme in the report. Lincoln and Guba's four criteria for ensuring trustworthiness were followed (21). The consolidated criteria for reporting qualitative research (COREQ) checklist was adhered to for reporting the findings of the qualitative study (22).

## Triangulation

The principles outlined by O'Cathain et al. (23) supported the triangulation of findings in both phases of this study (23). The process included (1) analyzing and extracting threads independently from each phase, (2) connecting the threads between the first and second phases to enable a joint interpretation, and (3) formulating comprehensive conclusions and meta-inferences through the integration and interpretation of findings from both study phases.

**TABLE 1** Demographic characteristics of the respondents and practice history by location.

| Characteristic                                 | Overall, <i>n</i> = 106 |
|------------------------------------------------|-------------------------|
| Age, mean (SD)                                 | 39.0 (11.3)             |
| Years of working, mean (SD)                    | 9.3 (9.5)               |
| <b>Gender, <i>n</i> (%)</b>                    |                         |
| Female                                         | 53 (50)                 |
| Male                                           | 53 (50)                 |
| <b>State, <i>n</i> (%)</b>                     |                         |
| Queensland                                     | 104 (98.1)              |
| Victoria                                       | 2 (1.9)                 |
| <b>Rurality of work location, <i>n</i> (%)</b> |                         |
| Remote or very remote community (MM6 or 7)     | 13 (12)                 |
| Small rural town (MM5)                         | 13 (12)                 |
| Medium rural town (MM4)                        | 29 (27)                 |
| Large rural town (MM3)                         | 12 (11)                 |
| Regional center (MM2)                          | 26 (25)                 |
| Metropolitan area (MM1)                        | 10 (9.4)                |
| <b>Current work, <i>n</i> (%)</b>              |                         |
| Hospital                                       | 37 (35)                 |
| Blended                                        | 33 (31)                 |
| GP                                             | 24 (23)                 |
| ACCHS                                          | 7 (6.6)                 |
| <b>Graduate type, <i>n</i> (%)</b>             |                         |
| AMG                                            | 87 (82)                 |
| IMG                                            | 19 (18)                 |
| <b>Curriculum, <i>n</i> (%)</b>                |                         |
| FACRRM                                         | 48 (45)                 |
| FRACGP and FARGP or RACGP-RG                   | 16 (15)                 |
| FRACGP                                         | 15 (14)                 |
| FRACGP and FACRRM and FARGP or RACGP-RG        | 13 (12)                 |
| FRACGP and FACRRM                              | 9 (8.5)                 |
| FARGP or RACGP-RG                              | 5 (4.7)                 |
| <b>Fellowship status, <i>n</i> (%)</b>         |                         |
| Fellowed                                       | 65 (61)                 |
| Current                                        | 41 (39)                 |
| <b>Advance training, <i>n</i> (%)</b>          |                         |
| AST                                            | 59 (56)                 |
| Unknown                                        | 19 (18)                 |
| ARST                                           | 17 (16)                 |
| Extended skills                                | 9 (8.5)                 |
| ARST and AST                                   | 2 (1.9)                 |
| <b>Skills discipline, <i>n</i> (%)*</b>        |                         |
| Anesthetics                                    | 28 (28.0)               |

(Continued)

**TABLE 1** (Continued)

| Characteristic                               | Overall, <i>n</i> = 106 |
|----------------------------------------------|-------------------------|
| Emergency medicine                           | 17 (17.0)               |
| Obstetrics and gynecology                    | 16 (16.0)               |
| Aboriginal and Torres Strait Islander health | 8 (8.0)                 |
| Adult internal medicine                      | 5 (5.0)                 |
| Academic practice                            | 5 (5.0)                 |
| Mental health                                | 4 (4.0)                 |
| Child Health/pediatrics                      | 4 (4.0)                 |
| Surgery                                      | 3 (3.0)                 |
| Population health                            | 3 (3.0)                 |
| Palliative care                              | 3 (3.0)                 |
| Small town rural practice (discontinued)     | 2 (2.0)                 |
| Remote medicine                              | 2 (2.0)                 |

\*Out of 100 responses for this question. ACCHS, Aboriginal Community Controlled Health Service; AMG, Australia Medical Graduate; ARST, advanced rural skills training; FACRRM, Fellowship of the Australian College of Rural and Remote Medicine; FRACGP, Fellowship of the Royal Australian College of General Practitioners; FARGP, Fellowship in Advanced Rural General Practice; GP, General Practice; IMG, International Medical Graduate; RACGP-RG, Royal Australian College of General Practitioners-Rural Generalist; SD, standard deviation.

## Results

### Quantitative phase

#### Demographic characteristics of the respondents and practice history by location

The demographic characteristics and practice history of 106 responding GPs are presented in Table 1. The average age was 39 ( $\pm 11.28$  years) with an average year of working experience of 9.33 ( $\pm 9.51$  years). The participants were evenly split by gender. Almost all (98.1%) the responding GPs were in Queensland. Representation was lower in remote communities, small rural towns, large rural towns, and metropolitan areas but a strong presence in medium rural towns (27%) and regional centers (25%). Predominantly, they worked in hospitals (35%) and blended practices (31%), followed by general practice (23%) and Aboriginal Community Controlled Health Services (6.6%). The majority (82%) are Australian Medical Graduates. Fellowship of the Australian College of Rural and Remote Medicine (FACRRM) was the main curriculum (45%). Furthermore, (61%) have achieved fellowship status. More than half (56%) undertook the AST, and the majority (28%) undertook anesthetics as their AST discipline.

#### GPs attitudes toward additional skills training

Figure 1 presents GPs' attitudes toward AST program. There was a high agreement about the motivators for pursuing AST. Ninety-one percent of GPs agreed that pursuing AST is a valuable investment for professional and career development, indicating a strong intrinsic motivation related to career advancement with a mean score of 4.44 out of 5. The opportunity to acquire

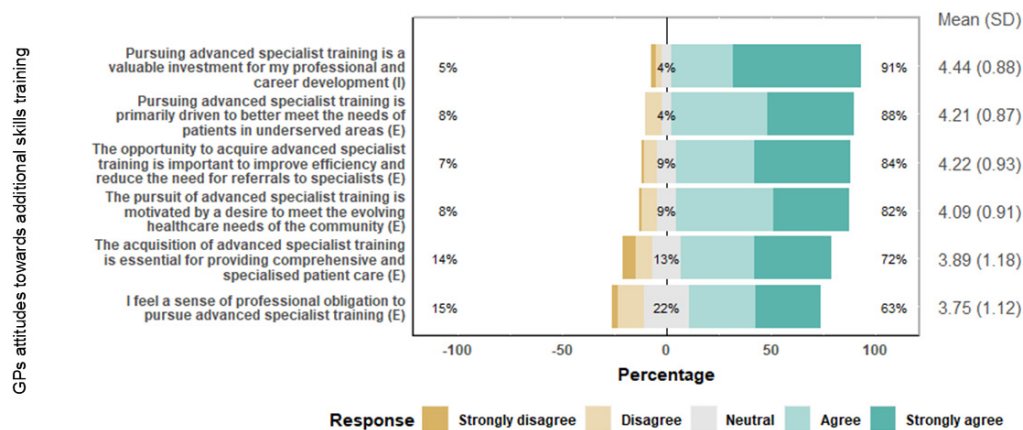


FIGURE 1

Responses to questions on commitment to excellence in healthcare as factors affecting decision to pursue additional skills training (AST).

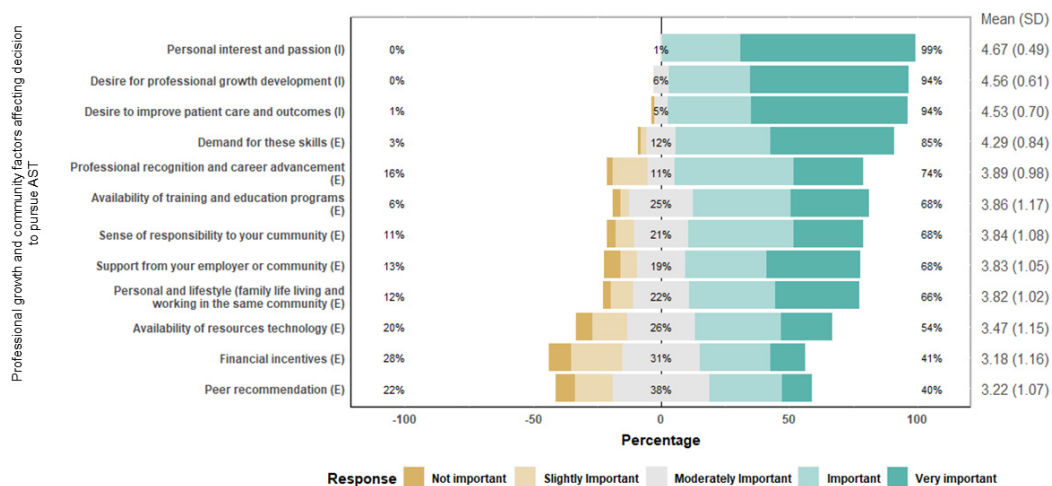


FIGURE 2

Responses to professional growth and community factors affecting decision to pursue additional skills training (AST).

AST to improve efficiency and reduce referrals had the second-highest mean score of 4.22. Although, still more than average, the statement with the lowest level of agreement (63%) was the sense of professional obligation to pursue AST, suggesting extrinsic motivation related to professional duty is less of a driving factor with a mean score of 3.75.

## Professional growth and community factors affecting decision to pursue AST

In Figure 2, the responses to questions regarding professional growth and community factors affecting the decision to pursue AST were all above average. The three highest rated factors were intrinsic factors, “Personal interest and passion” (Mean = 4.67), which had a 99% importance rating, “Desire for professional growth development” (Mean = 4.56), 94% and “Desire to improve patient care and outcomes,” (Mean = 4.53), 94%. Also, 85% and 74% of the surveyed GPs rated extrinsic factors such as “Availability of training

and education programs” and “Professional recognition and career development” as highly important, respectively. Other factors include “Support from your employer or community,” “Sense of responsibility to your community,” and “Demand for these skills,” which were also rated highly, with 85% and 68% of respondents, respectively, considering them important. Financial incentives, an extrinsic factor, had a relatively lower mean importance score (Mean = 3.18).

## Enablers and barriers of AST

The enablers and barriers to acquiring AST among GPs are presented in Figure 3. The majority (86%) of responding GPs agreed or strongly agreed that policymakers and healthcare organizations need to prioritize AST, with a mean response of  $4.41 \pm 0.79$ . A notable divergence in opinion was observed regarding the impact of exposure to diverse patient populations on acquiring AST, with a mean score of  $3.12 \pm 1.10$ . While 36.5% agreed or strongly agreed that it was a barrier, 32.9%,

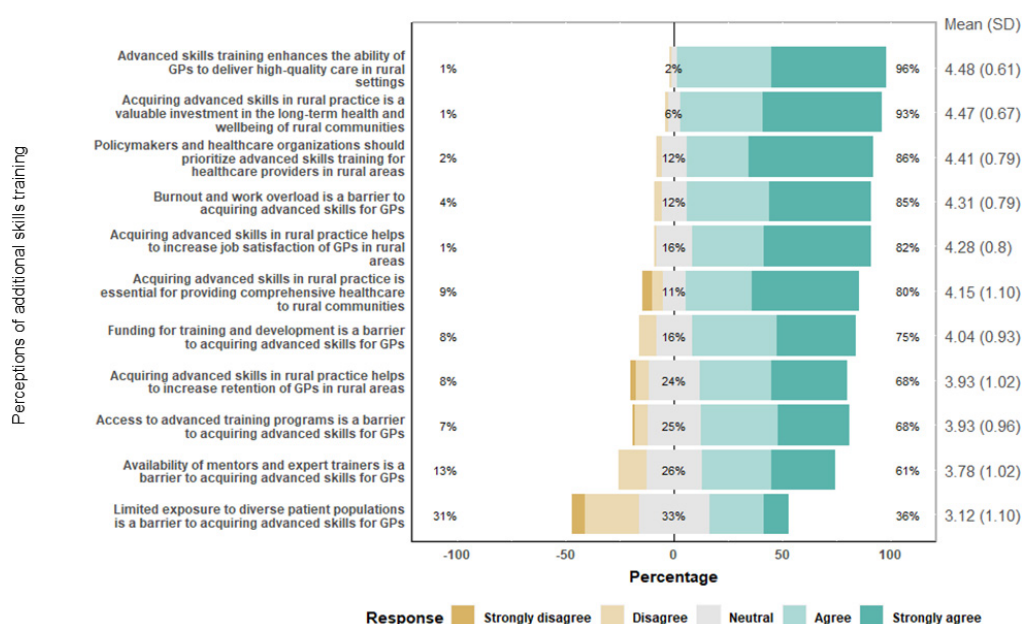


FIGURE 3

Responses to questions on enhancing skills and overcoming barriers through additional skills training (AST).

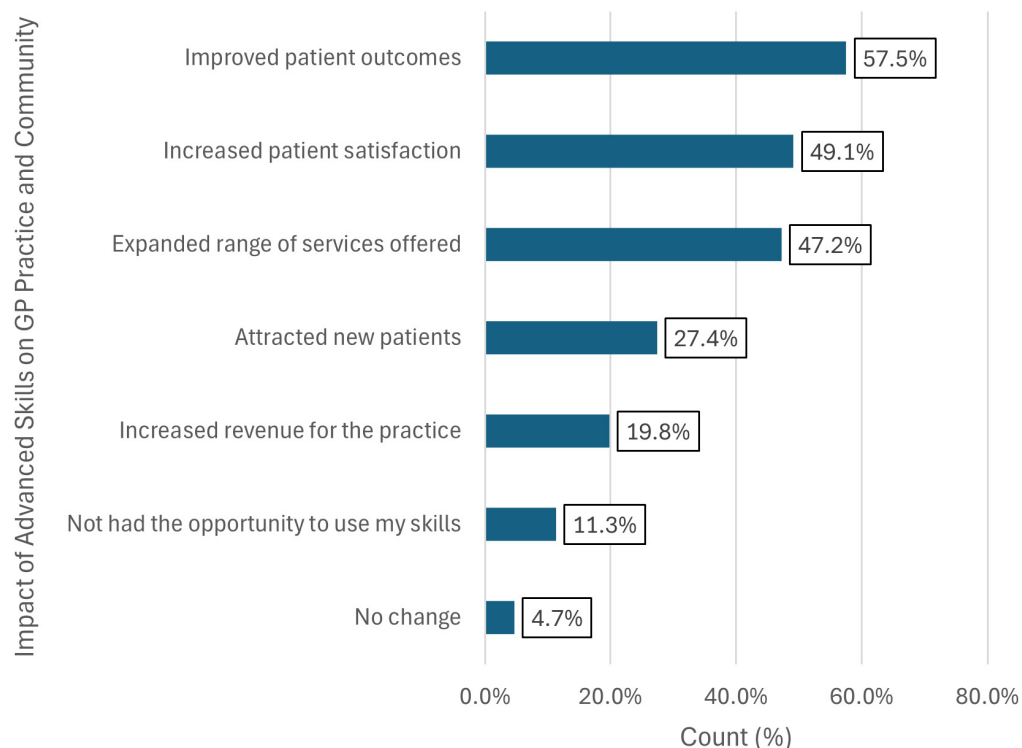


FIGURE 4

Distribution of how advanced skills have changed or impacted General Practitioners (GPs) practice or community.

remained neutral. Funding, burnout, workload, and the availability of mentors were also identified as significant barriers to AST. The mean scores for these items were  $4.04 \pm 0.93$ ,  $4.28 \pm 0.81$ , and  $3.78 \pm 1.02$ , respectively, indicating general agreement with these statements. In particular, the impact of burnout and workload

was acknowledged, with 85% agreeing or strongly agreeing that these factors were barriers. A high proportion of GPs agreed or strongly agreed that investment in AST was crucial for the “delivery of high-quality care in rural settings” and for “investment in the long-term health and wellbeing of rural communities,” with mean

scores of  $4.48 \pm 0.61$  and  $4.47 \pm 0.67$ , respectively, reflecting strong agreement (See Figure 3).

## Perceptions of additional skills training

The GPs were asked how AST impacted or changed their practice (Figure 4). Over half (57.5%) indicated that AST improved patient outcomes, and 49.1% reported increased patient satisfaction. Additionally, 47.2% observed an expanded range of services offered in their practice due to AST, while attracting new patients was noted by 27.4%. About 4.7% reported no change after acquiring additional skills (Figure 4).

## Additional skills discipline and frequency of utilization

As shown in Table 2, respondents were asked about the frequency of utilization of listed skillsets in their practice. The top five skills the respondents used daily were chronic disease management (60.7%), mental health (53.9%), internal medicine (52.8%), pediatric (51.7%), and adolescent and youth health (46.1%) while the least used were travel medicine (3.4%) and refugee health (1.1%).

## Qualitative phase

Of the 13 DMS contacted, five participated in the interviews, while eight of the 17 contacted medical fellows participated. Overall, 13 participants participated in the qualitative phase, of which eight were male (61.5%) and five were female (38.5%). The most reported AST was Anesthetics (5), followed by emergency ( $n = 4$ ), obstetrics and gynecology ( $n = 2$ ), internal medicine ( $n = 2$ ), and academic ( $n = 1$ ).

Inductive thematic analysis of the data revealed six key themes concerning enablers and barriers to access and effective participation in the AST programs. The identified enablers related to factors that positively influenced their participation, while the barriers pertained to factors that negatively impacted GPs' access to and participation in the AST program. Three of the themes (desire to work rurally–intrinsic motivation, meeting workforce needs and support networks) were related to the enablers, while the remaining three (work life balance, mismatched expectations, and inadequate knowledge and recognition of AST) were linked to the barriers.

## Enablers to the additional skills training program

### Desire to work rurally (intrinsic motivation)

The first theme in relation to enablers of AST was the intrinsic motivation of participants to work rurally and advance their career. Some of the participants described how, while growing up

in rural areas, they witnessed challenges with healthcare access, contributing to a desire to support to addressing healthcare disparities in rural and remote areas. This motivation prompted them to undertake AST to achieve this goal. Additionally, some participants expressed a lack of interest in working in metropolitan areas.

*“Well, I grew up on a farm in a rural area and we often didn't have local doctors. And if you had to have like a simple procedure done, you would often have to travel a long way to do it. And so I'm talking like taking over 2 h to actually see doctor to have a procedure done. So I did placement as a medical student out in the [health district], in [rural town] and I really liked it.” Fellow 4, Female.*

### Meeting workforce need

The second theme generated from the data on enablers to AST training was meeting workforce needs. Some of the fellows reported that meeting workforce needs propelled them to undertake AST. They discussed the dynamic nature of career paths in the medical field, where unexpected opportunities can lead individuals to alter their plans based on emerging possibilities and unique circumstances.

*“Originally, I had planned to do emergency medicine as an advanced skill. And I did that for, I guess the clinical experience and just getting better at emergency presentation. But then someone pulled out of the obstetric program in [regional center] and they're like, “why don't you apply?” So I did and I got it. So I ended up doing the obstetrics. I have always liked Women's Health, but I didn't particularly see myself doing rural generalist obstetrics.” Fellow 2, Female.*

### Support networks

Another important enabler the participants discussed was the support networks available to them. Specifically, some participants emphasized the importance of organizational mentorship, professional networks, and their positive impact on their AST.

*“... I had a really great supervisor who was able to guide me, which was, really good and overall, I had a really good amount of support. I think because I wasn't aware of other people doing an academic AST... that actually, I knew of another fellow who did it through RACGP who did an academic placement through RACGP, but I wasn't aware.” Fellow 3, Male.*

## Barriers to the additional skills training program

Despite the positive training experiences or enablers to AST highlighted by some of the participants, some barriers were discussed. The themes generated from the data on barriers are discussed below.

TABLE 2 Frequency of skills utilization.

| Skills                                       | Frequency of utilization (%) |             |                  |         |                        |
|----------------------------------------------|------------------------------|-------------|------------------|---------|------------------------|
|                                              | Daily                        | Once a week | Once a fortnight | Monthly | Once a year/<br>rarely |
| Anesthetics                                  | 13.5                         | 13.5        | 9.0              | 12.4    | 51.7                   |
| Aboriginal and Torres Strait Islander health | 39.3                         | 16.9        | 10.1             | 13.5    | 20.2                   |
| Adolescent and youth health                  | 46.1                         | 25.8        | 9.0              | 2.3     | 16.9                   |
| Academic practice or academic post           | 10.1                         | 10.1        | 10.1             | 10.1    | 59.6                   |
| After hours medicine                         | 14.6                         | 34.8        | 12.4             | 7.9     | 30.3                   |
| Aged care                                    | 41.6                         | 20.2        | 10.1             | 9.0     | 19.1                   |
| Allergy medicine                             | 7.9                          | 14.6        | 12.4             | 19.1    | 46.1                   |
| Chronic disease management                   | 60.7                         | 15.7        | 3.4              | 6.7     | 13.5                   |
| Cosmetic laser and dermatology medical       | 4.5                          | 5.6         | 12.4             | 4.5     | 73.0                   |
| Emergency medicine                           | 40.5                         | 18.0        | 10.1             | 12.4    | 19.1                   |
| Education                                    | 33.7                         | 23.6        | 13.5             | 9.0     | 20.2                   |
| Internal medicine                            | 52.8                         | 23.6        | 5.6              | 1.1     | 16.9                   |
| Mental health                                | 53.9                         | 21.4        | 6.7              | 5.6     | 12.4                   |
| Obstetrics and gynecology                    | 29.2                         | 28.1        | 13.5             | 10.1    | 19.1                   |
| Occupational medicine                        | 7.9                          | 11.2        | 21.4             | 15.7    | 43.8                   |
| Pediatrics                                   | 51.7                         | 20.2        | 12.4             | 2.3     | 13.5                   |
| Palliative care                              | 12.4                         | 25.8        | 12.4             | 27.0    | 22.5                   |
| Population health                            | 13.5                         | 13.5        | 14.6             | 16.9    | 41.6                   |
| Remote medicine                              | 25.8                         | 7.9         | 10.1             | 15.7    | 40.5                   |
| Refugee health                               | 1.1                          | 2.3         | 4.5              | 12.4    | 79.8                   |
| Respiratory disease                          | 42.7                         | 22.5        | 13.5             | 5.6     | 15.7                   |
| Sexual and reproductive health               | 32.6                         | 29.2        | 13.5             | 7.9     | 16.9                   |
| Skin cancer                                  | 18.0                         | 27.0        | 10.1             | 15.7    | 29.2                   |
| Sports medicine/musculoskeletal              | 28.1                         | 24.7        | 11.2             | 13.5    | 22.5                   |
| Surgery                                      | 13.5                         | 12.4        | 15.7             | 16.9    | 41.6                   |
| Travel medicine                              | 3.4                          | 10.1        | 18.0             | 27.0    | 41.6                   |

## Work-life-balance

Work life balance was a challenge that the participants felt hindered the smooth and successful participation in the AST program. In addition to that, some participants also discussed how challenges associated with rural living impacted their AST program. Some shared how they were already established and had to relocate causing a major disruption in the work and family life balance. Some of the participants also discussed the practical challenges faced by medical professionals in rural areas, emphasizing the impact on personal and professional dimensions and serving as barriers to their AST training. They discussed the interplay between housing conditions and technology infrastructure, focusing on inadequate internet coverage.

*“The biggest challenges are... the first one is... that you are already established in the community, so I was a GP and a*

*hospital doctor in [rural town] and you’re already established in that community and you’ve literally got to pack up your life for an entire year, move away.” Fellow 3, Male.*

*“So at that point it was a boom in [Rural Town] housing was either poor quality or extremely expensive. Or very substandard. My wife was traveling with me during that time and one of the big issues was Internet coverage. We couldn’t get any decent Internet coverage.” Fellow 1, Male.*

## Mismatch between skills and expectations

The other theme generated from the data on the barriers to AST was mismatched expectations. The participants discussed this in relation to systemic barriers and financial challenges. Most of the participants shared their experiences relating to the systemic barriers they were confronted

TABLE 3 Triangulation of study findings.

| Topic/theme                                   | Quantitative findings                                                                                                                                                         | Illustrative qualitative quote                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Synthesis                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enablers                                      |                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Desire to work rurally (intrinsic motivation) | The quantitative findings showed that most respondents are pursuing AST due to their personal interest and passion with a mean score of $4.67 \pm 0.49$ .                     | <i>"I got sick of metropolitan practice..." Fellow 1, Male.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                        | This underscores the need to emphasize the importance of intrinsic motivation among GPs.                                                                                                                                                                                                                                                                                                                             |
| Meeting workforce needs                       | The quantitative data also showed that respondents were motivated to undertake AST due to the demand for those skills they trained for with a mean score of $4.28 \pm 0.84$ . | <i>"I did my student placement as well as registrar years as well as going back as a fellow in the same place. So I've had the ability to get to know the local teams and current DMS in the point of view of saying, look, I know that this is going to be needed. I know that you don't currently employ this type of AST. But I can bring these skills back in 2 years." Fellow 6, Male.</i>                                                                                                        | Ensuring that AST is delivered to fill specific needs is crucial. Also prolonged and consistent engagement with the same institution suggests a deep familiarity with local needs and challenges, which is important for rural settings. By developing strong local relationships and understanding specific requirements, RGs can effectively introduce new skills to meet the needs of the communities they serve. |
| Support networks                              | The quantitative results showed that support from employer or community is a major factor affecting their decision to pursue AST with a mean score of $3.83 \pm 1.05$ .       | <i>"I was much more able to do the emergency department work that I was required to do in the rural hospital, and I got some very clear direction and support about what courses to do." Fellow 1, Male.</i>                                                                                                                                                                                                                                                                                           | Support networks are essential in every human endeavor. This emphasizes that having clear direction and support in training enhances RGs confidence and self-efficacy and overall ability to perform effectively. This structured guidance ensures that RGs are well-prepared and competent, leading to improved patient care and overall health outcomes in rural settings.                                         |
| Barriers                                      |                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Work life balance                             | The majority (85%) agreed that burnout and work overload is a barrier to acquiring AST with a mean score of $4.31 \pm 0.79$ .                                                 | <i>"It was particularly challenging because I'm a single dad and I managed to get a spot in [regional center], but my kids were in [major city]. So that year alone, I drove almost 50,000 Kilometers between [major city] and [regional center], and on my 2 days off, I'll finish at 5 or 6 or 7 p.m. then I will drive down to [major city] for 1 day. I will see my kids and family for 1 day and drive back that was quite challenging, but I just had to be resilient." Fellow 7, Male.</i>      | The results underscore the need for comprehensive support systems, flexible training structures, and strategic planning to address the unique challenges facing rural generalist trainees. These measures are essential to ensure the wellbeing of trainees and the success of the AST program.                                                                                                                      |
| Inadequate knowledge and recognition of AST   | About 74% of the responding GPs perceived professional recognition and career development through AST as highly important.                                                    | <i>"And I think the other thing is. It wasn't so bad in [regional center], but I know that there's places where the cultural attitude toward general practice and rural GPs is less than positive because there is a metro centric sort of attitude in health which says that if you're not in the big city, you're a failure. So there's, you know, [regional center's] not so bad because [major city] thinks [regional center] is the rural sticks and it's not. It's a big city." DMS 3, Male.</i> | It is necessary to address metro-centric biases against rural generalists through education and branding. Changing perceptions, improving training environments, and providing strong support systems can significantly enhance the recruitment, retention, and wellbeing of rural GPs.                                                                                                                              |

with during their AST training. Some shared their views on the conflicting expectations from ACCRM, and the limitations imposed by their placement. The discord between these entities led to stress and challenges in meeting requirements.

*"One of the frustrations I had was that there was a very big discord between what Queensland Rural Health expected I should do, what ACCRM required me to do, and what my placement allowed me to or could afford me to do, and that caused quite a lot of angst because a concept if you don't do this, you'll fail. Can't say you can't do it. It's like well so some of the*

*parts I had to do in my days off rather than being so actually had to take some of the academic things off in my own time rather than doing it as a registrar under the banner of paid time." Fellow 6, Male.*

Some participants shared their experiences on the challenges they faced during their AST training as financial issues. Specifically, some shared how their income decreased due to change in rank. Despite the financial setback, some participants felt compelled to accept the role due to high demand and competition for the position notwithstanding the financial sacrifices involved.

*“The other thing is that a lot of us, at least in my case, I was a Senior Medical Officer before I did my AST, and I was dropped to Registrar hourly rate income, and I came from an income and then it dropped by half or more. And there was no way around it because well, according to Queensland Health, you’re not supposed to change your pay scale. But on the other hand, if I don’t do it, and I don’t take the job on the pay they will have 20 more people who want to take it but just yeah, just get on board and just go in and do it.” Fellow 7, Male.*

## Inadequate knowledge and recognition of additional skills training

Most of the participants indicated how inadequate knowledge and recognition of AST is a major barrier to smooth AST program. Some discussed that specialists, particularly those in higher positions, undervalue them and shared that many specialists lack a comprehensive understanding of the work of their junior colleagues and the scope of their work. Some used the phrase “glass towers” suggesting a disconnect between those in leadership roles and the practical realities. These participants suggested that if these specialists were more involved in hands-on work, they would gain a better appreciation for the capabilities and contributions of the junior colleagues and recognize the advanced skills they have acquired.

*“I don’t think they value (us). ... they undervalue us, I think quite a lot. I think most specialists up there really don’t understand the breadth of what we actually do. I think that’s one of the biggest problems and you know, certainly the guys that do get out of the glass towers and come down and do some work, go back with much better appreciation of what we can actually achieve.” Fellow 5, Female.*

## Triangulation of study findings

Table 3 shows triangulation of the quantitative and qualitative findings.

## Discussion

Building health workforce through additional skills is essential to promoting health accessibility and equity, especially for those in rural and remote Australia (24). AST empowers GPs to acquire additional skills to provide essential services in these areas (11, 13). This mixed-methods study explored the extrinsic and intrinsic factors influencing GPs choice of AST and their perceptions of the enablers and barriers to the AST program.

Quantitative findings revealed that GPs reported improved patient outcomes, increased patient satisfaction, and expansion of services offered as benefits of AST. However, significant barriers included funding challenges, burnout, workload, and low availability of mentors. Most GPs emphasized the need for policymakers and healthcare organizations to

prioritize AST for GPs and healthcare providers in general and provide more opportunities to undertake the AST to support the delivery of specialized and essential services to their respective communities (15). The WHO (25) has also argued for increased visibility of training programs to enhance impact on delivery of effective health services. Intrinsic motivations for pursuing AST included personal interest and passion, desire for professional growth and development, and a desire to improve patient care and outcomes. Qualitative findings highlighted enablers such as desire to work rurally (intrinsic motivation), meeting workforce needs, and support networks. Conversely, barriers included poor work-life balance, mismatch expectation from different stakeholders involved in the AST, and inadequate knowledge and recognition of AST.

Overall, the study findings reinforced that while GPs are willing to undertake AST, their main motivation is intrinsic, with financial compensation being less of a priority for participation (26). Although finances were not a primary motivation for participants pursuing AST, they faced significant financial challenges in practice. Participants reported issues such as loss of rank and salary, high housing costs, and hidden expenses related to travel. Previous studies have also argued that intrinsic motivation positively influences engagement in training and work (27, 28). However, work life balance remains a major challenge affecting learning, wellbeing during advanced training (29) and long term satisfaction (30, 31). Previous surveys have also indicated that 60% of physicians and 58% of trainees are dissatisfied with their work-life balance (32, 33). Poor work-life balance often leads to reduced work hours, practice changes, and exiting the medical field, negatively impacting the affordability and availability of care. Improving work-life balance for all trainees is crucial and requires organizational changes, such as flexible arrangements and adaptability (29). Additionally, fostering strong social support networks could help mitigate training pressures (29).

The findings also showed that inadequate knowledge and recognition of AST was a barrier. Previous studies have also shown a similar challenge with recognition of AST (2, 14). Specifically, these studies (2, 14) have all found that the level of recognition was limited in the general healthcare system although communities, GPs and some peers appreciate the value of AST. The findings also showed that the top five ASTs pursued were anesthetics, emergency medicine, and obstetrics and gynecology, whilst the top five additional or extended skill sets surveyed GPs reported they use daily were chronic disease management, mental health, internal medicine, pediatrics, and adolescent and youth health. It is important to add that respondents might have provided the skills they use daily in their GP role instead of the additional skills. Nonetheless, this may imply skills mismatch at the community level as discussed in a previous study (34). Mason et al. (34) reported that participants emphasized the need to align AST specialty choices with community needs prior to starting training. This approach helps ensure that the skills gained address existing gaps and that there are opportunities for the GP to return and practice within the community. This also points to the fact that skills other than procedural skills are also more required in rural and remote settings (3) to manage their disease and health conditions in general. This suggests that funding allocation could also prioritize widely used

skills, particularly in chronic diseases and mental health, which are prevalent in rural and remote areas (6, 35). The need to also pay attention to mental health and chronic diseases reflects the disease burden globally and specifically in Australia (35). Hence, the skills needed should align with these prevalent health issues in the respective communities (12).

## Implications for policy and practice

The study findings have implications for policy and practice. In terms of ensuring that the AST meet the community needs, it is essential that specific skills needed in rural and remote communities in which RGs work are promoted. It also requires that the trainee receive timely advice from career development practitioners to inform their selection of AST (14). This sequential approach could address the current mismatch in the expectations where AST is completed before GPs begin to establish their practice within a community. Second, enhancement and promotion of utility of AST is needed. This will ensure that it is highly valued and recognized within the GPs space and among prospective RGs. Third, providing incentives such as scholarships and mentorship avenues are crucial for the success of AST program.

## Strengths and limitations

This study provides key insights into the enablers and barriers faced by GPs in pursuing AST. By employing a mixed methods approach, it integrates both quantitative and qualitative data to enrich the study's findings. However, some limitations are worth discussing. First, this study included only the views of fellows and DMS. Second, the qualitative phase of the study did not cover all AST programs, hence the possibility of missing some perspectives. Although the study invited GPs across Australia, most participants, particularly, in the qualitative phase, were currently employed in Queensland, where pathways for rural generalist are available (34). Future studies should include more respondents from other states and territories in Australia. Additionally, there is a possibility of sampling bias, as probably only those who showed interest participated in the study. Moreover, there is possibility that sampling bias and social desirability biases of responses in both phases of the study are possible.

## Conclusion

To conclude, AST is a highly valued training program. Most GPs are intrinsically motivated to participate in the program. However, to ensure sustainability, wider recognition, better visibility, and better alignment with community needs need to be prioritized.

## Data availability statement

The original contributions presented in this study are included in this article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by James Cook University (JCU) Human Research Ethics Committee (HREC H9139). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Mechanisms to build research capacity in the rural health workplace: a realist synthesis

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**Introduction:** Workplace-based research training contributes to research capability and capacity in rural areas where access to university expertise is limited. Rural health complexities and the diverse approaches previously used to build research capacity have led to a lack of clarity about how to build research capacity within rural health services.

**Methods:** Using a critical realist foundation, we explored distributed workplace-based rural research training and synthesized five studies centered in rural New South Wales, Australia. Critical realism allowed the exploration of the structural supports and barriers for workplace-based research training activities and the ability of individuals to pursue research activities within rural health workplaces.

**Results:** The component studies showed that distributed rural research training programs improve individual research capability by developing research skill, increasing research experience and facilitating research networks across sectors. Rural research activities are characterized by individual agency and partnering or relationships to access support and expertise. Structural barriers including a lack of operational planning for research and few ongoing research opportunities limit translation of capability into research capacity.

**Discussion:** Individual workplace-based research training is effective, but not sufficient to build and maintain research capacity. Structural supports such as organizational commitment and careful training design can maximize cooperative partnerships with education partners. Addressing both structural and individual factors is needed to build rural health research capacity and generate real-world health research to drive meaningful improvements in rural health.

## KEYWORDS

distributed training, research education, rural health, workplace-based education, realist synthesis

## 1 Introduction

People living in rural and remote locations experience significant health disadvantage when compared to their urban counterparts (1, 2). These disadvantages are linked to disparities in healthcare access (3, 4), fewer specialist doctors and allied health professionals, and specialist services clustered in cities (5). Other health service access challenges include large geographical distance between centers, low population densities (1) and disparities caused by social determinants of health (6, 7).

These challenges highlight the unique circumstances associated with rural and remote healthcare delivery. In Australian healthcare delivery, urban models of care are often

applied to rural or remote areas, a “one size fits all” approach that may not translate into rural and remote areas (8, 9). The development of tailored rural solutions and bespoke models of care are required to better meet health needs of these unique populations with a goal of equal opportunity for good health “regardless of location” (10).

Addressing these particular circumstances and needs of rural and remote healthcare delivery in Australia indicates a need for rural-specific research (11, 12) including developing and implementing rural models of care (13) and translating relevant urban research into rural environments (14). Better rural healthcare relies upon a better understanding of the rural healthcare environment and rural health delivery.

One difficulty in understanding rural health issues is the limited number of rurally-based researchers (11, 15). Historically most researchers have been urban-based and if they conducted research in rural areas, this has not led to increased research activity driven by those rural communities (12). Research conducted with, within and by rural health services and rural clinicians has advantages in identifying the critical issues relevant to the rural or remote context and understanding of rural people’s mindset and characteristics (11, 16, 17). The unique circumstances surrounding rural healthcare delivery have led for a call for specific rural training for researchers in Australia (12).

Research training and capacity building within health services has taken many forms over the past two decades, including grant programs (18, 19), partnerships (20, 21), embedded researcher models (22–26) and training programs (27–31). The success of these initiatives is measured using different metrics, including self-rated research experience (28, 32, 33), completion rates (34), research activity (18, 35) and the ability to secure grant funding (21, 36). Other reported metrics include publications or presentations (37, 38), workforce development (29, 39), influence on policy and practice (18, 20) or research confidence (40). Provision of a formal qualification or articulation with research higher degrees was an important feature of some programs (26), but many programs led to no formal qualification. In Australia a range of health disciplines have been targeted for research capacity building, including Aboriginal health workers (39, 41, 42), allied health staff (22, 23, 43–47), medical staff (35, 48) and primary health care workers (20, 33, 49, 50).

The range of learner groups, approaches, contexts and metrics add complexity to understanding the relative merits of each approach. This highlights the need for studies such as this synthesis, where critical realism is used to create clarity from this complexity.

The setting for this synthesis is the public health system New South Wales (NSW), Australia. The NSW public health system is structured with a centralized governance and policy body overseeing 15 Local Health Districts (LHDs) and multiple specialty networks responsible for delivering clinical services (51). Nine of these LHDs cover rural and remote areas (51).

Within these rural LHDs, there has been an effort to build research capacity through the Rural Research Capacity Building Program (RRCBP), a distributed, workplace-based research training program (27–29, 34). This program was created in recognition of limited research expertise in rural health services and within rural health workers (29). The stated aims of the program are to build research knowledge and skill while contributing to the rural research evidence base (34). This

aligns closely to the clinician-researcher model, producing rural clinicians with research capability and experience, whilst building research capacity.

The synthesis explores the constraints inherent in the rural health system and what rural research capacity building can achieve within this context. Five papers examining research capacity building within NSW and within the public health system (33, 52–55) were included in this synthesis. Collectively, the studies and a critical realism perspective allow development and testing of generative mechanisms that explain “why things are as they are” in research capacity building in rural health services, with the rural NSW experience as an exemplar. These underlying explanations may have applicability and relatability to other rural contexts outside NSW and outside Australia.

The aims of this synthesis were:

1. To describe and understand the contexts in which rural health research training occurs and the outcomes of research capacity building endeavors in the rural health workplace.
2. To use these outcomes in context to theorize what mechanisms exist in the education of research for the rural workforce which have led to the kinds of outcomes we see.
3. To develop key principles to guide the development of rural research capacity building programs.

## 2 Materials and methods

This paper brings together five papers centered on rural research capacity building (Table 1) in the form of a realist synthesis. Unlike a traditional systematic review which takes a broad view of the available literature, this realist synthesis uses purposively selected studies to form a unique data set that can be explored using realist principles to extract a new understanding. This approach is underpinned by the concept that the papers present theories about what works for who in what circumstance and that by synthesizing together these theories the underlying causative mechanisms can be unveiled in what is otherwise a complex area (56).

For this synthesis, the included papers report on the context of research training and the outcomes of the RRCBP and another similar program conducted in a more remote part of NSW and

TABLE 1 Papers included in synthesis (103).

| Referenes              | Study type            | Location                                                   | Number of participants |
|------------------------|-----------------------|------------------------------------------------------------|------------------------|
| Schmidt (52)           | Single case study     | NSW (two organizations)                                    | Single case            |
| Schmidt and Kirby (33) | Cross-sectional study | NSW, Victoria, Northern Territory (multiple organizations) | 20                     |
| Schmidt et al. (53)    | Content analysis      | NSW (single organization)                                  | N/A                    |
| Schmidt et al. (54)    | Qualitative study     | NSW (single organization)                                  | 18                     |
| Schmidt et al. (55)    | Qualitative study     | NSW (multiple organizations)                               | 22                     |

other states. These studies were selected for a number of reasons. Firstly, the RRCBP provides the longest-running example of rural research capacity building in Australia (29, 55) and as such provides opportunity for learnings that cannot be gleaned from shorter-term programs. Secondly, understanding the context in which these programs is an important part of realist synthesis (56) and the authors' positions as "informed insiders" within these programs allows a nuanced perspective that an outsider may not achieve. Including papers that explore similar programs to the RRCBP or similar contexts to which the RRCBP is conducted provides a diversity of sources, paralleling the fact that rural communities are not homogenous (2). Bringing these studies together creates a necessary richness to the data.

The process of realist synthesis involves synthesizing the findings from the individual studies into new generative mechanisms and was led by the first author (DS). The process commenced with extracting elements known as Context, Mechanism and Outcome statements (CMO) of each of the included studies. These statements (also known as CMO chains) were broken down into their individual elements such as observations on the Context of the rural research capacity building endeavor or the proposed Mechanism that explains observed Outcomes within the study. The elements were considered separately, that is all Context statements were combined to create a collective understanding of Context, and so forth for Mechanisms and Outcomes. These collected components were then reviewed in light of existing literature, particularly through the structural levels of capacity building; individual, team, organizational and supra-organizational (57, 58). These elements were then combined via an iterative and intuitive process of retrodution and hypothesis building to form new CMO chains, using the "creative imagination" described by Bhaskar (59). Critical realism tenets of stratified reality, agency and structure were applied, along with external literature, as mechanisms were hypothesized, discussed between the authors and then explored for logic and coherence, leading to proposed mechanisms being refined, adopted or abandoned. These mechanisms were tested in two ways. Two external experienced health research educators checked the proposed mechanisms for coherence (60) and the consistency of proposed mechanisms with their knowledge and experience of rural research capacity building. Feedback was used to refine the mechanisms and the way they were expressed in CMO chains. Mechanisms were then compared to those highlighted by Cooke et al. (61), in their realist synthesis, a work that applies realist principles to the area of research capacity building but importantly does not consider the rural context. Bracketing and reflexive conversations with the second and third authors (EW and DL) added further rigor to the process (62–64).

Central to this process was the knowledge inherent in being an embedded insider with a deep understanding of the rural health context, the NSW public health system and the process of research capacity building. This insider perspective provided a credible foundation from which creative imagination could be employed. This process was repeated multiple times until a suite of proposed mechanisms were compiled. These CMO chains were then tested and consolidated into practical understandings of what works where and for whom, which could then be transferred into practical recommendations for health system, health service and education purposes.

## 3 Results

Context and outcomes for rural research training within rural NSW were explored at the individual, team and organizational structural levels at which research capacity building occurs (57, 58). While the supra-organizational context is acknowledged, none of the included papers focused on this structural level and it was therefore not a focus in this analysis.

### 3.1 Individual contexts and outcomes

Rural clinicians, with the challenges of rural health service delivery, see not only problems but also opportunities for research investigation (52). Rural individuals experience limited operational planning for research, which can act as an inhibitory structure for research (53). Rural clinicians want rural research to be immediately useful (55).

The individual rural clinician context and the way the individual interacts with that context is constantly evolving. Developing research experience and capability contributes to increased confidence in rural individuals (55), which can translate to changes in their individual agency, or ability to take action within their context. Distributed research training in the workplace can keep experienced health professionals in their roles whilst building research experience (55). It should be noted that not everyone who learns about research wants to continue to apply research skills in their work role (55).

Obtaining organizational support for research training and ongoing research activity where individuals can use their new skills is challenging (55). Without organizational support, a disconnect between workplace and individual can arise where research is seen as an individual pursuit unrelated to organizational goals (54).

The context for individual learning includes a low base of research activity and limited research expertise in rural areas (53). Research training generally needs to be introductory in nature, matched to the learner's needs (65), and supported by expertise from experienced researchers where available (54). Many clinicians in rural NSW have existing research-relevant skills, so training may build on existing project management or quality improvement skills (52) and may require a multilevel training strategy (58).

Training programs have shown increased individual research experience (28, 33) and a range of research-specific and transferable skills such as project management experience, enhanced critical thinking, improved communication and improved confidence (55).

Close-to-practice research, such as that completed in experiential rural research programs (33, 55), is a key enabler of capacity building (29, 57, 58). This research activity, along with changes in individual research capability, skill and experience amount to real-world research capacity building (66) and continue to demonstrate that individual training can have capacity building outcomes (29).

### 3.2 Team contexts and outcomes

The papers synthesized focused on the organizational (53, 54) or individual level (33, 52, 55) and provide fewer insights

into the team context. A supportive work team is an important facilitator of research (67), and the attitudes of work colleagues can be a powerful structure that influences rural clinicians undertaking workplace-based research. Research-emergent and novice clinician-researchers can make their own research networks to provide team level support that their workplace team may not (55).

Building a more capable, confident and skilled worker as a result of research experience and research training has team benefits including improved evaluation rigor, raised profile of research within a team, creating research activity and retaining a skilled workforce (55). Building team research capacity may be cumulative, with the collective individual capability outcomes contributing to team level capacity.

### 3.3 The organizational level

Research conducted within rural health organizations in NSW is often not conducted for or by these organizations (53), perpetuating the perception that research is not something that rural health organizations can do: a “too rural and too poor” view (54). The perception of limited capacity is both an outcome of the limited health research expertise within rural health organizations (12) and the difficulty accessing research funding (68), and is also a mechanism of limited research activity. This co-occurring role of both cause and outcome reflect a stratified reality: organizations that see themselves as incapable of undertaking their own research may engage with outside organizations in a passive way, thus limiting opportunities for research capacity building within the organization.

External partnerships are a potential solution to limited access to research expertise in rural areas (12, 54). These collaborative approaches across sectors, either formally or informally, can help provide access to research knowledge and support that is vital for research capacity development.

The organizational context for those wanting to learn about research includes the ability to access practical support, such as operational planning or positional responsibility for research (53), valuing and promoting research endeavors (54) and organizational commitment (55). Practical support may include creative solutions such as incorporating research activity into routine work to offset a lack of funding (52).

The value placed on research in rural health organizations may vary between strategic and operational levels (53) and a mismatch between organizational language and actions concerning the value of research activities (55) can create an inhibitory influence on rural health staff. A perception that research is a low-value individual activity inhibits the uptake of research opportunities and learning in research (54). Demonstrating that research is valued is a key facet of research capacity building (57, 58, 61).

An organizational perception that research is an individual, rather than an organizational, activity can lead to research activity being driven largely by the agency of individuals (53, 54). This reliance on individual agency is associated with a limited number of nursing and allied health research projects (53).

Maintaining research activity outside of the supportive structure of training programs also relies upon the individual

agency of the worker (55), although there is a limit to how much individual agency can overcome structural limitations. A mismatch between research capability and research capacity can lead to discontent (55).

Organizational outcomes resulting from research training include increased local research activity, dissemination of research findings, demonstrable leadership and the establishment of partnerships (29, 33, 49, 54, 55).

Research training can be viewed as an organizational investment rather than a cost burden (52), if the organization acknowledges that retaining experienced staff whilst improving policy and practice (55) is a real return on that investment. Research-trained clinicians demonstrate capability as an outcome of a capacity building endeavor, whilst being an enabling mechanism of research activity by assuming the roles of researcher, resource person or mentor.

### 3.4 Synthesis and new generative mechanisms

This new understanding of outcomes in context reveals generative mechanisms that underlie research capacity building for the rural health workforce. A suite of proposed mechanisms were derived and are expressed as CMO chains in Table 2.

Perceptions and beliefs can exert influence (69), and in a critical realist sense are therefore real. In rural health services a real underlying perception that the organizations are “too rural and too poor” to undertake research can lead to empirical limited research activity (54). Beliefs can, at an organizational level, stifle new approaches (70) and exert a real influence on rural health research. Beliefs and knowledge can intersect as explanations of the social world (71), and while there is evidence rural organizations are empirically disadvantaged in research grant funding (68), it is the real perception that rural health organizations are inherently incapable of undertaking research that is a key driver of low levels of research activity.

While research capability is an important part of research capacity within rural health services, limited operational planning for research, low organizational prioritization of research, and a perceived low organizational valuing of research directly are factors that impact on engagement with research. In rural NSW, Australia, a clear gap in organizational planning for research (53) has led to a reliance on individuals, and individual agency, to drive research activity. This resulted in research being seen as an individual activity disconnected from organizational research priorities and thus of low organizational value. The alignment between individual and organizational priorities for research is critical, given that a lack of organizational support leads to limited research activity (55) and is a cause of withdrawal from research training programs (34).

Limited research expertise in rural health organizations (54) is a mechanism leading to a need for collaborative approaches to provide both introductory research education and expert support for research. Collaborative approaches are essential for providing access to expertise, particularly when the rural context is considered (17, 23, 31).

Rural partnership arrangements are often relationship-based (33) and are contingent upon goodwill, flexibility and mutual

**TABLE 2** Generative mechanisms of research capacity building in rural health workplaces expressed as context, mechanism outcome (CMO) chains (103).

| Context                                                                                                                                                                         | Mechanism                                                                                                                                                   | Outcome                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| In rural health services                                                                                                                                                        | A perception that the organizations are “too rural and too poor” <sup>†</sup> to undertake research                                                         | Limited research activity                                                                                                                                      |
| Where individual and organizational rural research capability exists                                                                                                            | Limited operational planning for, organizational prioritization of, and valuing of research                                                                 | Limited engagement with research and a reliance on individual agency as a primary driver for internal research activity                                        |
| Viewing research as an individual activity                                                                                                                                      | A disconnect between individual and organizational research priorities                                                                                      | Research seen as being of low organizational value                                                                                                             |
| Rural health workers with an interest in research are seeking to build on their existing skills, and seek an introductory level of education and support by experts in research | Limited access to research expertise in rural health services                                                                                               | A need for collaborative approaches where health services and training organizations, research units and universities create mutually beneficial relationships |
| Where there is little funding to create formal partnership arrangements                                                                                                         | Informal collaborations based on existing relationships                                                                                                     | Collaborations that are contingent upon goodwill, flexibility and mutual goals                                                                                 |
| When research capacity building activities occur in rural health services                                                                                                       | The experiential nature of research capacity building programs used in rural Australia                                                                      | Builds individual skill, increases research activity, and produces research that changes practice                                                              |
| Where research capacity building programs are designed to upskill individuals                                                                                                   | Training delivered at an individual level                                                                                                                   | Produces changes primarily at the individual level and primarily in capability, with fewer team and organizational benefits                                    |
| When undertaking research capacity building with rurally-based health workers                                                                                                   | Structural solutions such as the design of program, creative ways to enable protected research time, and strategic engagement with the hosting organization | Can overcome some of the inherent limitations which include a small, dispersed workforce, lack of organizational support and limited funding                   |
| Where introductory research training has been undertaken                                                                                                                        | Limited opportunities and structural inhibitors                                                                                                             | Reinforce that individual skill development is important, but not sufficient for ongoing independent research                                                  |

<sup>†</sup>Schmidt et al. (54).

goals. Mutual goal-setting is an important part of collaborative approaches to research partnerships (72) and in rural areas these relationships can be effective where the goals of the workplace and the learning institution align (54).

When training in research occurs in rural areas the experiential nature of training programs used in rural NSW builds individual skill, increases research activity, and produces research that changes practice (33, 55). Experiential learning aligns closely with adult learning principles (73, 74).

Training programs delivered at an individual level lead primarily to individual outcomes, with fewer team and organizational benefits. It must be noted that the tools used to empirically assess outcomes, such as the research spider (75) which is commonly used in assessing research experience (28, 76), are aimed at the individual level so could fail to identify co-occurring team and organizational outcomes. Team research capability and culture are less well developed in rural areas than individual or organizational capability (77) and thus an avenue for future research capacity building in rural areas should focus on team approaches as have been trialed elsewhere (19, 78–81).

Some of the inherent limitations of rural research education, such as a small, dispersed workforce, lack of organizational support and limited funding, can be accommodated by structural solutions such as the design of distributed training programs (33), creative ways to enable protected research time (17, 52) and strategic engagement with the hosting organization (17, 33).

While receiving training in research equips health workers for ongoing research activity (28, 29, 55) limited opportunities to use these skills and structural inhibitors such as a lack of time and resources reinforce that individual skill development is important, but not sufficient for ongoing independent research. This demonstrates the difference between research capability and research capacity; trained clinician-researchers *could* undertake independent research, but this does not mean that they *can* undertake independent research.

### 3.5 Testing research capacity building theory

The proposed mechanisms, after testing for coherence (60), were compared to the mechanisms of research capacity development proposed by Cooke et al. (61) in their realist synthesis (see Table 3). The mechanisms described by Cooke et al. represent a “best evidence available” model, one that is unencumbered by the constraints of the rural environment. This allows a comparison of “what is” in the rural environment of NSW, to “what could be” in Cooke et al.’s model. Demonstrating concordance between the two models confirms that these proposed mechanisms derived in this synthesis display coherence, whilst allowing an exploration of the rural and non-rural differences of the two models.

Notably, the mechanisms proposed in this synthesis contrast with those of Cooke et al. (61) in role modeling, signaling

**TABLE 3** Emerging mechanisms from this synthesis contrasted with mechanisms of research capacity development proposed by Cooke et al. (61, 103).

| Research capacity building mechanisms                                                                                                                                           |                       | Mechanisms of research capacity development <sup>†</sup>      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------|
| A perception that the organizations are “too rural and too poor” to undertake research<br>A limited amount of research expertise in rural areas                                 | <i>Contrasts with</i> | Modeling positive behaviors                                   |
| Limited operational planning for, organizational prioritization of, and valuing of research                                                                                     | <i>Contrasts with</i> | Signaling importance                                          |
| A disconnect between individual and organizational research priorities<br>Limited opportunities and structural inhibitors                                                       | <i>Contrasts with</i> | Exceeding the sum of the parts                                |
| Informal collaborations based on existing relationships                                                                                                                         | <i>Aligns with</i>    | Exceeding the sum of the parts<br>Coproducting knowledge      |
| The experiential nature of training programs used in rural Australia that build individual capability, increases research activity, and produces research that changes practice | <i>Aligns with</i>    | Learning by doing<br>Feeling that you are making a difference |
| Structural solutions such as the design of program, creative ways to enable protected research time, and strategic engagement with the hosting organization                     | <i>Aligns with</i>    | Releasing resources<br>Liberating the talents                 |

<sup>†</sup>Cooke et al. (61).

importance (where individuals see that engaging in research is a valued part of the organization’s business) and exceeding the sum of the parts. In the rural context, a shortage of rural researchers and organizational commitment lead to limited role modeling and limited visibility of research (53, 54). This contrast highlights that rural and metropolitan approaches to research capacity building differ due to important structural influences, such as geographical spread of the workforce, availability of research experts and ability to access to research funding. While the increasing the number of rural researchers is a long-term solution, rural health organizations can influence other elements such as increasing the visibility of research and signaling its importance within rural health organizations.

The final aim of this synthesis was to use these mechanisms to develop general principles to guide the development of rural research capacity building programs. These are found in Table 4. These principles extend the mechanisms into useful actions that can be applied in rural health contexts.

## 4 Discussion

Embedding academic researchers into rural health services provides a number of solutions to problems within rural organizations (82). Given the challenges associated with attracting and retaining rural academics (83), the idea of creating research-capable rural health workers that function as clinician-researchers is appealing. The “train them where you need them” philosophy has been shown to be instrumental for building and retaining rural workforce in health services such as medicine, nursing and allied health (84–87). Applying this principle to research, developing research experience and research capacity within rural health services will lead to rural-relevant research that leads to improved healthcare for rural communities.

There is no single model of research capacity building that can be applied across rural environments. While distributed programs built on a capacity building framework (28, 29, 55) are seen within the NSW context, programs built on other foundations also aim to build elements of research capability such as experience and research skill, or increase both research capability and research capacity in individuals (65, 76, 88–90). Educational philosophy is a component of research capacity building literature which did not emerge as a causative mechanism within this synthesis. Ensuring that educational foundations are described in future studies would allow exploration of alternate foundations and the outcomes of these educational approaches.

Educational and capacity building approaches are most effective when they incorporate experiential learning (61). Experiential elements extend the learning experience from building capability to building capacity, simply by the act of doing. From a learning point of view, “doing” or applying knowledge demonstrates a greater level of expertise than “learning about” (91).

Those building health research capacity must account for the unique characteristics and context of the rural environment; the organization’s goals, the individual’s position within the organization and the willingness of the organization to tangibly support the individual through funding or protected time for research. Models may need to be designed with a structure that assists learners in overcoming rural or remote challenges, including programs designed to reduce isolation for learners (33), as reduced isolation is associated with completion of researcher training in rural areas (34).

As there is limited research expertise within rural health services, capacity building approaches must include partnering for expertise. Partnering may be internal within the organization or with an external partner such as a university (92), but must be mutually beneficial and without the rural health organization ceding control of the direction of the research (54). Maximizing the value in existing relationships using a collaborative approach is a logical means of extending support. Rural universities have a role in researcher development through higher degree programs, and have undertaken a range of collaboration approaches with health services (92). The articulation between university-based and workplace-based training approaches is an area for further exploration.

Alongside this experiential component there is a need for targeted education. Given the limited critical mass of research expertise in rural areas this education is likely to be introductory

**TABLE 4** Key elements and strategies to optimize rural research capacity building (103).

| Key element       | Strategy                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| For individuals   | Systems should be implemented to identify research-interested individuals whose research interests match the health organization's research plan. Offering short training courses on research related topics like systematic reviews or evidence-based practice can be a way of identifying these individuals.                                                                                                               |
|                   | Assessment of learning needs, the characteristics of the team in which they operate and levels of organizational support should be undertaken. This ensures training matches the learning needs of the individual, delivers education appropriate to the learner's context and ensures the organization is capable of, and willing to, create an environment conducive to the development of research capacity and activity. |
| For teams         | Rural research training should integrate skills for teamwork and relationship building into learning experiences. This will emphasize the importance of researching in teams and the value of collaborative relationships.                                                                                                                                                                                                   |
|                   | Specific research training for teams that is developed, trialed, and evaluated is a strategy that can be implemented.                                                                                                                                                                                                                                                                                                        |
| For organizations | Rural health organizations should have a clearly defined and communicated research plan that explicitly includes investment in research capacity building and that will allow researchers and training organizations to align their activities and goals for mutual benefit.                                                                                                                                                 |
|                   | Dedicated roles and resources via a research office that ensures ongoing coordination and commitment by senior leaders within the health organization to ensure capacity building is progressing in line with organizational planning.                                                                                                                                                                                       |
|                   | Formal partnership arrangements between the organization in which the trainee works and any external partnering body should be implemented to develop structures to support the development of research capacity.                                                                                                                                                                                                            |
| For educators     | Training in research methods should be underpinned by capacity building principles, as the short and long-term outcomes for programs built on this platform are evidenced within the literature. If another specific educational theory is applied, this should be explicitly named to allow future study of the outcomes from alternative educational theories.                                                             |
|                   | Peer support, mentoring and supervision aspects are critical. The risk of social isolation for rural researchers can be mitigated by developing opportunities for connection between research capable people within and beyond any research capacity building program. These connection processes can be extended to link those with a research interest to those with research capability.                                  |
|                   | Given the importance of informal relationships, continuity and consistency in training delivery is needed. The design of research education can provide continuity by avoiding short-term funded projects and favoring long-term partnership-based approaches.                                                                                                                                                               |

research methods. However, “liberating the talents” (61) may mean that research education builds on existing skills rather than assuming all rural staff are commencing as novices. An assessment

of learning needs should enable educational opportunities at the required level, rather than a generic approach.

Being an informed consumer of research that knows how to understand and apply research as part of evidence-based practice does not mean that all rural clinicians need to be capable of undertaking a research project. Selecting individuals for research capacity building opportunities should balance the passion of the individual and the needs of their organization. A committed and enthusiastic individual may become a valuable independent researcher given the right support.

Delivering training at the individual level will produce primarily individual level outcomes. Despite limited evidence of team approaches to research capacity building, a team approach does present as a structural solution to the risk of isolation for rural health workers undertaking research. Training in teams also maximizes the use of existing expertise with a rural team, again “liberating the talents” (61).

In addition to formal learning, research capacity can be enhanced through peer learning, with those who have research experience taking a role in building research activity and capacity with those around them (55). Learning about research by interacting with others who are undertaking research can be a form of cultural constructivism (33, 93), where a sense of belonging in the world of research is constructed through interaction and immersion, as well as activity and education. Connecting research capable and research interested individuals is a means of providing a supportive environment.

Extending capability into research capacity is more than an educational endeavor (94). As a health system the focus has often been on developing the motivated individual without the accompanying supportive environment (94). Structural supports (54) and meaningful opportunity to conduct research post-training (55) are essential to addresses the limited opportunities and structural inhibitors that prevent the transformation of research capability into research capacity. An organization committing to developing a rural health worker into a clinician-researcher should make a similar organizational commitment to creating conditions in which a clinician-researcher can function as both clinician and researcher. This combination of “smart and motivated people positioned in supportive environments that allow(ed) them to ask hard questions and pursue hard problems” is the key to success for clinician-researchers (95).

Delivery of research capacity building programs or approaches by those internal to the health system may influence the development of these supportive environments in a way that external education providers cannot. While informal relationships are a cornerstone of rural collaboration, training providers from outside the health system may need to partner with rural health organizations in formal agreements in addition to reciprocity and mutual respect (54). Continuity is important to building relationships, and consistent long-term offering of a research capacity building program (55) adds to this continuity.

Extending this concept of organizational commitment, there needs to be an operational responsibility for research (53). Aligning individual research effort to organizational direction is needed (54). The provision of a clear research direction for

the rural health organization, one that is signaled as important (61), will allow clinicians to align their own research agenda to that of their organization. Specific research directions within an organization can allow external education partners to align teaching goals and processes to this direction. This allows effective partnering without the health organization ceding control of the direction of research activity and education (54).

Urban-centered research conducted in rural areas does little to enhance research capacity in the rural workforce, and ensuring urban-developed research has a rural individual as part of the project team is a practical capacity building step. This brings rural staff into contact with experienced researchers, thus maximizing the rural benefit of this research activity (53). Other models such as embedded researchers may also provide a more engaged organization (22, 26, 82). Similarly, a more egalitarian funding model that emphasizes partnerships may provide greater capacity building potential (18).

Lastly, organizations can address the “too rural and too poor” perception by adjusting the way in which they perceive and value research. Structures such as the hierarchy of evidence (96) and the way in which small-scale clinician-led research has been gradually subsumed by larger research driven by networks (97, 98) may lead rural organizations to view smaller, clinician-led projects to be of little or no value. Supporting, acknowledging, valuing and celebrating these smaller projects, “signaling importance” (61), can add to real-world research capacity. This small-scale research capacity can become a foundational building block for larger future research activity or for collaboration with a larger research organization.

In NSW the combination of individual LHDs with a centralized “system manager” (51) presents an opportunity for an educational body within the central system to interact with and influence the individual rural organizations. Australian states with a greater or lesser degree of centralization will have different challenges. Internationally the difference in health funding models and health system structures should also be acknowledged.

This synthesis has considered factors at three of the four structural levels of capacity building; individual, team and organizational (57, 58). Additional research considering the supra-organizational level, that is system-wide and policy factors, again from a critical realist perspective, would add another layer of depth in addition to the levels explored in this synthesis. This would be possible only in a program or programs that have been running for a sufficient length of time for outcomes of this type to be realistically achieved. Other future research directions include expanding team-level rural research capacity building approaches started in Queensland (19) and a nuanced economic evaluation of a capacity building program for rural areas which explores the longer-term value of investment in research capacity building from a business perspective. Research training, along with valuing and supporting research at multiple levels of an organization can lead toward a research-supportive culture (53). Research culture is often measured by self-report (45, 77, 99). An ethnographic study exploring the impact on research culture within a team as a result of training individuals in research would provide valuable insights and could be incorporated into a critical realist perspective (100).

## 4.1 Strengths and limitations of this synthesis

This synthesis draws from five papers containing small sample sizes, which may be considered a limitation. The size of these studies are consistent with similar studies in this field, and the studies themselves have samples representative of their trainees drawn from organizations typical of large rural health services within NSW. The focus on the NSW, and similar, contexts may limit generalizability however the nature of realist approaches is to explore what works for who in what circumstance (101). A broader approach which includes a wide range of contexts would in turn limit the ability to derive new understandings using realist approaches.

Drawing data from a single body of work may be seen as a potential limitation. The primary author’s position is as an insider who works in rural health research. This can be both a strength and limitation, with this insider perspective and inherent knowledge allowed for nuanced exploration and the expertise to apply retroductive processes and develop explanatory mechanisms of “why things are as they are” using critical realism (102). Offsetting these strengths is the limitation inherent with the personal biases brought by the researcher. Reflexive practices and consistent application of bracketing were used to enhance the rigor of this synthesis.

The diversity of source and approach enabled by different organizations, research types and data collection methods is a strength of this synthesis. Combining these as a single body of work in this synthesis is made possible by the use of critical realism, which embraces diversity in research methods.

## 5 Conclusion

This synthesis of studies focused on rural research capacity building has revealed a range of mechanisms including prevailing attitudes toward research, limited organizational valuing of research and a disconnect between individual and organizational research priorities, along with limited access to research expertise in rural health services. These inhibitory mechanisms are countered using existing relationships to build informal collaborations within teams and organizations to maximize the use of current expertise.

Distributed research education is important but not sufficient alone to develop rural clinicians into clinician-researchers. Structural supports are needed within rural health organizations, including organizational commitment to create environments in which rural health workers can learn about research, develop research experience and opportunities to undertake research. It is this combination of research training and supportive environments that will lead to optimized rural research capacity.

Capacity building endeavors should carefully consider the learner context and commit to long-term relationship-based approaches to rural research training programs. Further structural solutions such as the design of distributed education programs, creative ways to enable protected research time, and strategic engagement with the hosting organization are important aspects of research capacity building.

Individual level interventions have driven individual level outcomes. These are important but may miss opportunities to

maximize the potential to move from individual capability to individual and organizational research capacity in rural health organizations. Considering and addressing structural supports will not only inform the next stage of organizational investment but will maximize the benefits of distributed training for rural research capacity building.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

DS: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing. EW: Formal Analysis, Investigation, Methodology, Supervision, Validation, Writing – review & editing. DL: Investigation, Methodology, Supervision, Validation, Writing – review & editing.

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# Twenty-five years of Alabama's Rural Health Leaders Pipeline: what difference has it made?

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**Introduction:** This community case report describes the Alabama Rural Health Leaders Pipeline operated as a demonstration research project, 1993–2017, tests of its effectiveness, and supportive studies. The purpose was to demonstrate production of physicians for Alabama's diverse rural population. The community-centric conceptual model was operationalized as two precollege summer pipeline programs and a master's in rural community health/rural medicine track that engaged 1,045 rural Alabama students over 25 years: 651 Rural Health Scholars after 11th grade, 174 Rural Minority Health Scholars after the 12th, and 220 Rural Medical Scholars in the combined MS/MD track. Rural students, rural community-based instruction, family medicine instructors, and community engagement were key components.

**Method:** Review of Rural Health Leaders Pipeline publications. Four papers evaluated medical student academic performance, specialty choice, geographic location of practice, and production of other health professionals. Sixteen explored (a) factors associated with limited physician distribution in the Black Belt and (b) circumstances that engaged institutional and community collaborators in program development.

**Findings:** Compared to peers in traditional medical education, rural medical track alumni more frequently chose family medicine specialty ( $p < 0.001$ , OR = 15.6) and rural Alabama practice ( $p < 0.001$ , OR = 6.4) with no difference in academic performance ( $p > 0.05$ ). Few rural medical track alumni established practice in the Black Belt, with many hypothetical factors identified. RHLP also produced other health professionals. Contextual studies engaged local physicians, institutional colleagues, school systems, the agricultural community, and health care entities in planning, collaboration, and advocacy regarding rural adaptations of admissions, curriculum, pedagogy, and educational context.

**Discussion:** The demonstration proved successful across much of rural Alabama, gained continuing state funding, and was institutionalized and expanded in the University of Alabama System. Further expansion is required to meet rural needs. Limited impact in the Black Belt remains a challenge for rural medical education and provides opportunities for future research.

## KEYWORDS

rural physicians, medical education, pipeline, educational model, minority populations, cultural dissonance, evaluation research

## Introduction

Worldwide, medical education that assures personal physicians for rural populations progresses slowly. The Rural Health Leaders Pipeline (RHLP), a rural medical education (RME) initiative in Alabama, was a demonstration research project from 1993–2017 in response to different philosophies propelling medical education. The traditional model linking universities, hospitals, urban populations, and laboratory research stimulated an oversupply of urban specialists and too few primary care physicians. Popular demand for personal medical care brought forth in the 1960s the specialty of Family Medicine and federal support for care of poor and elderly populations (1, 2). However, traditional medical schools in poor states, such as Alabama, were concerned that the costs of medical education differentiated to produce family physicians would divert funds from existing operations. The question arose—could a medical school simultaneously advance scientific discovery and service population healthcare needs.

In 1972, the University of Alabama (UA) attracted Bill Willard, who had led the American Medical Association's efforts creating the specialty of Family Medicine (2), to build the College of Community Health Sciences (CCHS) in Tuscaloosa to produce family physicians for Alabama (3), a rural state. Tuscaloosa is located at the nexus of rural Appalachian and Black Belt regions, both with chronic doctor shortages. The established medical school (SOM) in Birmingham, Alabama's largest city, had a growing reputation for research and specialty care (4). Limited state funding pushed the research and service philosophies into competition, which delayed the completion of Willard's plan. CCHS established an independent family practice residency, while its Doctor of Medicine (MD) program evolved as a regional extension of SOM (5).

The 1980s economic downturn compounded the shortage of rural physicians. Alabama declared a rural health crisis in 1989 and created an agency with appropriations to enhance production of rural family physicians (6). This mandate united SOM and CCHS to address RME. They recruited the author for this purpose in 1990 (5). Tensions between the two camps remained, but each accepted the demonstration research strategy to determine the utility of a long-term commitment to RME.

By 1990, RME programs in Minnesota (7), Pennsylvania (8), and Illinois (9) were reporting development of comprehensive programs linking rural students, family medicine instruction, and community clerkships. These programs were taken as benchmarks for planning Alabama's RME initiative.

A fundamental question was what modifications to the benchmark model would be necessary for success in Alabama. CCHS had the family practice residency and the SOM clinical branch campus with a rotation in rural family practice and community medicine, but few rural students were admitted to SOM. Rural students' premedical preparation and support during the preclinical years at Birmingham were foremost concerns when populations of Alabama and benchmark states were compared. Alabama had a lower education level, greater poverty, more rural, more diversity, poorer health ranking, and lower doctor to population ratio (10).

Alabama's history inscribes exploitation of natural and human resources (i.e., fertile soil, timber, minerals, slavery, sharecropping or tenant farming, mining, and institutional racism) (4, 11, 12). A diverse population (i.e., 66% White, 27% Black, and 5% Latinx)

distributes among 67 counties of which 55 are rural with persistent health care shortages. A region of 17 rural counties with dark soil, the Black Belt, produced the historical cotton economy and continues to maintain predominantly African American (AA) communities living with poverty and associated determinants of health, including below average educational offerings (12). The Black Belt represents one of America's geographical subpopulations with severe need of physicians (i.e., black, non-metropolitan and low income, South) (13). Table 1 contrasts population and physician supply among the Black Belt, the State of Alabama, and the US. The disparity in the Black Belt (i.e., one physician per 3,500 population vs. one per 1,300 nationally) forecasts efforts required to produce and maintain physicians in this region.

Before RHLP, Alabama's higher education officials discounted rural students' preparation and "fit" for medical school. That schools in the Black Belt were either all black public or all white private was another complicating factor (12). Rural communities, however, insisted on "growing our own" physicians who identified with the local population, prompting a vision of the Rural Health Leaders Pipeline (RHLP). Healthcare entities, farmer groups, and community leaders were motivated to help create a predictable supply of rural family physicians (14).

Rural students approached medical careers, typically, through hometown schools, in-state colleges, and Alabama's two public medical schools. Endorsing the communities' proposition of local students, RHLP was conceived to attract rural students to healthcare careers and nurture their ability and resolve to become rural family doctors and leaders in developing healthy communities in Alabama. Students were considered rural if from a rural county or a town of less than 2500 (15).

## Details—program design and research methods

### Purpose

This paper describes the RHLP, including its conceptual model, operationalization, evaluation, and associated research, and forecasts future developments.

TABLE 1 Alabama's Black Belt region by population, African American percentage, and PCP supply, 2020.

| Region                        | Population (73) | Black or AA % (73) | Avg. population per PCP <sup>a</sup> (74) |
|-------------------------------|-----------------|--------------------|-------------------------------------------|
| Black Belt (17 counties) (75) | 558,473         | 60                 | 3593                                      |
| Alabama (all 67 counties)     | 5,024,356       | 27                 | 1540                                      |
| United States                 | 329,500,000     | 12                 | 1330                                      |

PCP, primary care physician. Data were obtained from the University of Alabama Center for Economic Development (75), the US Census (73), and the University of Wisconsin Population Health Institute (74). Reprinted from Wheat et al. (26). Used by permission under CCBY-NC-ND 4.0.

<sup>a</sup>Montgomery County in the Black Belt was excluded in this column because it includes the capitol city and has a ratio of 1030 population per PCP.

## Reporting strategy

The report is a community case-report limited to and reflecting research associated with RHLP. The author selected peer-reviewed research articles indexed by PubMed, categorized them according to purpose, synthesized the findings, and discussed future steps. The UA Institutional Review Board approved the research reported in each article.

## Conceptual model

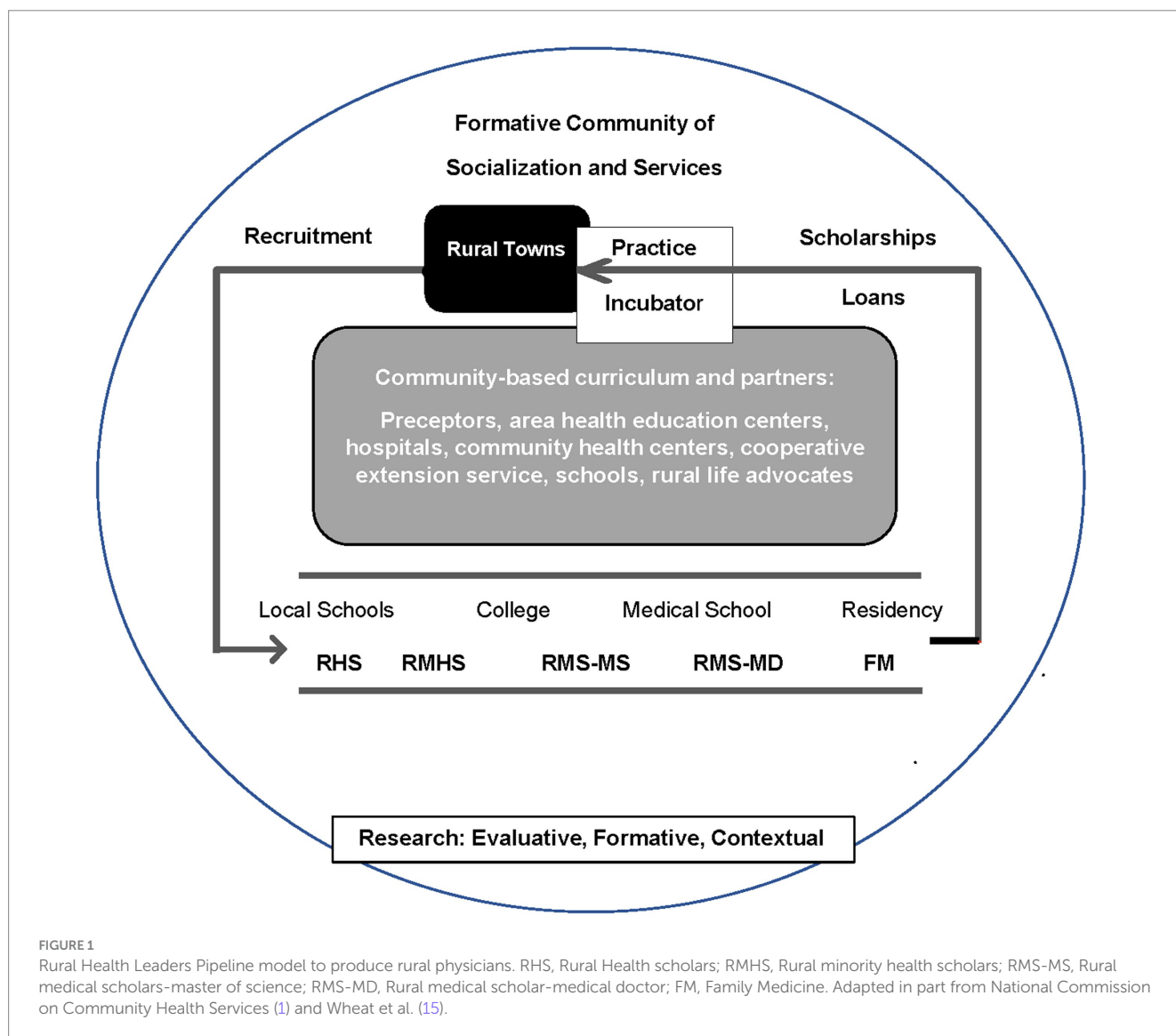
The RHLP model conceptualizes a way to produce physicians for rural Alabama and to guide its evaluation. We summarized previously literature that informed construction of the model (16) and consulted seminal work of Willard (2, 3, 17) and benchmark programs (8, 18) to draft the RME plan that was authenticated by rural physicians, hospital administrators, and community leaders (14). The resulting model, depicted in Figure 1, depended on rural students, their formative communities (19), family medicine instructors, and a longitudinal community-based curriculum (7–9) starting in high school. The

influence of a student's formative community is included throughout the model (15) including the local community in which they were socialized and the larger community with agencies and institutions on which their families depend for services (1). The recommendation to complete four years of medical school at the branch campus was not accomplished, maintaining instruction in the preclinical medical sciences at the main campus at the periphery of rural students' formative communities.

The model locates RME within students' formative community, which is hypothesized to be a decisive factor in the development of rural physicians. It provides an identity and significant others (e.g., family, peers, and community members) and agencies (e.g., school, health care, cooperative extension, and church) that encourage students, affirm their aspirations, and nurture their development. Students learn from local patients and instructors whose practices are informed by local needs.

## Operational model

The demonstrated RHLP included 3 educational program components. Two programs supplemented students' local education



with summer pipeline programs at UA. The other formed an RME track. Each program was initiated with input and collaboration with rural stakeholders. Program emphasis was supported or adjusted by information generated through these collaborations.

The Rural Health Scholars Program (RHS) (15), 1993–2017, enrolled 642 rural 11th grade students in a five-week on-campus summer program that was informed by UA's experience with college preparatory programs (20). We introduced students to college life, health careers, and rural healthcare advocates through chemistry and creative writing courses (6 semester hours), peer group activities, field trips, and seminars with rural college students, health professionals, and advocates.

The Rural Medical Scholars Program (RMS) (16), 1996–2017, engaged 230 rural students to promote progression toward rural family practice. In-state colleges were targeted for recruitment (21). The five-year RME track included a one-year master's program (RMS-MS) focused on rural community health supplemented with advanced biomedical science courses followed by medical school (RMS-MD) with preclinical sciences at SOM main campus and clinical medicine taught from the regional campus emphasizing rural community-based instruction. Program specifications addressed admissions, campus, curriculum, community engagement, and family physician instructors (15, 16).

The Rural Minority Health Scholars Program (RMHS) (22, 23), 2000–2017, involved 179 students in response to progress reviews showing that students from the Black Belt were well represented among RHS but their admission to the RMS program and medical school lagged. Ten RMHS per year were accepted from rural minority applicants after completing high school; many had been RHS. Conducted in parallel with the RHS, RMHS took courses in premedical sciences and seminars on social determinants of health. Table 2 summarizes participation in RHLHP programs.

Students could be admitted into RHLHP at any one of the component programs but had to apply separately for each one. Investigators recruited students directly at local schools (RHS and RMHS) or colleges (RMS) and indirectly through groups representing educators, health professionals, hospital administrators, farmers, and government officials. The admissions committee for RHLHP programs included members from rural Alabama, faculty, and program

personnel. Admission criteria included attendance of a rural school, recommendations by community leaders, and scholastic performance. SOM interviewed RMS applicants with at least eight years of rural Alabama residence, GPA  $\geq 3.2$  (out of 4), and Medical College Admission Test (MCAT) score  $\geq 24$  old or 495 new.

## RHLHP diversity climate

Program staff had rural backgrounds and represented Alabama's population subsets. The medical director served as a continuous role model throughout all component programs while maintaining a rural family practice in a nearby small town. Programs included experiences in or near students' home communities and interactions with individuals who supported their rural ambition. Family members participated in students' community assessments and program ceremonies.

## RHLHP research

Table 3 shows the distribution of 20 research articles among three categories: I. Evaluation (4), II. Formative (2), and III. Contextual (14) studies and characterized them by research questions and design.

### Evaluation studies (I) assessed RHLHP outcomes

The overall *a priori* evaluation question asked if RHLHP produced rural physicians at a rate exceeding SOM's existing program. We used educational epidemiology (24) with longitudinal designs to pursue 4 subordinate questions as students progressed through RHLHP. We addressed the first three questions with a non-randomized intervention study (i.e., quasi-experimental) with multiple controls. The intervention group was RMS that matriculated to SOM (RMS-MD). Contemporary classmates on the main campus (reference group) and non-RMS peers on branch campuses were control groups. Medical school academic performance and choice of family medicine training were intermediate outcomes; rural Alabama family practice was the policy-relevant outcome. Questions, as shown in Table 3, were addressed as soon as enough participants to produce statistically valid results reached the outcome under study.

#### Question I. A

After five classes of RMS (entering medical school 1997–2001) had graduated from medical school ( $n = 47$ ), academic performance was determined by adjusted standardized test scores after preclinical (United States Medical Licensing Examination [USMLE] Step 1) and clinical (USMLE Step 2) coursework and graduation rates. We compared RMS performance to that of their classmates with statistical models that adjusted for sex, MCAT score, and premedical GPA (15).

#### Question I. B

After nine RMS classes (1997–2005) had graduated, RMS's (high dose RME) selection of family medicine residency was compared with two control groups, non-RMS students at branch campuses (moderate dose) and main campus students (low dose). The logistic regression analysis adjusted for sex, race, MCAT score, and four-year graduation rate (16).

TABLE 2 RHLHP participants by program and race, 1993–2017.

|                                           | No. and % participants |                      |             |
|-------------------------------------------|------------------------|----------------------|-------------|
|                                           | African American       | Non-African American | Total       |
| RHLHP programs                            | N (%)                  | N (%)                | N (%)       |
| Post-11th grade program (RHS), 1993–2017  | 195 (30.0)             | 456 (70.0)           | 651 (100)   |
| Post-12th grade program (MRHS), 2000–2017 | 169 (97.1)             | 5 (2.9)              | 174 (100)   |
| MS/MD track (RMS), 1996–2017              | 16 (7.3)               | 204 (92.7)           | 220 (100)   |
| Total                                     | 380 (36.4)             | 665 (63.6)           | 1,045 (100) |

MRHS, Minority Rural Health Scholars; MS/MD, Master of Science/Doctor of Medicine; RHLHP, Rural Health Leaders Pipeline; RHS, Rural Health Scholars; RMS, Rural Medical Scholars. Adapted from Wheat et al. (26). Used by permission under CCBY-NC-ND 4.0.

TABLE 3 Rural Health Leaders Pipeline (RHLP) research, 1993–2017.

| Research question                                                                   | Research design      |
|-------------------------------------------------------------------------------------|----------------------|
| <b>I. Evaluation studies</b>                                                        |                      |
| A. Does RHLP medical students' academic performance equal peers'? <sup>a</sup> (15) | Quasi-experimental   |
| B. Does RHLP medical students' choice of Family Medicine equal peers'? (16)         | Quasi-experimental   |
| C. Does RHLP graduates' choice of rural practice equal peers'? (10)                 | Quasi-experimental   |
| D. Does RHLP participation produce non-physician health professionals? (25)         | Retrospective cohort |
| <b>II. Formative studies</b>                                                        |                      |
| A. What was the RHLP experience with Black Belt students? (26)                      | Descriptive cohort   |
| B. What are AA alumni and rural medical educator views of RHLP? (27)                | Focus groups         |
| <b>III. Contextual studies</b>                                                      |                      |
| A. Do counties' numbers of medical students correlate with life expectancy? (28)    | Prevalence study     |
| B. Does institutional commitment correlate with rural physicians? (33)              | Prevalence study     |
| C. Do students from small colleges differ from other matriculants? (21)             | Prevalence study     |
| D. What RMS characteristics correlate with choice of family practice? (36)          | Prevalence study     |
| E. What do rural medical educators advise for new rural medicine programs? (37)     | Focus group          |
| F. Can physicians and extension agents cooperate to teach Agromedicine? (40)        | Focus group          |
| G. What interest do practicing physicians have in agricultural medicine? (41)       | Prevalence study     |
| H. What are rural physicians' views of long-term community preceptorships? (42)     | Focus group          |
| I. What are farmers' views on medical education needed? (43)                        | Focus groups         |
| J. What are limited resource AA farmers' views of farming health and safety? (44)   | Interviews           |
| K. How does Industrial Hygiene relate to farmers' healthcare? (45)                  | Case report          |
| L. What are the 3-year results of a rural school-based child health program? (46)   | Cohort study         |
| M. What health conditions are prominent in a 10-year child health study? (47)       | Cohort study         |
| N. What sources of health information do rural households use? (48)                 | Prevalence study     |

AA, African American; RMS, Rural Medical Scholars.

<sup>a</sup>References are numbered as they appear in the reference section.

### Question I. C

When 54 RMS matriculating 1997–2002 had completed residency and entered practice, we addressed uptake of rural Alabama practice among RMS and control groups. Rural practice was defined by RUCA

ZIP Codes  $\geq 4$ . Logistic regression adjusted for sex, MCAT score, and four-year graduation rate. A geographic analysis mapped home and practice counties of RMS choosing rural practice in Alabama (10).

### Question I. D

This question addressed the RME pipeline programs' contribution to the non-physician healthcare workforce. RHLP data from 1993 to 2018, including 642 RHS, 179 RMHS, and 230 RMS participants and the outcomes of 216 health professionals and 70 family physicians, supported a retrospective cohort study. We studied Alabama's 67 counties to examine the relationship between county participation (i.e., number of student participants) in pipeline programs and number of family physicians gained and other health professionals (e.g., nurses, dentists, pharmacists, and technicians) produced. Linear regression models for each RHLP program assessed the relationship while controlling counties' rurality, poverty, race, and education level (25).

### Formative studies (II) sought information to improve the RHLP

As a consequence of the geographic distribution of RMS alumni practice sites, we sought to better understand recruitment and medical education experiences of RMS alumni from the Black Belt to inform future adaptations in RME for this region. For Question II. A, we searched the literature to describe the Black Belt and for RME programs addressing similar regions.

Association of American Medical Colleges (AAMC) data showed the distribution of rural AA medical students among all US allopathic medical schools, and we retrospectively tracked 16 AA students' participation and progress, 1996–2017, in the RMS program to note their completion rate of RMS-MS and RMS-MD (26).

Question II. B led to a focus group study of the RMS program with 10 AA alumni and 7 rural medical educators exploring opinions about adapting RME to regional populations like the Black Belt (27).

### Contextual studies (III) were integral to RHLP development

These studies supported the rationale for differentiated RME and engaged stakeholders from students' formative communities as partners in support and conduct of programs. These studies evolved organically during program implementation as opportunity generated from program and stakeholders' interests permitted.

Two studies addressed the rationale for differentiated rural medical education. III. A explored Alabama counties by path analysis (28) testing for an association between number of local medical students and the established relationship of local primary care physicians to population health (29). III. B used linear regression to test for a correlation between medical school commitment to rural medical education and the output of rural physicians (30) using published medical school data (31, 32) and a primary survey to create a 32-item Rural Commitment Index (RCI) (33).

We explored admission characteristics with two studies. III. C employed SOM archival data to examine characteristics and outcomes of matriculants who had attended small Alabama colleges (21). III. D surveyed 64 RMS alumni to explore factors (34, 35) correlated with choice of family practice residency training (36).

Four studies sought information to plan RMS education to address rural concerns that diverge from what is taught traditionally. In III. E, we convened a focus group with 15 members of the National Rural

Health Association's Rural Medical Educators Group to identify key elements to a successful rural medical education program (37). Another focus group (III. F) engaged medical faculty and agricultural extension agents to discuss ways to teach students about agriculture-related health concerns (38, 39) and plan farm field trips (40). We surveyed primary care physicians (III. G) to determine interest in teaching agricultural medicine (41). A qualitative study (III. H) of 19 rural family physicians discussed extending the two-month rural community clerkship to an eight-month longitudinal integrated rural curriculum (42).

We pursued three topics with six studies related to stakeholder interests. The farm community wanted to participate in the development of RME responsive to farm families. Farmers and cooperative extension agricultural agents invited us to explore farmers' expectations of RME (III. I) through focus group discussions (43). Limited resource AA farmers shared their concerns about agricultural health and safety (III. J) with interviews (44). Two farm workers presented the opportunity for a case-study of pesticide poisoning and its care including Industrial Hygiene (III. K) (45).

Child health was of interest to teachers, health care providers, and parents. We completed a school health program with annual surveys of health, health care, and insurance coverage in a K-12 county school system reporting 3-year (III. L) (46) and 10-year (III. M) (47) results.

The cooperative extension system collaborated with us to survey rural households for their sources of medical information (III. N) (48).

## Synthesis of findings

The RHLP aimed to produce rural physicians in all population groups, however, success was seen only in the white population. Adaptations were community-centric and longitudinal with local students, family medicine focus, and community-based curriculum. Individuals and agencies from rural communities collaborated to nurture students' rural affinity and ambitions from high school through medical school and to shape the curriculum. The RHLP demonstration included two precollege programs (RHS and RMHS) and the MS-MD rural medicine track (RMS) conducted from the branch campus, except the preclinical medical sciences.

## Evaluation studies (I)

Evaluation of the RMS-MD component confirmed RHLP's utility. RMS's academic performance in medical school (USMLE Step 1 and

2 tests and graduation rates) was not statistically different ( $p > 0.05$ ) from the remainder of the class ( $n = 787$ ) when adjusted for gender, MCAT score, and premedical GPA (15). Table 4 shows the RHLP's effects on choice of family practice training (16) and uptake of rural practice in Alabama (10).

Eighty-four RMS that matriculated to medical school, 1997–2005, exceeded 296 branch campus students who in turn exceeded 840 main campus students in selection of family practice residencies (44.0, 18.9, and 3.9%, respectively) by substantial and highly significant rates (RMS OR = 15.6,  $p < 0.001$ ), exhibiting an RME dose–response effect with RMS > branch campus > main campus (16).

Fifty-four RMS (1997–2002 matriculants) compared similarly to 182 branch campus and 649 main campus peers in uptake of rural practice in Alabama: 48.1% (OR 6.4,  $p < 0.001$ ), 23.8% (OR 2.5,  $p < 0.001$ ), and 11.2% (OR 1.0), respectively. Again, a dose–response effect was apparent with RME exposure (10). These results were comparable to the benchmark programs in Minnesota (49), Pennsylvania (50), and Illinois (51). A regional effect appeared among the geographical distribution of RMS family physicians in rural Alabama. Of three RMS physicians from the 17-county Black Belt region, one located in practice there. Of the other RMSs, 24 located among the remaining 38 rural counties, 24 in non-rural locations, and none in the Black Belt (10).

The retrospective cohort study (I. D) of 67 counties' participation in the RHLP showed a positive relationship between the number of county participants and both family physicians and non-physician health professionals produced. Linear regression models of the three RHLP programs showed the best model for counties' acquisition of family physicians from the RHLP ( $R^2=0.30$ ) included the number of RMS participants per county ( $b = 0.24$ ,  $p < 0.001$ ); for each four RMS participants a county gained, on average, one family physician. The best model for health professionals produced per county ( $R^2=0.31$ ) included the number of RHS per county ( $b = 0.20$ ,  $p < 0.001$ ), indicating that for each five RHS participants the county produced one health professional. From the RMHS models, a county gained one family physician for each 33 and one health professional for each 7 participants, neither of these results reached statistical significance ( $p > 0.05$ ) (25).

## Formative studies (II)

In response to regional variation in RHLP impact, these studies disclosed conditions of economics, education, demographics, and

TABLE 4 Family medicine choice and rural practice by Rural Medical Scholars and control groups.

| Campus group | Rural level | 1997–2005 <sup>a</sup>      |      |                 |        | 1997–2002                    |      |     |        |
|--------------|-------------|-----------------------------|------|-----------------|--------|------------------------------|------|-----|--------|
|              |             | Family medicine choice (16) |      |                 |        | Rural practice location (10) |      |     |        |
|              |             | N                           | FM%  | OR <sup>b</sup> | P      | N                            | RP%  | OR  | P      |
| Main         | Minimal     | 840                         | 3.9  | 1               | –      | 649                          | 11.2 | 1   | –      |
| Regional     | Moderate    | 296                         | 18.9 | 5.8             | 0.001  | 182                          | 23.8 | 2.5 | <0.001 |
| RMS          | High        | 84                          | 44.0 | 15.6            | <0.001 | 54                           | 48.1 | 6.4 | <0.001 |

FM, Family Medicine; OR, Odds ratio; RMS, Rural Medical Scholars; RP, Rural practice. Data adapted from Wheat et al. (10, 16).

<sup>a</sup>Dates show the time periods of matriculation to medical school.

<sup>b</sup>Odds ratios were adjusted for independent variables distributed differently among comparison groups.

public resources that distinguished the Black Belt. Table 1 shows Alabama's population is 27% AA, but 60% in the 17-county Black Belt. Most applicants to RHLF programs from this region were African American (AA). AAMC data showed that, nationwide, less than 0.01 percent of medical school matriculants were rural AA (52) (i.e., six matriculant per year from an estimated six million rural AA). We found no precedents in the literature of medical education designed to prepare southern rural AA to become physicians. For II. A, Table 2 shows that among participants in the RHLF, 30% of RHS and 97% of RMHS were AA, while 7.3% (16 of 220) of RMS were. All 16 AA RMS completed RMS-MS, 12 entered medical school (RMS-MD), and 10 completed medical degrees (26). However, consistent with AAMC data (52), the number of AA RMS (one every two years) was too small for statistical analysis.

The focus group with rural medical educators and minority RMS alumni (II. B) suggested critical factors in the development of physicians for the rural Black Belt region categorized according to an ecological model. Table 5 demonstrates the hypothetical categories of interpersonal relationships, nurturing local community, institutional climate, and supportive policies (27).

## Contextual studies (III)

These studies served important purposes with RHLF. Two studies supported the rationale for RME implementation. III. A showed that in Alabama the number of medical students from a county correlated positively with the number of primary care physicians ( $b = 0.37$ ,  $p < 0.001$ ) that, in turn, correlated positively with life expectancy ( $b = 0.29$ ,  $p = 0.005$ ) in a path analysis that controlled county rurality and poverty. County rurality correlated negatively with the number of medical students ( $b = -0.24$ ,  $p = 0.043$ ) (28). III. B showed that, nationally, an index of medical schools' commitment to RME correlated positively ( $r = 0.52$ ,  $p < 0.001$ ) with graduates in rural primary care in a regression model ( $R^2 = 0.48$ ) that included states' % rural population ( $r = 0.41$ ,  $p < 0.001$ ), National Institutes of Health (NIH) research support ( $r = -0.29$ ,  $p = 0.007$ ), and number of graduates ( $r = -0.22$ ,  $p = 0.06$ ) (33).

Two studies explored recruitment and admission of rural medical students. III. C suggested that SOM students from small in-state colleges were more diverse than their peers, had a greater struggle completing medical school, and more often practiced in Alabama (5.6% vs. 3.8%). These differences were resolved when adjusted for race, age, premedical science GPA, and MCAT, suggesting that these students contribute equally with their peers to rural practice (21). The survey of 64 RMS alumni (III. D), though too small to adjust for other factors, suggested bivariate correlations between family practice residency and both prematriculation attraction to family practice and commitment to rural and underserved communities (36).

Four studies provided insights for teaching rural medicine. The Rural Medical Educators focus group (III. E) suggested that successful rural medical education program development should include rural-oriented students, curriculums that require training in rural contexts with rural patients, dedicated rural preceptors, program financial security, and program evaluations (37). The focus group with RHLF faculty and agricultural extension agents (III. F) led to an experiential curriculum for agricultural medicine, including field trips to farms that introduced various roles (farmer, extension agent, and local

TABLE 5 Suggested critical factors for developing rural African American physicians for Alabama.

| Ecological level            | Suggested factors                                                                                                                                                                                                                                                                    |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interpersonal relationships | Peers, friends, and community members, especially racially similar, as role models/mentors<br>Counselors, advisors, program directors, and faculty that are trusted and culturally competent                                                                                         |
| Nurturing community         | Family, church, schools, and trusted community members, e.g., cooperative extension agents<br>Local health professionals and health care establishments                                                                                                                              |
| Institutional climate       | Supportive policies, e.g., financial support, flexibility in admission criteria and curriculum, and assigned advocates<br>Cultural competence among administrators, faculty, staff, and students                                                                                     |
| Policy support              | Recognize rural racial minorities as priority representatives of their underserved populations<br>Reconcile perspectives of institutions and rural minority communities<br>Support holistic approaches to professional education and practice tailored to rural minority communities |

Adapted from Wheat et al. (27). Used by permission under CC BY-NC-ND 4.0.

physician) and explored farmers' concerns and the circumstances in which they lived and worked (40). The survey of primary care physicians (III. G) indicated that potential RME preceptors were interested in agricultural medicine, an interest that correlated with family practice, rural background, and personal experience in agriculture (41). The qualitative study of 19 rural family physicians (III. H) yielded the opinion that a long-term rural clerkship (> 6 months) should include preference for rural students with interest in family medicine and that the roles of preceptor, students, medical school, and community be clarified (42).

Rural Alabama stakeholders catalyzed six studies drawing attention to their interests. In focus group sessions (III. I), farmers' greatest concern was for physicians who understood their farming culture and could make decisions that matched farmers' realities (43). From the LRAA farmer interviews (III. J), 6 themes characterized their concerns: limited capital and sources of information, distrust of public institutions and agencies, old unsafe machinery and equipment, a pragmatic resilient attitude, lack of safety training useful on their farms, and personal health conditions (44). The case-study of farm workers with pesticide poisoning (III. K) demonstrated the value of Industrial Hygiene in caring for agricultural workers and the safety of their workspaces (45).

In the rural child health program studies, we found that after 3 years (III. L) uninsurance rates and referrals for dental care decreased and referrals for primary care increased (46). After 10 years (III. M), prevalence of overweight/obesity increased from 17 to 23% with an associated increase in referrals for blood pressure elevation, and medical care utilization was more common among obese students (47).

The rural household survey (III. N) showed that personal physicians and pharmacists were preferred sources of health information. Households with personal computers and the internet used them occasionally to contact their physicians and find additional information (48).

## Discussion

In Alabama, 1993–2017, we found that a comprehensive RME model from the Northeast and Midwest adapted well to rural Alabama, except for the 17-county Black Belt. Adaptations to the model that centralized rural communities in RME development led us to preprofessional pipeline programs and a master's program in Rural Community Health.

These adaptations supported students' academic preparations and helped, we hypothesize, to consolidate their rural identity (53) prior to entering medical school in a rural track including admission of rural students, clinical years directed from a regional branch campus, Family Medicine instructors, and community-based rural instruction. Medical education in the community emphasizing family practice, in our opinion, affirmed RMS rural identity and aspirations as professional competence was being achieved (54). Continuous engagement with rural communities and advocates is critically important to affirm students' aspirations as rural denizens, provide exposures and experiences integrating social and professional ambitions, and, thereby, buttress students' resolve to complete training for rural service. SOM accepted this premise by institutionalizing the rural track and replicating the RMSP at an additional branch campus (55), thus addressing both the research and rural service missions. Judging the RHLP to be successful, the Alabama Legislature provided continuing state funding, and SOM institutionalized and expanded the RHLP through the University of Alabama System.

The diverse contextual studies that arose during the course of RHLP implementation were vital to adapting program experiences to the mutual interests of medical education and the communities. More than information, these studies consolidated community-program collaborations that addressed specific community interests and generated support for the programs including scholarships, advocacy, and local experiences. This process of community engagement would be expected to provide different results in different contexts leading to differentiation of RME to fit community needs.

The Black Belt benefited from preprofessional RHLP programs but, similar to Native Americans and indigenous populations worldwide (56), had few students enter medical school (57). We attribute much of the success of the RHLP to engagement with rural communities and stakeholders, an engagement that was more difficult to affect and maintain with Black Belt communities whose traditions developed differently from the larger society. RHLP efforts were rooted in majority thought from Willard (3), traditional medical education, and local physicians, administrators, and community members (14). As the limitations of this approach became apparent, we sought information from the literature and from explorations that privileged the voices of Black Belt alumni of the RHLP and citizens. The analysis of qualitative data (27) was sobering—interventions at all ecological levels of human behavior (i.e., interpersonal, institutional, community, and policy) may be necessary to affect and maintain a system of education and care in this socially marginalized region.

Work from the World Health Organization provides a model for building medical education to match findings suggested by the

exploratory studies among Black Belt alumni and farmers and informal inquiry with local ministers and elected officials. Boelen's unity for health concept (58) places the development of medical education among marginalized communities, guided by indigenous as well as professional thought in a multi-sector collaboration. Social accountability operationalized through engagement with the community to be served and additional partners is at the core of this model (59, 60). Adaptations in current policies and institutional traditions, as exemplified by Boelen et al. (61), will require consideration if modern medical education is to accommodate to healthcare needed in these communities and overcome counterproductive aspects of tradition (62). The utility of this approach is suggested through experience in Africa and well chronicled in North America at the Northern Ontario School of Medicine (62–64), where standards of modern medical education and indigenous concepts found common cause to produce doctors serving a large diverse region of Ontario (65).

## Study limitations

The RHLP model was incompletely operationalized yet included three basic components following precepts of comprehensive rural medical education, except preclinical medical sciences were not conducted in a nonurban context. RHLP evaluation design, a non-randomized intervention study with multiple control groups, had strong internal validity. However, generalizability was limited in that the studies represented one southern state. RHLP's replication of successful rural programs from other regions of the US modifies this limitation, as does RHLP's successful adoption by another regional campus in Alabama (55). Areas similar to Alabama and benchmark states may find the RHLP experience useful among majority populations.

## Conclusion and recommendations

In conclusion, RHLP applied principles of rural medical education within a framework of community engagement to produce physicians for rural Alabama at multiple times the rate of traditional medical education. This engagement was activated by inclusive program planning and collaborations in studies to inform programs' emphasis. Information generated helped adapt the RHLP for relevance to much of rural Alabama. However, modifications to accommodate regional distinctions are required for success among Alabama's Black Belt population.

This compilation of research provides evidence for addressing persistent primary care workforce needs in rural Alabama and perhaps other populations that find their circumstances to be similar. To address the continuing decline in rural physicians (66), the author recommends expansion of differentiated rural medical education programs shown to be successful among dominant rural populations (67), continuation of research to perfect models responsive to diverse rural communities, and formulation of policies to translate this knowledge into common use.

Since the RHLP was institutionalized in 2018 and continues development, we have turned attention to understanding and

employing local knowledge from the Black Belt to inform high quality and culturally consonant medical education and care that will be effective in this population (62, 68–72). The current era of intense rural needs and tight-fisted fiscal policy makes this mission interesting and challenging, one that will require the collaboration of multiple sectors, as exemplified by the unity for health model (58), to advance.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements.

## Author contributions

JW: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Building a rural medical workforce: the foundations of a place-based approach to program evaluation

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**Introduction:** To address the maldistribution of medical practitioners within Deakin University's rural training footprint, a place-based Rural Training Stream (RTS) was established (2022). Formal definition of the footprint has enabled priority admission of 30 local students annually. This paper describes graduate workforce outcomes for the footprint, providing a baseline for future evaluation of the RTS.

**Methods:** Graduates' (2011–2022) Principal Places of Practice (2023) were extracted from the Australian Health Practitioner Regulation Agency register and linked with demographic, admission and training data. Descriptive statistics, univariate analysis and multinomial logistic regression were employed to describe associations with practice in three defined rural Tiers (Tier 1: Deakin's rural footprint, Tier 2: other rural Victoria, Tier 3: other rural Australia), with metropolitan practice as the reference group.

**Results:** 120 (39.2%) graduates were working in Tier 1 and 93 (30.4%) in each of Tiers 2 and 3. Significant associations ( $p < 0.001$ ) with working in the footprint were: post-graduate years 1–3 (OR 7.2), rural longitudinal integrated clerkship and rural clinical school (RCS) pathway (OR 6.8); RCS pathway only (OR 4.1), general practice specialty (OR 4.7) and rural background (OR 3.0).

**Discussion:** The differential effect of rural training on graduates working in the rural footprint, compared with other parts of rural Victoria and Australia is noteworthy. Attrition of graduates from the footprint beyond post-graduate year three highlights the urgency of expanding rural specialty training pathways. These baseline data reinforce the place-based design of the RTS and provide a foundation for future evaluation of local workforce outcomes.

## KEYWORDS

rural medical education, rural footprint, place-based, program evaluation, longitudinal integrated clerkship, rural clinical school, rural workforce

## Introduction

In rural areas, access to healthcare is impacted by both geographic and specialty maldistribution of health professionals, including medical practitioners (1). Medical schools have a critical role to play in addressing these challenges through the adoption of comprehensive approaches to increase the number of graduates who will go on to practice in rural communities (2). Described elements of comprehensive approaches include selection of rural background students, extended periods of rural clinical training, rurally oriented curricula and integration with post-graduate rural training pathways (2).

Increasingly, place-based approaches have been identified as a critical component of addressing the medical workforce maldistribution (3). Place-based approaches consider the unique needs, conditions and opportunities of defined communities/regions and collaboratively engage local stakeholders to address complex socioeconomic issues within a defined geographic area (3, 4). Rural medical education lends itself to a place-based approach when there is a clear relationship between a medical school and a defined region, a collaborative approach to the recruitment and training of students, and an evaluation of outcomes that includes accountability to the region's workforce needs (5).

Deakin University's School of Medicine, established in 2008, includes funding from the Australian Government's Rural Health Multidisciplinary Training (RHMT) program to support its rural clinical schools (RCS) (6), with a key objective being to serve the workforce needs of Western Victoria. The primary workforce need for the region is an adequate supply of general practitioners (GPs) and rural generalists (RGs), the Australian equivalent of family medicine practitioners (7). GPs and RGs have a broad skillset and provide comprehensive primary care for individuals, families and communities (8). The School of Medicine's rural activity footprint, formally defined in 2020, comprises rural areas of the Western Victoria Primary Healthcare Network (PHN), west of the Greater Geelong local government area (9). The GP workforce is maldistributed within the PHN, with 62.3% working in areas classified as metropolitan or regional centers (Greater Geelong and Ballarat) (10). In 2023, only 5.3% (430) of the states 8,141 GPs were working in the rural footprint, with 64.2% (276/430) of these GPs over 45 years of age (10).

Deakin's Doctor of Medicine (MD) is a four-year graduate entry medical program. Until 2022, students meeting the national RHMT program definition of rural background were admitted to the course through an entry quota (between 25% and 30%), aided by the application of rurality bonuses during selection (11). All MD students spent the first two pre-clinical years at the Waurn Ponds (Geelong, classified metropolitan) campus, following which they completed two years of clinical training at one of five clinical schools; two metropolitan schools (Eastern Health and

Geelong), and three RCS [Ballarat, Warrnambool and the Rural Community Clinical School (RCCS)]. The RCCS uniquely offers a 12-month longitudinal integrated clerkship (LIC) based in rural GP, following which students relocate to another metropolitan or RCS to complete year four.

Noting deficiencies of early graduate outcomes in the Deakin program and a desire to address the critical regional workforce shortages, a Rural Training Stream (RTS), designed to incorporate comprehensive, place-based training strategies, was established in Deakin's MD course in 2022 (12). A key element of establishing the RTS was formally defining Deakin's rural training footprint, enabling the priority admission of 30 local students annually (9). These applicants (Tier 1) are selected ahead of applicants from other parts of rural Victoria (Tier 2) and rural Australia (Tier 3). Moreover, having a defined footprint enables more specific evaluation of work location outcomes, which previously was largely limited to being rural or metropolitan (13).

This paper aims to describe Deakin's graduate workforce outcomes for the rural footprint ("locally"), at the time of its RTS implementation, compared to the rest of rural Victoria and Australia, and reports on the demographic and training variables that are associated with graduates working locally. This provides baseline evidence of the regional workforce outcomes prior to the establishment of the RTS and key data for future comparison, as well as important feedback for the rural communities that have invested over an extended period in training Deakin's students.

## Materials and methods

Deakin graduates' (2011–2022) Principal Places of Practice (PPP) in 2023 were extracted from the Australian Health Practitioner Regulation Agency (AHPRA) register. PPPs were assigned to one of four geographical location groups, which align with the RTS selection Tiers. These are built upon Australia's national seven-level rurality classification, the Modified Monash (MM) model which defines locations as metropolitan areas (MM1), regional centers (MM2), large rural towns (MM3), medium rural towns (MM4), small rural towns (MM5), remote communities (MM6) and very remote communities (MM7) (14):

- (i) Tier 1: 965 localities within Deakin's rural training footprint (MM2–6)
- (ii) Tier 2: locations outside Deakin's footprint, in other parts of rural Victoria (MM2–6)
- (iii) Tier 3: locations outside of Victoria, in other parts of rural Australia (MM2–7) or
- (iv) Tier 4: metropolitan locations (MM1).

Administrative data were extracted from the School of Medicine's graduate database including gender, rural background (RB), bonded medical place (BMP), clinical school training pathway, and graduation year. These data were linked to graduates' PPPs by a data manager, de-identified, and provided to the research team for analysis. Post-graduate years (PGY) were assigned to four categories for analysis, reflecting different career stages after medical school: PGY 1–3, 4–6, 7–9, and 10–12. BMPs were considered to be any form of bonded return of service schemes

**Abbreviations:** AHPRA, Australian Health Practitioners Regulation Agency; BMP, bonded medical place; GP, general practice/general practitioner; LIC, longitudinal integrated clerkship; MM, modified Monash model; PGY, post-graduate year; PHN, Primary Healthcare Network; PPP, principal place of practice; RB, rural background; RCCS, Rural Community Clinical School; RCS, rural clinical school; RTS, Rural Training Stream; RG, rural generalist; VRGP, Victorian Rural Generalist Program.

in which graduates were enrolled. Graduates' registered specialties were assigned as no specialty, GP or non-GP specialty.

Four categories of clinical school training pathways were assigned:

- (i) metropolitan training only (Metro)
- (ii) 2 years of regional rural clinical school training (RCS)
- (iii) LIC and 1 year of regional rural clinical school training (LIC/RCS)
- (iv) LIC and 1 year of metropolitan clinical school training (LIC/metro).

All analyses were conducted using SPSS statistical software v30 (IBM, New York, NY, USA). Descriptive statistics, univariate analysis using Pearson's chi square, and multinomial logistic regression modeling were employed to describe graduate workforce outcomes and variables associated with working in each of the three rural location Tiers, with metropolitan practice as the reference group. The regression model included significant univariates ( $p < 0.05$ ), with an analysis conducted to determine odds ratios for graduates working in each of the three rural Tiers, with metropolitan work location as the reference group.

## Results

Registered Australian PPPs for 1,508 graduates were available, with 51 graduates from the 12 cohorts missing location data or outside Australia. 306 (20.3%) of graduates had a PPP in a rural location, with 155 (10.3%) in regional centers (MM2), 65 (4.3%) in large rural towns (MM3), 43 (2.9%) in medium rural towns (MM4), 33 (2.2%) in small rural towns (MM5), 6 (0.4%) in remote communities (MM6) and 4 (0.3%) in very remote communities (MM7).

Of the 306 graduates with rural PPPs in 2023, 120 (39.2%) were working in Deakin's rural footprint (Tier 1), and 93 (30.4%) working in each of Tiers 2 and 3 (Table 1). Within Deakin's rural footprint, graduates were clustered around the major RCS training locations situated in a regional center (MM2—Ballarat) and a large rural town (MM3—Warrnambool), aligned with the locations of early post-graduate training positions (Figure 1).

Table 1 displays the univariate associations between graduates' demographic and training variables and their practice location. In the univariate analysis, RB, BMP, clinical training pathway, PGY group and vocation had a significant association with work location ( $p < 0.05$ ). BMP did not retain statistical significance for any rural practice Tier in the regression model.

## Rural background

Table 2 summarizes regression model results of the associations between graduates' characteristics and work location. Graduates with a RB were working in all rural Tiers in higher proportions than metropolitan background graduates ( $p < 0.001$ ). The respective odds ratios were Tier 1: OR 3.02 (95% CI 2.00–4.57); Tier 2: OR 2.81 (95% CI 1.80–4.37); and Tier 3: OR 2.91 (95% CI 1.87–4.50).

## Training pathway

All LIC and/or RCS pathways saw a higher proportion of graduates working in Tier 1 compared with Tiers 2 and 3 (Table 1). LIC/RCS graduates had 6.80 times the odds of PPP in the footprint (95% CI 2.94–15.72,  $p < 0.001$ ) and RCS graduates had 4.08 times increased odds (95% CI 2.60–6.38,  $p < 0.001$ ), compared with metropolitan trained graduates (Table 2). In contrast, metro pathway graduates working in a rural area were least likely to be in a Tier 1 location.

Outside Tier 1, LIC/RCS students were the only group with significantly increased odds of working rurally in other parts of rural Victoria (Tier 2) compared with metropolitan trainees (OR 3.71, 95% CI 1.67–8.27,  $p = 0.001$ ). There were no other significant associations found in the regression analysis between any form of extended rural training and graduates working in other parts of rural Victoria or Australia, outside the rural training footprint (Tiers 2 or 3).

RCS graduates comprised the majority of graduates working in the rural footprint in every PGY group (Figure 2).

## Post-graduate year group

The overall proportion of graduates in rural practice fluctuated between PGY groups, highest at 24.7% in PGY 1–3 and lowest at 17.0% in PGY 4–6, however, the distribution of graduates between the Tiers changed significantly over time ( $p < 0.001$ ). In the PGY 1–3 group, 14.5% of graduates had a PPP in the rural footprint compared to 5.5% in PGY 4–6. This proportion remained similarly low at 5.0% for PGY 10–12 (Table 1). There was a concomitant increase in the proportion of graduates working in metropolitan areas (from 75.3% of graduates in metropolitan areas in PGY 1–3 to 83.0% in PGY 4–6), and in other areas of rural Australia (from 3.0% in PGY 1–3 to a maximum of 9.4% in PGY 7–9). The proportion of graduates working in other areas of rural Victoria fell from 7.2% in PGY 1–3 to a low of 5.4% at PGY 5–7.

Given the cross-sectional methodology, an analysis was conducted to identify any significant differences in PGY cohort characteristics that may be impacting on these findings. There was a significant difference found in the clinical school pathways undertaken ( $p = 0.014$ ), with a higher proportion of graduates in the PGY 10–12 cohort having undertaken the LIC/RCS pathway and fewer the LIC/metro pathway than in all subsequent PGY groups. There were no differences between the PGY groups in the presence of students with RB or BMPs.

## Vocation

There was a significant association between graduates with a specialty in GP working in the rural footprint (OR 4.65, 95% CI 2.26–9.56,  $p < 0.001$ ) or other rural Victoria (OR 3.76, 95% CI 1.88–7.55,  $p < 0.001$ ) compared with those with no registered specialty. This finding was not observed in other rural Australia (Table 2).

Graduates of the LIC/RCS pathway were most likely to be in GP, with 15/58 (25.9%) registered as GPs, compared with 133/857 (15.5%) metropolitan, 77/451 (17.1%) RCS and 18/142 (12.7%) LIC/metro grads.

TABLE 1 Univariate associations with graduates' (2011–2022) AHPRA registered principal place of practice (2023), by Tier.

|                                     | Tier 1: rural footprint | Tier 2: other rural Victoria | Tier 3: other rural Australia | Tier 4: metropolitan | <i>P</i> -value |
|-------------------------------------|-------------------------|------------------------------|-------------------------------|----------------------|-----------------|
| All graduates ( <i>n</i> = 1,508)   | 120 (8.0%)              | 93 (6.2%)                    | 93 (6.2%)                     | 1,202 (79.7%)        |                 |
| Gender                              |                         |                              |                               |                      |                 |
| Female ( <i>n</i> = 745)            | 60 (8.1%)               | 44 (5.9%)                    | 41 (5.5%)                     | 600 (80.5%)          | 0.715           |
| Male ( <i>n</i> = 763)              | 60 (7.9%)               | 49 (6.4%)                    | 52 (6.8%)                     | 602 (78.9%)          |                 |
| Rural background                    |                         |                              |                               |                      |                 |
| No ( <i>n</i> = 1,120)              | 68 (6.1%)               | 52 (4.6%)                    | 51 (4.6%)                     | 949 (84.7%)          | < 0.001         |
| Yes ( <i>n</i> = 388)               | 52 (13.4%)              | 41 (10.6%)                   | 42 (10.8%)                    | 253 (65.2%)          |                 |
| Bonded medical place                |                         |                              |                               |                      |                 |
| No ( <i>n</i> = 1,086)              | 80 (7.4%)               | 58 (5.3%)                    | 64 (5.9%)                     | 884 (81.4%)          | 0.049           |
| Yes ( <i>n</i> = 422)               | 40 (9.5%)               | 35 (8.3%)                    | 29 (6.9%)                     | 318 (75.4%)          |                 |
| Training pathway                    |                         |                              |                               |                      |                 |
| Metro only ( <i>n</i> = 857)        | 35 (4.1%)               | 53 (6.2%)                    | 47 (5.5%)                     | 722 (84.2%)          | < 0.001         |
| RCS ( <i>n</i> = 451)               | 65 (14.4%)              | 21 (4.7%)                    | 32 (7.1%)                     | 333 (73.8%)          |                 |
| LIC/metro ( <i>n</i> = 142)         | 10 (7.0%)               | 9 (6.3%)                     | 8 (5.6%)                      | 115 (81.0)           |                 |
| LIC/RCS ( <i>n</i> = 58)            | 10 (17.2%)              | 10 (17.2%)                   | 6 (10.3%)                     | 32 (55.2%)           |                 |
| Post-graduate year group            |                         |                              |                               |                      |                 |
| PGY 1–3 ( <i>n</i> = 433)           | 63 (14.5%)              | 31 (7.2%)                    | 13 (3.0%)                     | 326 (75.3%)          | < 0.001         |
| PGY 4–6 ( <i>n</i> = 365)           | 20 (5.5%)               | 21 (5.8%)                    | 21 (5.8%)                     | 303 (83.0%)          |                 |
| PGY 7–9 ( <i>n</i> = 350)           | 19 (5.4%)               | 19 (5.4%)                    | 33 (9.4%)                     | 279 (79.7%)          |                 |
| PGY 10–12 ( <i>n</i> = 360)         | 18 (5.0%)               | 22 (6.1%)                    | 26 (7.2%)                     | 294 (81.7%)          |                 |
| Vocation                            |                         |                              |                               |                      |                 |
| No specialty ( <i>n</i> = 1,115)    | 91 (8.2%)               | 62 (5.6%)                    | 63 (5.7%)                     | 899 (80.6%)          | < 0.001         |
| GP ( <i>n</i> = 243)                | 28 (11.5%)              | 27 (11.1%)                   | 25 (10.3%)                    | 163 (67.1%)          |                 |
| Non-GP specialist ( <i>n</i> = 150) | 1 (0.7%)                | 4 (2.7%)                     | 5 (3.3%)                      | 140 (93.3%)          |                 |

There was particularly strong rural practice (80.0%) observed amongst the small number of LIC/RCS graduates with a GP vocation, though their distribution was similar across the rural Tiers [Tier 1: 4 (26.7%), Tier 2: 5 (33.3%), Tier 3: 3 (20.0%), Metropolitan: 3 (20.0%)].

## Discussion

As place-based health professional education programs seek to train and retain graduates in the rural communities with which they partner, an understanding of the factors that influence graduate retention in the local region is critical. The results of this study provide important insights into the foundations of an effective place-based approach to rural workforce development and set a baseline for future comparisons of Deakin's graduate workforce outcomes.

### Place-based rural clinical training keeps graduates in the footprint

An important finding of this study is the differential effect of extended rural clinical training on graduates working in the

rural footprint, particularly early in their medical career, compared with other rural areas of Victoria and Australia. There was a significant effect of 2-year extended rural training pathways on graduates working in the footprint (LIC/RCS OR 6.80; RCS OR 4.08), but a lesser association was seen with working in other parts of rural Victoria (for the LIC/RCS pathway only, OR 3.7) and no association was found with working in other parts of rural Australia. This finding is supported by other research that found a stronger effect of rural training on working in the same region, compared to other rural areas (15). Whilst this is a positive outcome for rural communities investing in student training, training capacity limitations restrict the extent to which these rural pathways can be expanded. Strategies to enhance rural workforce outcomes therefore need to align rural training with other influential elements.

The significant influence of LIC participation on graduate workforce outcomes in the rural footprint (OR 6.8) supports other literature demonstrating the important association between LIC participation and positive rural workforce outcomes, including choice of GP (16). LIC students spend substantial amounts of time learning within the GP context, which is proposed to influence their career decisions through a range of mechanisms (16, 17). However, the findings also stress the importance of rural training continuity for LIC programs, noting the significant differences in work location and vocation between those LIC students who

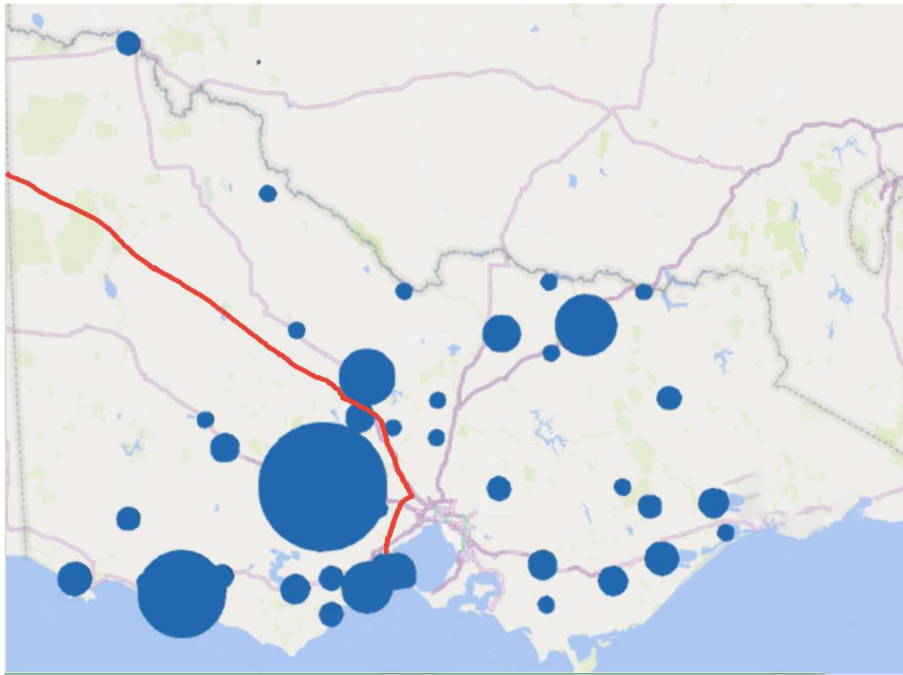


FIGURE 1  
Work locations of Deakin MD graduates in rural Victoria, 2023. \*Red line outlines rural footprint.

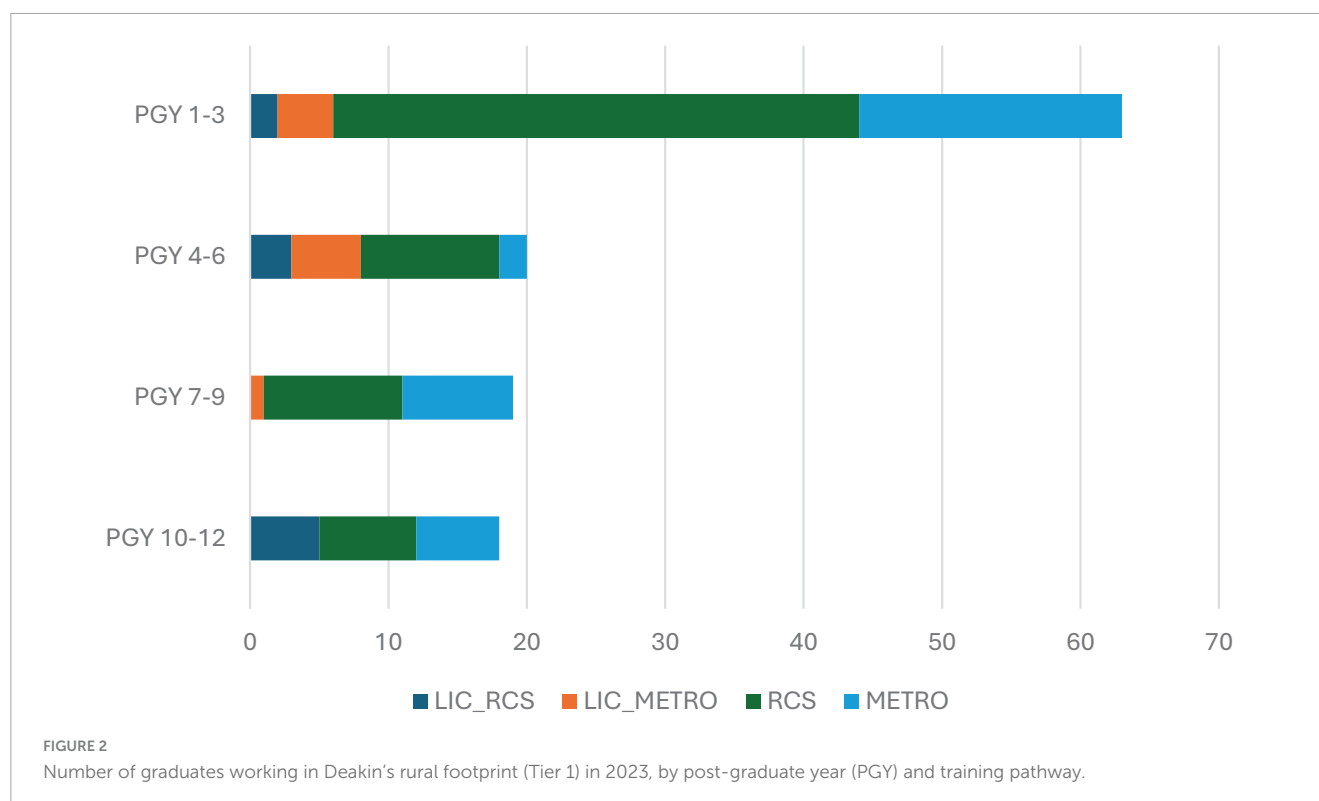
TABLE 2 Multinomial logistic regression model and odds ratios for 2011–2022 graduates’ principal place of practice (2023) in (i) Tier 1: Deakin’s rural footprint, (ii) Tier 2: other rural Victoria and (iii) Tier 3: other rural Australia.

|                                           | Tier 1: Deakin’s rural footprint |         | Tier 2: other rural Victoria |         | Tier 3: other rural Australia |         |
|-------------------------------------------|----------------------------------|---------|------------------------------|---------|-------------------------------|---------|
|                                           | Odds ratio (95% CI)              | P-value | Odds ratio (95% CI)          | P-value | Odds ratio (95% CI)           | P-value |
| Metropolitan background (reference)       |                                  |         |                              |         |                               |         |
| Rural background                          | 3.02 (2.00–4.57)                 | < 0.001 | 2.81 (1.80–4.37)             | < 0.001 | 2.91 (1.87–4.50)              | < 0.001 |
| Non-bonded place (reference)              |                                  |         |                              |         |                               |         |
| BMP                                       | 1.13 (0.74–1.74)                 | 0.57    | 1.50 (0.95–2.36)             | 0.08    | 1.12 (0.70–1.78)              | 0.65    |
| Metropolitan training pathway (reference) |                                  |         |                              |         |                               |         |
| LIC/RCS                                   | 6.80 (2.94–15.72)                | < 0.001 | 3.71 (1.67–8.27)             | 0.001   | 2.32 (0.90–5.96)              | 0.82    |
| LIC/metro                                 | 1.55 (0.72–3.29)                 | 0.26    | 0.90 (0.42–1.92)             | 0.79    | 0.94 (0.42–2.08)              | 0.88    |
| RCS                                       | 4.08 (2.60–6.38)                 | < 0.001 | 0.81 (0.48–1.38)             | 0.44    | 1.40 (0.87–2.26)              | 0.17    |
| PGY 10–12 (reference)                     |                                  |         |                              |         |                               |         |
| PGY 1–3                                   | 7.24 (3.16–16.56)                | < 0.001 | 2.62 (1.15–5.96)             | 0.02    | 0.46 (0.21–1.01)              | 0.05    |
| PGY 4–6                                   | 1.95 (0.82–4.63)                 | 0.13    | 1.69 (0.74–3.86)             | 0.21    | 0.73 (0.36–1.49)              | 0.39    |
| PGY 7–9                                   | 1.29 (0.623–2.67)                | 0.49    | 1.10 (0.55–2.20)             | 0.79    | 1.22 (0.82–2.64)              | 0.50    |
| No specialty (reference)                  |                                  |         |                              |         |                               |         |
| GP                                        | 4.65 (2.26–9.56)                 | < 0.001 | 3.76 (1.88–7.55)             | < 0.001 | 1.47 (0.82–2.64)              | 0.19    |
| Other specialty                           | 0.23 (0.03–1.83)                 | 0.16    | 0.71 (0.22–2.37)             | 0.58    | 0.37 (0.13–1.02)              | 0.54    |

completed a second RCS year compared with those who returned to a metropolitan clinical school. The former were more than twice as likely to work rurally (LIC/RCS 44.8%, LIC/metro 19.0%) and entered GP in greater proportions (LIC/RCS 25.9%, LIC/metro 12.7%).

### Expanded opportunities for rural post-graduate training are required

The results demonstrate stronger retention in the rural footprint during the early post-graduate years, with a significant



decline evident at PGY 4–6 that was then sustained. This loss after PGY 1–3 was associated with a concomitant increase in metropolitan-based graduates, likely an indication that many graduates are leaving the rural footprint after their junior medical training (intern/resident years) to pursue specialty training in metropolitan areas during this time period (18). Similar migration patterns have been observed in longitudinal studies, postulating the lack of available training pathways, especially outside of GP, as a key contributor to rural workforce shortages due to the disruption in the continuity of rural training (19, 20). The analysis of PGY cohort characteristics suggests there is nothing specific about the more recently graduated cohorts (PGY 1–3) to explain why they would be inherently more likely to work in the footprint, in fact the opposite might be expected based on their comparatively lower completion of LIC/RCS training pathways. The greater retention in the rural footprint in the early post-graduate years is therefore likely attributable to the availability of local prevocational training opportunities (PGY 1–3) and subsequent lack of vocational training opportunities beyond PGY 3.

In Western Victoria, completion of all components of GP training within the rural footprint has been possible for all Deakin graduates. The strong retention of graduates working in GP in the footprint (OR 4.65), suggests that when training pathways are locally available, graduates are more likely to train in place and remain working in the region.

The need to provide alternative rural specialty training pathways has been identified as a key priority of Australia's National Medical Workforce Strategy 2021–2031 and a 2024 recommendation of the Medical Deans of Australia and New Zealand (3, 18). The availability of these pathways within our footprint has been steadily growing, supported by the establishment of the Western Victoria Regional Training Hub

in 2017 and the Victorian Rural Generalist Program (VRGP) in 2019. The VRGP provides support for GPs to gain advanced skills aligned with the needs of rural communities. As more rural specialty pathways including surgery, internal medicine, rural generalism, emergency medicine, pediatrics and obstetrics and gynecology are being added to the local rural training offerings, we anticipate enhanced graduate retention in the footprint beyond PGY 3 in future. Longitudinal graduate tracking studies would be beneficial to further evaluate graduate migration patterns and the influence of the development of new rural post-graduate specialty training pathways on future retention in the footprint.

## Rural background students need access to local training

It has been well-established through international research that RB students are more likely to work rurally as graduates (21–25). This is a driver for policies, such as Australia's RHMT program, that requires all universities with a RCS to admit a minimum quota of RB students annually. However, Australia's national rural medical school admissions system results in RB students relocating throughout the country to gain one of these competitive places in medical school. The finding that our RB graduates were similarly likely to work in each of the rural Tiers (Tier 1: OR 3.02; Tier 2 OR 2.81; Tier 3: OR 2.91) may be an indication that following completion of training, graduates return to their home regions. This movement dislocates graduates from rural communities, potentially disrupting rural training continuity at a critical time. There is a need for local admission pathways to be developed that allow rural students to have priority access to medical training

in their home regions, and for national policy that supports this approach (3).

With the commencement of the RTS and the place-based recruitment of RB students from the rural footprint, our future research will report on workforce outcomes for RB graduates based on their Tier of origin, to determine whether priority admission of local rural students enhances rural workforce outcomes for the footprint beyond the general admission of RB students.

## A comprehensive place-based approach

Comprehensive approaches to rural medical training unite more than one effective element in program design to improve rural workforce outcomes (2, 26). From 2028, all Deakin RTS graduates are anticipated to have a rural background within the footprint and will also have completed four years of rural training there. Based on the evidence, this place-based alignment is anticipated to increase the proportion of Deakin's graduates who remain working in the rural training footprint over time, if other limiting factors such as the availability of post-graduate training pathways are addressed. Future research into Deakin's graduate workforce outcomes will investigate the effect of the RTS on outcomes for the region.

## Limitations

Given the RHMT program definition was used to identify RB graduates for the admission of these cohorts, the present study does not enable us to determine the differential workforce outcomes in relation to graduates having a RB in the rural footprint, compared with other parts of rural Australia. An analysis of the differential influence of graduates having a RB within or outside of the rural footprint will be included in our future graduate studies. The use of PPP to identify graduates working rurally does not capture all contributions that graduates may make to the rural workforce, for example through visiting services. The lower numbers of graduates completing some training pathways, or having completed their specialty training thus far, limits the confidence with which findings can be interpreted. Place-based approaches by nature require adaptation to local needs and findings from one context may not be generalizable to others.

## Conclusion

This study provides an example of how a place-based rural admission and training strategy will be coupled with an evaluation of workforce outcomes for the same region. Providing a baseline for the future evaluation of Deakin's place-based RTS, the results demonstrate the factors that are associated with positive rural workforce outcomes for the footprint and support the place-based design of the RTS. The critical need for a broader range of rural specialty training pathways to be established to enable local rural retention in later post-graduate years is evident, and

future research will evaluate the impact of these being established in the footprint.

## Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: Ethics approval for access and use of this data is restricted to the purposes of this project. Requests to access these datasets should be directed to Jessica Beattie, [j.beattie@deakin.edu.au](mailto:j.beattie@deakin.edu.au).

## Ethics statement

The studies involving humans were approved by the Deakin University Human Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## Author contributions

LF: Conceptualization, Formal Analysis, Investigation, Methodology, Writing – original draft, Writing – review and editing. JB: Conceptualization, Writing – review and editing. VV: Supervision, Writing – review and editing. GR: Supervision, Writing – review and editing. MM: Supervision, Writing – review and editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

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# Becoming more integrated into the community: a qualitative study of learners' experiences of the learning environment in a longitudinal integrated clerkship

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**Background:** While the significance of continuity in the learning environment of longitudinal integrated clerkships (LIC) is widely acknowledged, most studies have focused on continuity of the learner-preceptor relationship and learner-patient relationship. Yet learning environments contain a myriad of wider social dimensions, such as personal relationships, interactions with members of the multidisciplinary team and the broader social context of rural communities; learning is situated within a broad social system. This study aimed to understand how learners experience learning during a LIC.

**Methods:** Qualitative interviews involving learners in a final year LIC in Western Canada were analyzed inductively, informed by Bronfenbrenner's ecological systems theory and team reflexivity.

**Results:** Of the LIC cohort of 22, 18 consented to be interviewed. The participants were mature, had previous careers and most had families with them. Beyond the continuity of relationships with preceptors and patients, the study uncovered other factors that influenced the learning of the LIC students. Apart from students' interactions in the clinical settings (patients, preceptors and other multi-disciplinary teams), factors such as personal relationships, community connections, learning in a resource-strained environment, geographical isolation, and other socio-political dynamics, impacted the LIC learner experiences of continuity and community integration. The results showed that LIC students were self-directed in their learning and the LIC experience shaped their professional development and facilitated their readiness for future residency.

**Conclusion:** The relationship between learner and primary preceptor is central but the overall experience of the learning environment is much broader and more complex. Much of the richness of the LIC experience is embedded in the complexity of the learning environment. The use of Bronfenbrenner's ecological systems theory as a framework for understanding the complexity of the learning environment will be of interest to LIC leaders. The authors recommend potential action points at multiple system levels for medical schools to support the experiences of continuity and integration in the LIC environment and enhance students' professional journey. These will also provide supports for the ongoing active advocacy work regarding achieving a sustainable rural health workforce now and into the future.

## KEYWORDS

undergraduate medical education, rural curriculum, continuity, learning environment, integrated community clerkship, LIC, Qualitative, distributed learning

## 1 Introduction

Continuity is a foundational concept in learning within longitudinal integrated clerkships (LIC) (1). While continuity was initially defined in relation to the duration of LIC placements (2), later literature identifies several types of continuity in LICs: preceptor continuity, patient continuity, and ‘contextual continuity,’ which refers to continuity of space and place (3). The value proposition underpinning continuity is the opportunity for learners to develop relational continuity that supports learning and identity formation through immersive experiences in a continuous learning environment. To date, the concept of continuity of learning in LICs has focused primarily on learner-preceptor or learner-preceptor-patient relationships, with several recommendations for creating learning environments that support continuity for preceptors and students (1). Nevertheless, LIC learning environments are complex and often extend beyond these dyadic (or triadic) relationships and include continuity experiences with local hospitals, healthcare teams, and community organizations. Moreover, LICs are situated within a broader medical education environment that encompasses political and social contexts (4–6), which (in)directly influence medical students, their learning experiences, and career choices. Government policy, healthcare funding models, and rural health workforce are examples of contextual factors outside of traditional educational considerations that have substantial impact on the LIC learning environment. Education in longitudinal integrated clerkships can then be viewed as a social process, with learning and learners situated in complex and often nested learning environments.

The importance of the learning environment and its impact on learning is well established in medical education. The term environment refers to ‘that which is around or surrounds’—encompassing the physical and social aspects of a particular setting. It describes the common ways in which people interact with one another, the tone of the social and cultural climate, as well as the organizational structures and physical surroundings that influence learning (7). This broad perspective of a learning environment underscores the importance of examining learning beyond interactions between the learner, preceptor and/or patient (for example, in the consultation room) to consider ‘all that surrounds’ learning. A key feature of learning environments is their dynamic nature, shaped by the people and working relationships that emerge from underlying patterns of patients, locations, practice, education, and society, and from the unpredictable interactions between these patterns (8). One way to study the complex interactions of learning environments is through systems theory (9, 10). Systems theory is a multidisciplinary framework that examines how complex systems function by analyzing the interactions and relationships between various components (11).

One of the most applied systems theories is Bronfenbrenner’s ecological theory (12–15). Originally developed to comprehend human development, Bronfenbrenner’s theory has been used to understand student learning and the educational environment across various training contexts (16, 17), including medicine (18, 19) and rural learning (20). Bronfenbrenner proposed that the overall environment consists of

several layers or sub-environments, each nested within one another, with each layer exerting its own impact on the individual (Table 1, Figure 1). Conceptualized in this manner, all the sub-environments where learning and training occur are interdependent. A strength of the model is its focus on the lived experience of the learner in context, highlighting the bidirectional and dynamic interactions between an individual (the learner) and their environmental sub-systems (16).

While the broader context of Longitudinal Integrated Clerkships (LIC) is widely discussed in commentaries and recommendations for practice, the broad context, to the best of the research team’s knowledge, has received less attention from the learner’s perspective. On one hand, this is understandable given the importance of the preceptor-learner relationship as a source of continuity in LIC learning. However, it also overlooks the layered and often complex additional relationships that learners encounter – relationships that can either support or undermine learning. Furthermore, LICs are frequently embedded in socio-political contexts, driven by medical schools’ and funders’ commitment to developing tomorrow’s rural workforce, yet they often operate with fragile funding and limited community resources (21). At the same time, they are often evaluated on par with more well-resourced central university hospital placements. In this study, a LIC program has been established for 15 years, during which the context of LIC learning has evolved. Specifically, rural communities in the authors’ province are experiencing increasing shortages of physicians and healthcare professionals, becoming a focal point for community advocacy and broader political negotiations.

The pedagogical soundness of the LIC model is well established (22–28) and overall outcomes of LIC connect favorably to desired workforce outcomes in primary care and rural settings (29–32). However, the mechanism of the connection between the LIC model and workforce outcomes is not fully understood. With this in mind, the authors sought to explore the totality of the learner experience, and to examine the learning environment beyond the preceptor-learner relationship. Developing a more holistic framework of the LIC learning experience will inform LIC leaders furthering the development and refinement of LIC placements.

## 2 Methods

### 2.1 Setting and participants

At the authors’ institution, the rural longitudinal integrated community clerkship (LIC) program is designed for students in their final year of Undergraduate Medical Education (UME) training. This program immerses students in a rural or regional community for up to 8 months, where they learn rural generalist medicine and various specialties in an integrated manner. It has been operating for over 15 years. Students apply to the program using a formal application process early in the second year of the three-year accelerated medical curriculum. Selection includes both an application and structured interview, which have been iteratively developed by the LIC committee to focus on student learning goals, rurality, and readiness to work in

TABLE 1 Bronfenbrenner’s ecological system levels.

| System level | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Microsystem  | The microsystem is the innermost layer and consists of the immediate settings of the learner, including the interpersonal relations and settings in which the individual lives.<br>A “setting” in the microsystem is defined as “a place where people can readily engage in face-to-face interaction” Bronfenbrenner [(13), p. 22].                                                                                                                                                                                 |
| Mesosystem   | The mesosystem, comprises the linkages and processes taking place between two or more settings containing the learner (micro-systems) i.e. “system of microsystems.”<br>Bronfenbrenner described 4 types of interaction: multi-setting participation (working in different settings), inter-setting communication and inter-setting knowledge (how communication and knowledge is shared (or not) across settings) and indirect linkage (interactions that do not involve the learner but impact their experience). |
| Exosystem    | The exosystem describes events that do not directly involve a learner but still have an impact on them.                                                                                                                                                                                                                                                                                                                                                                                                             |
| Macrosystem  | The macrosystem includes overarching cultural values, economic systems, political ideologies that shape the broader environment in which the learner is studying.                                                                                                                                                                                                                                                                                                                                                   |
| Chronosystem | This system represents the dimension of time, considering how both personal and societal changes over time influence a learner’s development.                                                                                                                                                                                                                                                                                                                                                                       |

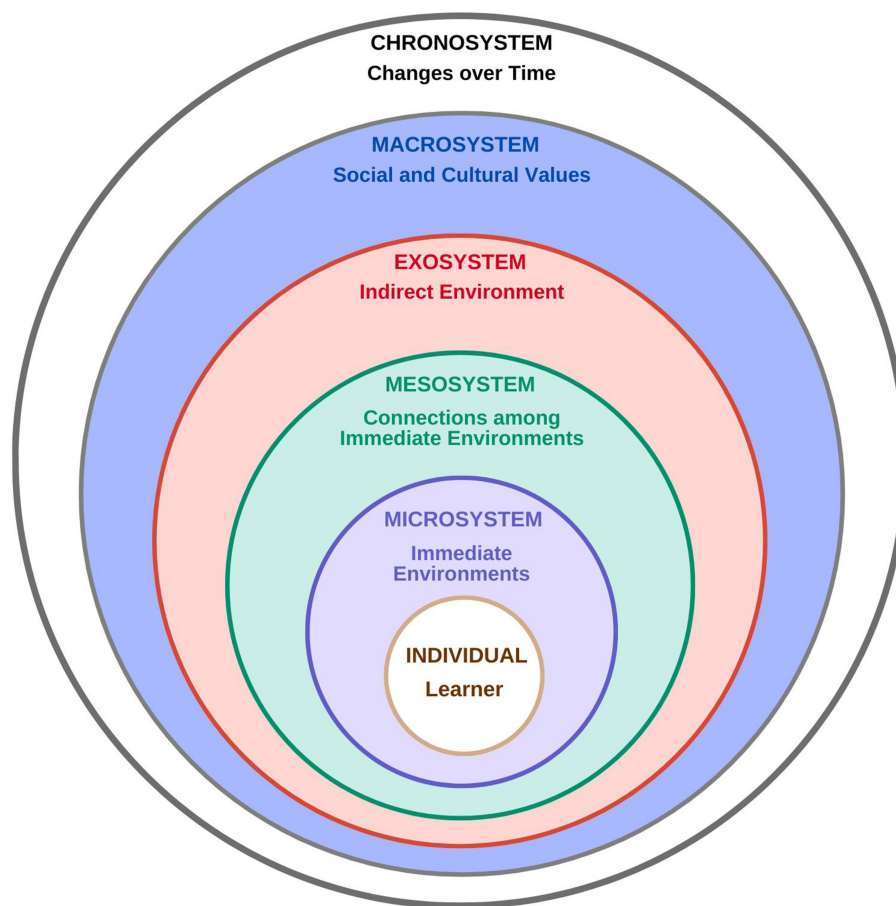


FIGURE 1  
A diagrammatic representation of Bronfenbrenner’s ecological systems theory.

a self-directed learning environment. Neither academic marks nor class standing are considered for selection. Typically, there are more LIC applicants than positions, so all eligible students who apply are interviewed. Students who are not selected for LIC enter the traditional rotation-based clerkship (RBC). A two-person interview panel uses structured questions. Students are chosen based on an evaluation of their written applications and interviews.

The rural and regional communities selected for the LIC are located in central and southern Alberta, and one is in the Northwest Territories, ranging in size from 2,700 to 99,000 in population (Table 2). In line with the definition of rural by Statistics Canada (33) and Warren (34), all communities but one are classified as rural (population <30,000), and all but one are more than 80 km from an urban center with a population greater than 50,000, with one community labelled as

a remote location (35–37). The factors required for a community to become an LIC site include (i) interested preceptors who are in long-term practice in the community, (ii) adequate physical space in clinical settings to host learners, (iii) sufficient breadth of community and hospital-based practice to meet the clerkship curriculum learning objectives, (iv) availability of housing for LIC students embedded in community. Students have a primary preceptor and work with various other physicians in the community to gain a breadth of experience across rural generalist medicine. Students follow patients through many care settings, including patient medical home primary care clinics, emergency departments, hospital inpatient wards, operating rooms, delivery rooms, continuing care facilities, and patients' homes, working with a range of preceptors and multidisciplinary team members. The longitudinal aspect of the LIC enables students to appreciate the natural history of illness, grasp the significance of continuity of care, and adopt a patient-centered approach within the supportive framework of a rural healthcare team. Preceptors are primarily family physicians with rural generalists, many possessing enhanced skills certification in the focused clinical areas, including mental health and addiction medicine, care of elderly, emergency medicine, enhanced surgical skills, family practice anesthesia, obstetrics surgical skills, palliative care and sports and exercise medicine (38). The LIC provides the necessary learning environment for students to achieve the objectives for the final year of the MD program. Medical students from the LIC cohort of the graduating class of 2024 ( $n = 22$ ), who were distributed across 13 rural communities, were recruited to participate in the research study.

## 2.2 Study design

This exploratory qualitative study is informed by a social constructivist epistemology that recognizes learning as a socially constructed process within various contexts (39). Social constructivism was appropriate for the research question as it emphasizes that knowledge and meaning are constructed through interactions with others and the sociocultural environment. It allowed

the authors to explore how learners construct meaning from their specific rural context(s) based on their individual educational experiences (40). The authors opted for a qualitative methodology to foster deeper engagement with participants, allowing them to share their experiences openly rather than limiting their responses to predefined questions typical of an end-of-placement survey. Ethical approval was granted by the Conjoint Health Research Ethics Board (CHREB) of the University of Calgary.

## 2.3 Data collection

The authors conducted semi-structured interviews to explore student learning experiences during the LIC. The interview guide was developed over several meetings of the study team. Development was informed by historical exit interviews performed by the LIC program and modified and expanded to probe into different aspects and layers of the LIC experience. The interview guide included questions about aspects of the participants' medical training and rural immersion experiences (see [Supplementary Appendix 1](#)). One of the co-authors (NB) conducted the interviews via Zoom in May 2024. To ensure a conversational tone, the interview guide was applied flexibly. Interviews lasted between 45 and 60 min. They were recorded and transcribed verbatim by a professional transcription service, which removed any identifiers. As only one to two learners are assigned to each site, interactions and experiences described could be identifiable despite efforts at anonymization. For this reason, to protect participant confidentiality, individual interview transcripts are not publicly available.

## 2.4 Study team's reflexivity and positionality

The research team consisted of three physicians experienced in educational leadership (RR, AJ, MK), two research staff adept in qualitative research (GP, NB), and a former program learner (AK). RR

TABLE 2 Description of the rural communities and distribution of LIC student placements.

| Community            | Distance* (Km) | Population (approx.) | Start year | Physicians | Students (Class 2024) |
|----------------------|----------------|----------------------|------------|------------|-----------------------|
| Brooks               | 190            | 14,451               | 2013       | 24         | 1                     |
| Canmore              | 104            | 14,000               | 2009       | 66         | 2                     |
| Cardston             | 234            | 3,900                | 2016       | 9          | 2                     |
| Drumheller           | 135            | 8,100                | 2008       | 19         | 2                     |
| High River           | 67             | 13,600               | 2008       | 39         | 2                     |
| Lethbridge           | 212            | 99,000               | 2015       | >150       | 2                     |
| Pincher Creek        | 217            | 3,600                | 2008       | 7          | 2                     |
| Raymond              | 247            | 4,199                | 2023       | 10         | 1                     |
| Rocky Mountain House | 215            | 7,000                | 2010       | 23         | 2                     |
| Stettler             | 227            | 6,000                | 2019       | 15         | 1                     |
| Sundre               | 116            | 2,700                | 2008       | 14         | 1                     |
| Taber                | 263            | 8,400                | 2008       | 14         | 2                     |
| Yellowknife, NWT     | 1,748          | 19,600               | 2011       | 35–40      | 2                     |

\* Distance from Calgary, AB.

and AJ serve as academic leads for the LIC program. AJ is the associate dean for distributed teaching at the medical school, overseeing all distributed teaching activities, while MK previously held the position of family medicine clerkship director. RR also directs the LIC program, works as a rural generalist physician, and acts as a clerkship preceptor. He reviews all student applications and makes decisions regarding student placements. NB serves as the community placement coordinator for the LIC program and directly addresses student concerns throughout their clerkship immersion. GP supports the various scholarship activities of the distributed teaching faculty, preceptors, and medical learners. AK is a practicing family physician from a rural community and a postgraduate learner in an emergency medicine enhanced skills program.

Reflexive thematic analysis (RTA) was used as the primary approach in this study. RTA is an approach for interpreting data patterns, themes, and meanings, specifically informed by researcher reflexivity. It relies on researchers critically reflecting on their values and assumptions throughout the research process. This was particularly significant for this study, given the involvement of academic leadership in the LIC program. On one hand, the participation of RR and AJ provided rich contextual detail, but their leadership roles risked emphasizing positive experiences while downplaying less favorable learner experiences. To support their reflexivity, the authors periodically paused to examine their accounts using reflexivity questions, as outlined by Crabtree and Miller (41). The team balanced their closeness to the data by being intentionally attentive to negative comments and counter themes in the data. Team reflexivity was further reinforced by GP and MK's more distant relationship with the program.

## 2.5 Data analysis

Data analysis involved two iterations. In the first phase of analysis, the authors openly coded the data using reflexive thematic analysis (RTA) (42). Analysis commenced with team members reviewing the transcripts broadly to familiarize themselves with the data and consider patterns and preliminary themes. Each interview transcript was read by at least 2 members of the research team. This was followed by an open coding phase, during which each team member independently examined the transcripts, made remarks, highlighted significant quotations, and engaged with the data based on the diverse experiences as physicians, educational leaders, and preceptors involved in the LIC program. Coding for this project was done manually. Subsequently, the authors gathered to discuss the initial codes. Each interview was then coded by two members of the research team, who reconvened to refine the coding scheme. Through a series of meetings, the authors deliberated and enhanced the coding while reflecting on the various stakeholders that influenced (or hindered) a learner's experience, as well as the extent to which this affected each participant's overall learning journey.

A 'thinking with the theory approach' was used to iteratively deepen understanding between the data and the framework (43–46). As the analysis developed, the authors drew on Bronfenbrenner's ecological systems theory (13) as a sensitizing theoretical framework to enhance the emerging interpretation. Team members reread the codes, using the conceptual map to identify the dynamics among varying stakeholders and their level of influence. To ensure the interpretations

were grounded in the data, each team member revisited a subset of interviews to check the codes against the overall model, confirming that the coding labels aligned with the research team's thoughts and interpretations. This conceptual framework was employed to map codes and identify themes, demonstrating connections between issues and experiences identified by the participants.

For example, preliminary reading identified the learner-preceptor relationship as being of central importance. Subsequent deeper reading, with the model in mind (i.e., thinking with the theory approach) uncovered the importance of day-to-day relationships with other health professionals and alternate preceptors. Through systematic analytic engagement with the raw data, acknowledging the team's personal positioning and engagement with theory, the authors constructed the final interpretive synthesis.

## 3 Results

### 3.1 Demographic profile

Of the 22 students in the LIC program, 18 (82%) consented to be interviewed. The average age was 30.8 years. Most of the students were female (11/18, 61%) and had partners (13/18, 72%). Among the partnered students, 4 (22%) had children. Two-thirds of the students had a rural background (12/18, 67%). Almost three-quarters expressed interest in Family Medicine at the outset (13/18, 72%) and the same number of students eventually matched to a Family Medicine Residency program after LIC (13/18, 72%), mostly in a rural or remote setting (9/18, 50%). (Table 3).

### 3.2 Qualitative interpretation

The final interpretation of the data is represented in Table 4 and Figure 2. Table 4 outlines the domains of Bronfenbrenner's theory to illustrate the range of stakeholders and interactions that contribute to how learners experience the learning environment in a longitudinal integrated clerkship. These are represented in Figure 2, adding arrows and directional symbols to help readers appreciate the dynamic (and individual) nature of how the various components of the learning environment can support or detract from a learner's experience.

#### 3.2.1 The learner

Analysis of the transcripts indicated that the learner and their approach to learning is central to how learning is subsequently experienced. The sub-themes noted are (i) that participants identified as motivated and self-directed learners, (ii) that learners were actively seeking learning opportunities.

Participants compared their LIC experience to their colleagues' experiences in traditional block-based rotations and indicated that the LIC had less formal learning than traditional block-based rotations, but significantly more opportunity for experiential, hands on, learning. Participants felt capable of navigating resources to retrieve formal information for self-consumption, while highly valuing for direct hands-on experiences, with supervision and feedback by their preceptor.

Multiple participants identified strategies they used to seek out learning opportunities, including seeking out specific experiences

TABLE 3 Demographic profile of participants.

| Demographics                     |                                        | N          | %   |
|----------------------------------|----------------------------------------|------------|-----|
| LIC cohort size                  |                                        | 22         |     |
| Participated in the study        |                                        | 18         | 100 |
| Gender                           | Male                                   | 7          | 39  |
|                                  | Female                                 | 11         | 61  |
|                                  | Other                                  | 0          | 0   |
| Average age (at entry to LIC)    |                                        | 30.8 years |     |
| Graduated rural high school      | Yes                                    | 10         | 56  |
|                                  | No                                     | 8          | 44  |
| Family status                    | Single, no children                    | 5          | 28  |
|                                  | Single with children                   | 0          | 0   |
|                                  | Partnered, no children                 | 9          | 50  |
|                                  | Partnered with children                | 4          | 22  |
| Self-reported rural background   | Yes                                    | 12         | 67  |
|                                  | No                                     | 5          | 28  |
|                                  | No data                                | 1          | 6   |
| Career interest                  | Family Medicine                        | 11         | 61  |
|                                  | FM, Focused Practice                   | 2          | 11  |
|                                  | Anesthesiology                         | 2          | 11  |
|                                  | Emergency Medicine                     | 1          | 6   |
|                                  | Internal Medicine                      | 1          | 6   |
|                                  | Undecided                              | 1          | 6   |
| Previous professional background | Advising/consultancy                   | 3          | 17  |
|                                  | EMT/paramedic                          | 1          | 6   |
|                                  | Physician assistant                    | 1          | 6   |
|                                  | Physiotherapist                        | 1          | 6   |
|                                  | Psychologist/mental health/social work | 4          | 22  |
|                                  | Registered nurse                       | 5          | 28  |
|                                  | Research and policy                    | 3          | 17  |
| Residency match after LIC        | Family medicine - Rural                | 8          | 44  |
|                                  | Family medicine - Remote               | 1          | 6   |
|                                  | Family medicine - Urban                | 3          | 17  |
|                                  | Family medicine and emergency medicine | 1          | 6   |
|                                  | Anesthesiology                         | 2          | 11  |
|                                  | Diagnostic radiology                   | 1          | 6   |
|                                  | Emergency medicine                     | 1          | 6   |
|                                  | Internal medicine                      | 1          | 6   |

with specific preceptors, willingness to be being pushed beyond their comfort zones in the context of positive preceptor relationship, recognition of the limits of their own abilities, and active thinking about taking on progressive levels of responsibility over time. This approach to learning connected to the microsystems level as an enabler of the learner-preceptor relationship, particularly around mutual trust and mentorship.

*P2: Those of us who decide to pursue LIC are probably, on balance, people that aren't necessarily afraid of undifferentiated situations or*

*the new and the unfamiliar. ...Being successful in LIC definitely requires initiative and a self-directed approach to training. And kind of managing one's time..... There's going to be a ton on the exam that I did not see in clinic and that's up to me to learn independently regardless.*

3.2.2 The microsystem

The microsystem refers to the environment directly surrounding the learner, including their immediate settings and interpersonal relationships. In addition to the immediate relationship with their

TABLE 4 LIC learning environment: sub-system content examples and codes, considered through Bronfenbrenner's ecological theory.

| Bronfenbrenner's system level                           | Content                                                                                                                                                                                                                                                                                                                                                                                                                                  | Codes                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Learner                                                 | The self-directed learner is at the center of the learning environment.                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Participants identified as motivated, self-directed learners.</li> <li>They described actively seeking out learning opportunities.</li> <li>They especially valued experiences that offered hands-on learning.</li> </ul>                                                                                                                                                                                                 |
| Microsystem (immediate environment)                     | The immediate environment of the learner comprises of relationships and interactions with: <ul style="list-style-type: none"> <li>Primary preceptor</li> <li>Additional preceptors</li> <li>Members of multidisciplinary team</li> <li>Personal relationships</li> </ul>                                                                                                                                                                 | <ul style="list-style-type: none"> <li>Preceptor-learner relationship: preceptors regarded the learner as a professional, and a person.</li> <li>Learners valued the additional mentorship provided by other preceptors.</li> <li>Learning was enhanced by multidisciplinary teamwork.</li> <li>Learners' interpersonal relationships were integral in their learning.</li> </ul>                                                                                |
| Mesosystem (linkages and relationships between systems) | Factors include the direct experiences with peers, preceptors, patients in the learning environment and experiences of the curriculum: <ul style="list-style-type: none"> <li>Working in multiple settings</li> <li>Social activities with preceptor and local team members</li> <li>Social activities in the community</li> <li>Exposure to patient continuity</li> <li>Indirect linkages with Undergraduate Medical program</li> </ul> | <ul style="list-style-type: none"> <li>The LIC allowed multi-setting participation among learners.</li> <li>The LIC promoted inter-setting knowledge and communication.</li> <li>The learners appreciated being seen and felt welcomed, promoting a sense of commitment to community.</li> <li>Participant learning was enhanced by exposure to patient continuity.</li> <li>Participants experienced indirect linkages that impacted their learning.</li> </ul> |
| Exosystem (indirect environment)                        | These factors may include: <ul style="list-style-type: none"> <li>Lack of clinical resources</li> <li>Geographical isolation</li> </ul>                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>LIC training in a resource-constrained environments impacted the participants' learning.</li> <li>The geographical isolation indirectly impacted learning.</li> <li>Learners witnessed burnout among rural healthcare professionals.</li> </ul>                                                                                                                                                                           |
| Macrosystem (social and cultural factors)               | These factors exist outside the medical learning environment (beyond the medical school or clinical learning environment), but that influence the inner "sublevels" and the learner. <ul style="list-style-type: none"> <li>Accreditation requirements</li> <li>Economics of supply and demand</li> <li>Political system – models of compensation and professional remuneration</li> <li>Social accountability</li> </ul>                | <ul style="list-style-type: none"> <li>In addition to the academic requirements of the medical program, the LIC learners acquired deeper understanding and awareness of the geopolitical, socioeconomic issues affecting rural Canada, which in turn impacted their sense of social accountability.</li> </ul>                                                                                                                                                   |
| Chronosystem (changes over time)                        | These are changes related to personal and professional conditions and the learning environment associated with time. <ul style="list-style-type: none"> <li>Professional identity formation</li> <li>Preparation for future practice</li> </ul>                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>The LIC program increased participants' clinical confidence and preparedness for next level of training.</li> </ul>                                                                                                                                                                                                                                                                                                       |

primary preceptor, participants described the value of working with additional preceptors, locums, and multidisciplinary team members. They also emphasized the role of personal relationships, such as with partners and family. These relationships supported or undermined experiences of continuity.

### 3.2.2.1 The preceptor-learner relationship related to knowing the learner as professional, and a person

Learners most significant interaction was with their primary preceptor. Most participants described a collaborative and trusting relationship with their main preceptor, which developed over time. They explained how the relationship grew as the preceptor and learner became familiar. Preceptors dedicated time to understanding learners' learning approaches, interests, and expectations, tailoring learning objectives accordingly. They also got to know their learners as individuals, exploring their personal interests (e.g., hobbies, career aspirations) and supporting their personal development as they adjusted to life in rural communities. This fostered a safe learning environment where learners felt comfortable asking questions. They

also appreciated how their preceptor granted them increasing independence, trusting them as their skills developed and challenging them at times, scaffolding their learning to expand their 'comfort zones.'

*P9: Because he got to know me very well, he was very good at knowing what my limits were, and then kind of pushing me to my limits, or pushing me a bit outside my comfort zone. But he was always there.*

The learner-preceptor relationship was described as 'respectful, engaged, very supportive' (P4). Learners valued the personal mentorship offered by their preceptors, with opportunities to discuss career choices, navigate professional boundaries, and experience living in a rural community.

*P5: Yeah, no, I think he's definitely a role model. My preceptors all really balance family and work very well. So, in a way, they were very dedicated to their profession, but they were also very*

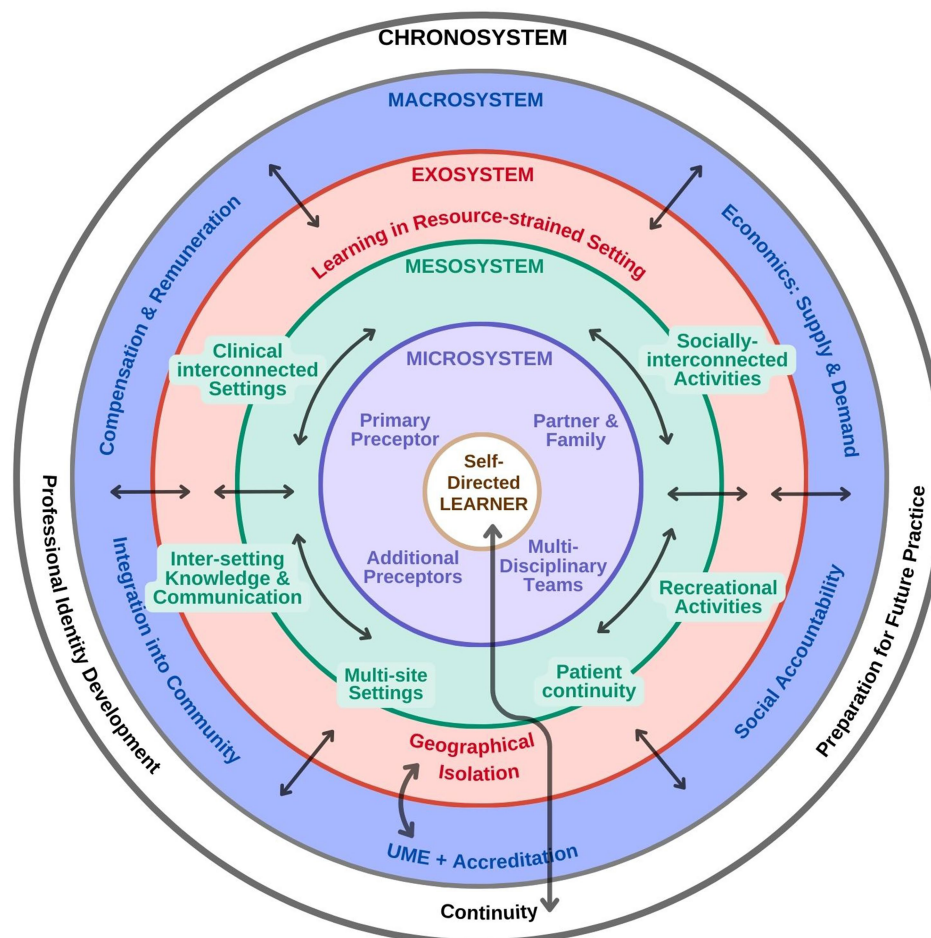


FIGURE 2  
Dynamic model of LIC learning environment.

dedicated as parents and as community members. And I thought that they were role models in the sense that they had, they really had a serving attitude towards their patients, and they really had that kindness towards their patients. But at the end of the day, they also said, "I'm going to go home," or "I'm going to go see my child's basketball game," or "We're going to go see our grandkid," or something. So, to me, that was a really, that is a role model to me.

However, not all participants experienced supportive relationships. One participant described challenges in initial relationship formation with a preceptor who was absent at the beginning of the LIC due to a personal emergency. Another participant described the challenge of working with a preceptor with different world views in specific areas of practice such as harm reduction, and the resulting need to reflect and broaden their work with other preceptors.

Engaging with locum doctors was identified as a particular challenge. Learners in communities with high numbers of locum physicians faced challenges in educational continuity, progressive autonomy and even in securing learning opportunities when some locums declined to work with LIC learners.

P1: The biggest challenge I faced ... was that there is no continuity in terms of the people who are working there. Everybody's a locum. And so, when you have a new preceptor that does not know where you are at in learning, then they go, "You're a medical student, so I'm going to assume you do not, you are at a certain level... Whereas every time I was there, there was someone brand new who's, 'Ooh, I do not know if I'm going to let you do anything today.'" And for me, that was the biggest struggle.

### 3.2.2.2 Participants valued working with the other preceptors that provided additional mentorship

As they rotated through community hospital settings and worked with other physicians in the area, learners remarked on opportunities to observe how different preceptors approached clinical care and experienced a form of distributed preceptorship, where each community member actively supported their learning.

P2: So overall, the relationships that I had with all of the preceptors I ultimately did have was very positive. I felt supported and valued, and that my development as both a physician and as a person were prioritized..... my development as a physician .....was something that they were invested in..... They also....took a personal interest

*in my growth and development. And that made me trust in their methods and in their kind of their mindset when it came to approaching educating me, which was wonderful.*

### 3.2.2.3 Participants said their learning was enhanced by multidisciplinary teamwork

Alongside collaborating with other physicians, participants highlighted the importance of engaging with and learning from other multidisciplinary team members (27), notably when they witnessed its impact on patient care.

*P17: I think it gives you the opportunity to have stronger relationships with those allied health professionals, because they, most of them have permanent lines, the dieticians and the social workers and the nurses.....I know that I can safely discharge patients when I'm in the rural location, because I've had the opportunity to have them assessed properly, and come up with appropriate discharge planning, and homecare planning, to get them home. And because you have those relationships, our inpatient homecare navigator has a direct relationship with the community homecare planner, and so those things happen a little bit more efficiently. But I think that just shows relationship actually means something. Especially, you are working in a small group of people that can kind of share their own approach to ethics and decision making, which is great.*

### 3.2.2.4 The participants' interpersonal relationships were integral in their learning experience

Participants emphasized the prominence of maintaining their social relationships, particularly with partners and children. This included, for example, travelling back and forth between the community and city to see partners or their children if enrolled in city schools. Access to housing to facilitate partners and/or family living with them or visiting significantly impacted their experiences.

*P5: For me also, again I went with my family, with my fiancé, and so that I would say contributed really. A big core portion of my success was, so I think it's really good that LIC allowed for children and for spouses and for family members to come with them. I think that really contributes to the learner success... Having the housing also contributed to the success, knowing that I do not have to find a rental place. The move can be quite quick, it's a quick turnaround time to get from the orientation to your site.*

## 3.2.3 The mesosystem

The mesosystem acknowledges that factors within the microsystem are not isolated but interlinked. It refers to the connections, relationships, and linkages between various aspects of the microsystem - in other words, how the different spheres of influence intersect.

### 3.2.3.1 The LIC allowed multi-setting participation among learners

Participants shared experiences in various settings, from their preceptor's clinic to local hospitals, including the emergency department, obstetrics, surgery, and long-term care. Engaging with patients in diverse contexts deepened learners' understanding of the importance of continuity of care, especially for patients. Observing

patients in the emergency room and later in community settings reinforced this concept. Additionally, several participants highlighted the value of working with pregnant patients and accompanying their journeys alongside their families throughout their LIC.

*P10: I saw patients in prenatal clinic, and then I saw them in emerg, and then I saw their husbands in emerg. And then I got to deliver their baby with them, and then I was like. I had great relationships with the patient and her husband, and now their new baby, and then I saw them in family clinic, it was just great.*

### 3.2.3.2 The LIC promoted inter-setting knowledge and communication

As learners moved between settings, they reflected on how health professionals' knowledge of the patient, their context, and the local healthcare infrastructure promoted personalized, flexible care, which one participant described as 'this is how we do things here'.

*P18: Because they knew us by name and who we were, they were good about discussing things and coming up with collaborative plans together rather than bouncing notes back and forth. So, I think it, it really, it's crucial I think, especially when you are working in rural settings, to have everybody with that same mindset of engaging in that collaboration..... These are your people; this is your community. You, as a rural generalist, have an active interest in the health of the people you look after because they are also the people that you see at PTA meetings or across the hockey pond with your kids.*

Data also highlight the central role of interconnected knowledge and communication, learned through social (non-clinical) interactions within the micro-system. Opportunities to engage in social time with preceptors and other team members were vital in helping learners feel integrated into the community. Social integration extended beyond the immediate healthcare team and included making connections by attending local events, such as festivals, and engaging in recreational activities and community life.

*P5: The preceptors would actually invite you over to their house or to a party or a get together. And I found that that was actually a really amazing way of building trust, having a meal with their whole family, and getting to know their kids. And going to a barbecue and all of the doctors would be there. So, I thought that that was, so that would be how I built professional trust, but then also personal trust kind of, really just inviting you into the community.*

### 3.2.3.3 Participant learning was enhanced by exposure to patient continuity of care

The longitudinal nature of LIC allowed participants to understand natural disease progression, management and prevention and helped them become more patient-centred.

*P5: At my rural site, it's like, what antibiotics are we doing? What are we going to do with this patient? And so, you really do start to think about patient care from start to finish. ... And you really feel the weight of that. ... most of the people that you see in the rural practice are undifferentiated, you do have some people with chronic or known health conditions. But especially too, you really do have to think in the rural communities, when you do not have all these imaging*

*modalities, you do not have all these specialist consults or someone who's there to do ultrasound 24/7. So, it really does force you to go back to basics, and think about your differential when you have an undifferentiated patient. So, LIC was very useful in that.*

### 3.2.3.4 Participants appreciated being seen and felt welcomed, promoting a sense of commitment to community

Social integration was about more than just 'having a good time'. It helped learners connect with the community, foster a sense of commitment to that community, and understand what it means to live and work as a rural physician.

*P5: Basically, you take your role quite seriously, because you are not hiding behind anonymity, you are not going to never see this person again. And you might treat their whole family, and so you need to do a good job and you are honoured to do a good job... We did try to integrate into the community and we went garage sale-ing every Saturday, and we went to all the barbecues. And if there was a pancake breakfast in [the village], we went to that and we walked around. And we went to the library, and the grocery store, and yeah, we, and corn days, and all of the different things. So, we really did try to integrate into the community, and we found that that was a really rewarding experience. Especially, like I talked about the anonymity of Calgary, I find that to be quite distressing. And I really do not like to be this anonymous cog person, I really like to be someone who has some skin in the game, who has some stakes. So, I really enjoyed living in my small community.*

Not all participants, however, integrated into the community in which they were learning. Some participants found it difficult to settle in and form connections. For others, family commitments, such as having children attending school or partners living in a different community, resulted in their spending less time in the community.

*P8: I tried hard to find things to do for my first couple of weeks here. I did not really meet anyone. I did not know what to do. And so, then it just became the default to go back to the city on the weekends..... But it would have taken nothing for someone my age to be, do you want to go biking around the town on Wednesday night, and we'll show you some paths, that took me 6 months to figure out.*

### 3.2.3.5 Participants experienced indirect linkages partly due to the LIC'S geographical isolation

Indirect linkages refer to interactions that do not involve the learner but impact their experience. One example of indirect linkage was a mismatch between learning in the local community and expectations of the undergraduate medical education program, particularly in relation to curriculum coverage and assessment.

*P19: You'll get amazing practical experience, but for the exams, it's still very much tailored to the one size fits all clerkship unfortunately. And you need to pay attention to those objectives.*

## 3.2.4 The exosystem

This level includes factors that are not directly within the learner's immediate environment but still influence their experience.

Participants reflected on the impact of learning in resource constrained rural environments. They described challenges arising from this, including the need to manage logistics around patient transfer, specialist consultation across long distances, and recognition of health disparities arising from geography. While this was identified as a challenge, some participants who planned to practice rural medicine felt that this was an important window into the realities of rural practice and important learning.

*P18: But it was good to see how you could deliver healthcare in that under-resourced setting, which I do not, I think that's a misnomer. We were, more than often I saw enough complex, interesting stuff in that setting that we could handle there, that was sufficient, compared to the city. So, I think that was good from a learner perspective, to understand what I, and to reaffirm, I have a vague idea of that, in retrospect, going into rural medicine. And now that we are pursuing that, next or this year, in a couple of months, for real. I have now a firm understanding of that, which is going to help...*

### 3.2.4.1 Participants had to deal with challenges stemming from geographical isolation

Participants also dealt with challenges stemming from geographic isolation. Living at a distance from family and social connections was identified as a particular challenge. This was exacerbated in settings with poor cellular coverage and internet connectivity, which added an additional barrier to maintaining key relationships. Witnessing the challenges of others in relation to geographic isolating also impacted participants. Witnessing the burnout of other health professionals was particularly impactful. Participants noted how burnout in one person could impact others. For example, how temporary staff could get burned out and leave, but how this also caused burnout in the permanent staff responsible for training repeated waves of temporary workers.

*P1: ... A lot of the nurses, a lot of allied health professionals up there [remote town] are really burnt out. And a part of that was because they'd be up there [remote town], and then they would get a locum nurse, and then they train her, and then they, and then she'd leave. And so, they were burnt out, because all they were doing was training these people who did not stay, and then they left.*

## 3.2.5 The macrosystem

This level includes factors existing outside the medical learning environment (beyond the medical school, university, or clinical learning environment), but that influence the inner "sublevels" of the framework and the learner. This may include the wider context in which the school exists, including social, political, historical, and global, as well as other factors, such as professional regulatory or curricular requirements.

Several participants had selected into the LIC due to their interest in working in rural environments. In addition to commenting on the experience of learning to work in less resourced communities, learners commented on the impact this lack of resources had, at times, on the overall morale of a community. Learners were also very aware of external political factors occurring during the course of their LIC, for example political work on compensation models for rural physicians and developed their own opinions about the potential effectiveness of these models on physician recruitment.

*P5: I think that physicians in rural Alberta are remunerated fairly, I do recognize that there's an extra bit of stress to the job, not having all these access to specialists, not having access to all the scanners, you think a little bit more during the job. But no one was really ever hurting for money. And I feel like, yeah, it's tricky, because it's very hard to get people to come out and work in a rural community, unless they really want to. ... it's really hard to incentivize people with money. It's like, I say that I want to be incentivized with money, that would be fantastic, if I can get [incentives] in signing stuff. But I recognise that that's not going to retain people who just are doing it for the money, and who will take that two-year contract, and then they'll get out of there. Hopefully, by living there for 2 years, they'll recognise that maybe this is the way to go. But yeah, I do not know, I'm of the opinion where it's like, yes, I love physician compensation in rural areas, because that's what I want to do. But I think it has to be, it has to start a little bit earlier. It honestly has to start at the recruitment for med school stages. You have to just go and recruit rural people, because that's the best demographic who will actually go back and do good on these service contracts.*

### 3.2.6 The chronosystem

The chronosystem considers impacts and changes associated with the passage of time. Continuity was the dominant theme in this area with impacts at multiple levels, across other systems. Preceptor continuity, patient continuity, and community continuity were all highlighted, as important elements of a successful LIC experience. Continuity also had a powerful impact on learners' professional identity formation, learners reported personal changes, growth, and shifts in perspective over time. Likewise, when elements of continuity were disrupted, the impact on the learners' was significant (as an anti-theme).

#### 3.2.6.1 Preceptor continuity was integral in the students' learning

Working with a preceptor over time allowed the development of mutual trust as well as mutual adaptation of teaching and learning styles, and graded independence.

*P11: (We) developed mutual trust by basically being both accountable, so he was accountable for me, I was accountable for him and being accountable for our patients. So, we were both accountable for everyone that we are seeing, which I think is the way it works when you are an actual doctor working in fields, and you are working alongside your. And I think that really – he knew exactly where my learning was at, and could trust me with things that I had clearly demonstrated beforehand. And he, that way he was able to kind of allow, trusted me to be very independent, and that's how we kind of built the trust up between us, and yeah, it worked really well.*

#### 3.2.6.2 Patient continuity was supported by the nature of the LIC experience

Learners emphasized the value of seeing patients over multiple visits and across multiple settings. Learners provided examples that highlighted multiple visits as a strategy to deal with uncertainty, examples of emerging diagnostic clarity. Learners also provided examples of supporting patients over time through grief, challenging mental health issues, and transition between cancer diagnosis and

providing palliative care. We have chosen to describe these instances broadly and not link to specific learner quotes, because the specific nature of these quotes could be identifiable for patient, learner, preceptor, and community.

*P7: I saw somebody who was being worked up for chronic cough and then I saw him at a later time, after using a medication and seeing if it was helpful. Kind of reasoning between asthma and GERD and it seemed to be responsive so more likely GERD. I kind of saw people with consistent depressive symptoms and the progression of that and kind of working with non-responsiveness to medications.*

#### 3.2.6.3 Community continuity subsequently evolved over time as participants felt more integrated

Integration into the community over time allowed learners to understand the role of rural physicians as part of the community. Learners also became involved in community events as they settled into the community over time. Some learners described a process of 'fitting in' to a community and progressively becoming involved in the day-to-day life of the community beyond the work setting.

*P2: I actually think that was a real strength of UCLIC, where we get to ingrain, integrate into our communities, and really kind of learn the needs of the communities and the patients that we support. I think that was a real benefit there. Disease prevention, health promotion, same. I think one of the cool things about rural family, is these are your people, this is your community. You as a rural generalists have an active interest in the health of the people you look after, because they are also the people that you see at PTA meetings or across the hockey pond with your kids.*

#### 3.2.6.4 In some instances, participants described experiencing disruption of continuity

Disruption of continuity with the primary preceptor was among the most significant challenges an LIC learner could face. Learners who had challenging relationships with preceptors went out of their way to develop relationships and continuity with other preceptors. A learner who experienced significant challenges with their preceptor described how they developed a preceptor relationship with another local physician who became a surrogate preceptor.

*P6: I think he has a very busy schedule with the residents, but I think he probably went out of his way the most to make a point of making sure that I got time and experience and reference letters and things like that.*

However, even when learners did find alternate preceptors, the disruption of the continuity relationship with the primary preceptor had impacts that could not be overcome.

*P6: But no matter how many good things happen to you, if you have a bad primary preceptor, it's hard to make up for that.*

Continuity was also disrupted in one community due to wildfire evacuation. An evacuated learner discussed the impact of this, and how UME did not fully appreciate the challenges that this disruption caused.

*P16: I know they wanted to get us back into rotation so quickly when we got here, but that is not what [we] needed, we needed at least 2 or 3 days to be able to just breathe and then have somebody sit down with us and say, “How are you guys doing, what do you think that you are capable of handling, without the threat of you now need to make this up later on.”*

### 3.2.6.5 The LIC experience reinforced participants' professional identity formation

Learners used transformative terms to describe the impact of the LIC on professional identity formation, emphasizing the importance of time spent in the LIC space as providing the opportunity for these reflections. Discussions of professional identity formation were integrated with discussion of readiness to progress to the next level as a resident physician, ability to manage uncertainty, and progressive readiness to take on higher levels of responsibility in patient care.

*P2: It's shone a powerful light on me, for me in terms of what actually mattered to me in my career and in my life. I came out of LIC with a very different perspective on what I wanted to do for my career. And what, how I wanted my work and my life and my, how I wanted those two to interact. And that LIC, I think, in my time in [Rural Community] really solidified, clarified in my mind, a lot of things about what I wanted from my career and my life, that I did not fully appreciate going in. And I feel coming out of it very confident in my residency decision, having experienced those, for a lack of a better word, epiphanies about what I wanted for my life and my career.*

## 4 Discussion

This study used a qualitative data set from a cohort of LIC learners to understand the LIC educational experience from the learners' perspective. Employing Bronfenbrenner's ecological systems theory (12–16, 47) as a framework, the study investigated LIC student experiences across multiple systems within the rural LIC community. Table 5 presents a summary of proposed action responses and suggested interventions by system level to further support experiences of continuity and integration and enhance student learning.

While much of the existing literature on the LIC learning environment has concentrated on the learner-preceptor relationship (48–51), the findings of this study uncovered a previously recognized but poorly acknowledged level of complexity within the LIC learner environment. Although the learner-preceptor relationship was undoubtedly significant, the learning environment, as perceived by the learners, was layered and nuanced, encompassing experiences across various levels of Bronfenbrenner's framework. The learner-preceptor relationship does not solely define the learner experience; rather, the learner's experience of integration across the layers of the framework throughout their journey ultimately determined the quality of their experience.

The demographics of the learner group and their self-descriptions revealed a mature cohort, many of whom have prior professional experience before entering medical school. Their self-descriptions indicated that they are self-directed and prepared to take on a challenge. In the context of this subgroup of the overall UME class, who self-selected into a rural LIC, it is important to consider that this

self-perception may not represent all medical students and that the process of choosing the LIC may select for such personal characteristics. As mature students, many with prior professional backgrounds, individuals may have also had different experiences of key elements of clerkship, including ability to act as a self-directed learner, professional identity formation, and integration into healthcare teams. Although this LIC cohort was typical for our medical school, some caution is warranted in generalizing these results to all learners without regard for their individual backgrounds.

At the microsystem level, the relationship between the learner and the primary preceptor remains central to the overall learning environment experience. Learners' descriptions of this relationship indicate that it evolves over time within the LIC. Various types of relationships were described, including mentorship, coaching, senior-junior colleague interactions, and role modelling. Across a range of relationship constructs, the boundaries and nature of the relationship are framed in terms of professionalism. This suggested that there was not a single successful or desirable learner-preceptor relationship type; rather, it likely evolved to meet the specific needs of both the learner and the preceptor. Furthermore, the data highlighted the value students placed on working with a range of preceptors, which we referred to as a type of 'distributed preceptorship' across a community setting. Historically focus has been on fostering the learner-preceptor relationship, but consideration should also be given to preparing the broader healthcare team to successfully work with LIC learners.

Learners with challenges in the learner preceptor relationship described impacts beyond the relationship itself. One learner, whose primary preceptor was unavoidably absent at the start of the LIC described challenges integrating into the health system and community. Experiencing preceptor discontinuity also made it difficult for learners to gain progressive independence, describing starting from scratch with new preceptors. Some learners experienced philosophical differences with preceptors, which led to introspection and consideration of how they would personally practice in the future.

The microsystem also includes a range of other physicians and health professionals who the learners worked with and alongside. This aspect of the LIC experience was generally positively described as an opportunity to see a broader range of practice and learners generally felt welcomed in these experiences. However, a particular challenge in working with locum physicians was noted, including instances where locums preferred to not work with a learner. Since locums are typically less connected to a community this could represent disinterest in teaching an LIC learner, discomfort with the teaching role, or even unfamiliarity with the concept of LIC. While experiences with locums could be positive, they may be seen as higher risk from the perspective of the learner, who could risk rejection in asking to work with them. Many rural sites are dependent on locums for delivery of clinical services and contact with locums may be unavoidable in the LIC context. We identify this as a specific area to address, including the development of specific resources that can quickly orient locum physicians to the LIC concept, and the role of the LIC learner.

The learners' experience of the learning environment also involved factors beyond the immediate healthcare environment. Maintaining connections to partner, family, and children was an important factor in the overall experience, as was being welcomed into the community in a way that allowed participation in elements of community life. This interconnectivity describes the mesosystem of the LIC, in which these

TABLE 5 Action points to support experiences of continuity and integration in LICs.

| Bronfenbrenner's system level                           | Components/Factors                                                           | Take-home                                                                                                                                                                                                                                                                                                                                               | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Learner                                                 | The Learner                                                                  | <ul style="list-style-type: none"> <li>Students selected for LIC are often self-directed and relatively independent, valuing opportunities for autonomous hands-on learning</li> </ul>                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Make this clear to students, i.e., does this align with their approach to learning?</li> <li>Consider a session on self-directed learning, time management, etc. at orientation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                  |
| Microsystem (immediate environment)                     | Primary preceptor relationship                                               | <ul style="list-style-type: none"> <li>Preceptor selection is key.</li> <li>Preceptors were flexible, tailored learning to the learner.</li> <li>They scaffolded learning to extend comfort zones (zone of proximal development) (52).</li> <li>Preceptors got to know the learner as a person and were engaged in a mentoring relationship.</li> </ul> | <ul style="list-style-type: none"> <li>Carefully select preceptors and support through faculty development.</li> <li>Continuity of preceptorship key, e.g., if planning leave, this should be discussed at central and local level.</li> <li>Supporting open communication, e.g., to enable preceptors and learners to communicate if inter-personal differences to program leadership.</li> <li>Consider faculty development that explicitly outlines idea of scaffolded learning.</li> </ul>                                                                                      |
|                                                         | Working with additional preceptors                                           | <ul style="list-style-type: none"> <li>Students value variation and working with a range of preceptors.</li> </ul>                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>When establishing a LIC placement, it is important for the rest of the clinical team to be aware of their role and how they support (or not) a learner.</li> <li>The role of locums as teachers within LIC requires specific consideration. While these can be valuable learning opportunities, there is considerable variation in locum teaching interest. Consider the development of specific resources that can quickly orient locums to the concept of LIC and the role of the LIC learner for sites using locum physicians.</li> </ul> |
|                                                         | Working with other professionals                                             | <ul style="list-style-type: none"> <li>Same as above</li> </ul>                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Same as above</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                         | Personal relationships                                                       | <ul style="list-style-type: none"> <li>Family and friends play a supportive or undermining role.</li> </ul>                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Make clear to learners how personal relationships are / are not supported through the program, e.g., housing, access to community recreation activities (see below).</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| Mesosystem (linkages and relationships between systems) | Working multiple settings                                                    | <ul style="list-style-type: none"> <li>Working in different contexts helps learners understand how information and knowledge 'flows' across settings to support 'contextual continuities'.</li> </ul>                                                                                                                                                   | <ul style="list-style-type: none"> <li>Ask learners to write a reflection on how working in different contexts in a local community helps foster their understanding of generalist practice.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             |
|                                                         | Exposure to patient continuity                                               | <ul style="list-style-type: none"> <li>Continuity of care is fostered by learners working in different settings.</li> </ul>                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Help students care for a cohort of obstetrical patients and patients with mental health issues can support their understanding of continuity of care.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             |
|                                                         | Social activities with preceptor and local team members                      | <ul style="list-style-type: none"> <li>Social activities play a fundamental role in fostering student integration.</li> </ul>                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>Make explicit to preceptors and teams.</li> <li>Consider 'hosting' /funding a 'welcome' event at the orientation of the student to the community.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                         | Community connections: Role of partner/family<br>Recreational activities     | <ul style="list-style-type: none"> <li>Partner and family help integrate the learner and foster connection to the community</li> </ul>                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Have a 'recreation' activity list/engage a community member to help facilitate getting to know local resources and activities.</li> <li>Consider local gym/recreation pass.</li> </ul>                                                                                                                                                                                                                                                                                                                                                       |
| Exosystem (indirect environment)                        | Factors may include:<br>Lack of clinical resources<br>Geographical isolation | <ul style="list-style-type: none"> <li>Students learn in resource-strained environment</li> <li>Students felt disconnected with UME during their placement due to the geographic distance</li> </ul>                                                                                                                                                    | <ul style="list-style-type: none"> <li>Incorporate the physician advocacy role as an explicit learning objective relating to the rural healthcare environment.</li> <li>Ensure that students have clear ways to connect with UME and urban campus resources.</li> </ul>                                                                                                                                                                                                                                                                                                             |

(Continued)

TABLE 5 (Continued)

| Bronfenbrenner's system level             | Components/Factors                                                                                                                                         | Take-home                                                                                                                                                                                                                                 | Action                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Macrosystem (social and cultural factors) | Socio-cultural factors:<br>Accreditation requirements<br>Supply and demand<br>Models of compensation<br>Professional remuneration<br>Social accountability | <ul style="list-style-type: none"> <li>LIC students acquired deeper understanding and awareness of the geopolitical, socioeconomic issues affecting rural Canada, which in turn impacted their sense of social accountability.</li> </ul> | <ul style="list-style-type: none"> <li>Preceptors should include these issues in teaching and conversation.</li> <li>Ensure that the connection between the LIC learning environment and social accountability is clearly reflected as a curriculum objective.</li> </ul>                   |
| Chronosystem (changes over time)          | Changes related to personal and professional conditions over time: Professional identity formation<br>Preparation for future practice                      | <ul style="list-style-type: none"> <li>Teaching and supervision will change over the course of the LIC to reflect developing professional identity and capacity for independence.</li> </ul>                                              | <ul style="list-style-type: none"> <li>Support preceptors through faculty development, to adapt their approach to teaching and supervision over time with LIC learners, thereby supporting professional identity formation and readiness to transition to postgraduate training.</li> </ul> |

factors are linked together as part of the total learning environment. For instance, learners discussed the importance of housing options that could accommodate family, and integration into community life. Although such factors may be beyond what medical schools traditionally consider in terms of student placements, they were clearly understood by learners as part of a holistic and integrated learning environment. These interpersonal relationships and community connections were integral to the learner's experience.

Concepts of continuity also emerged in the mesosystem. Learners appreciated working across different environments such as clinic and hospital and following patients across multiple settings. Communication and care were enabled by both continuity with patients, and continuity between the learners, preceptors and other healthcare workers, where the learner was a known part of the team, and therefore part of team communications. Broader engagement of communities and municipalities may be a beneficial action to foster connection between LIC learners and the activities and amenities that exist within those communities.

An interesting dissonance arose in examination of the position of UME within the model. Elements of UME such as learning goals and examinations were very much part of the day-to-day life of learners as part of the microsystem, but at the same time students felt distant to UME, and that the UME expectations and learning goals were not always aligned with the day-to-day work in the LIC. Learners indicated a disconnect between the content of their day-to-day learning experiences and the expectations of their examinations. Although learners understood the goals of UME training to be generalist in nature, they also felt that specialist knowledge was prioritized on objectives and examinations and was different than their practical day to day learning. UME was also understood to be interacting with elements of the macrosystem, such as accreditation, that learners felt were a driving force in some of their experiences, such as returning to the urban environment. While UME may be most appropriately placed in the exosystem, it clearly interacts with other exosystem components, like geographical isolation, as well as the microsystem, learning objectives and examinations, and the macrosystem, accreditation.

Learners highlighted disparities between the goals and resources of the urban environment and the realities of rural practice. Learning to work in an environment geographically distant from specialist care, and with limited resources was also highlighted as an important part of the exosystem. Learners understood a 'real world' in their rural

communities, that stood in contrast to the well-resourced urban environment they experienced in pre-clerkship. This resource constrained 'real world' decision making, and the need for practical and patient centered thinking and decisions was felt to be key to working effectively in the rural setting, and while the disparities in healthcare access were noted, this was felt to be an important element of learning for students planning careers in the rural setting.

At the macrosystem level, learners had an awareness of the larger challenges of rural practice, such as workforce shortages, payment models, and burnout. Learners identified finances as being an important factor, but likely not a deciding factor in terms of future work and practice location. Resource disparities in the rural setting were readily identified by learners. Embedding social accountability objectives into the UME clerkship objectives and connecting these to the rural setting could support learning in this area and address the dissonance between specialist centered learning objectives and the reality of the rural setting.

Many of the learner responses across multiple layers of the model reflected the importance of the chronosystem. The LIC was not simply a set experience, but an experience that evolved over the learner's time in the community. The relationship with the preceptor, integration into community, connection with other healthcare workers, as well as independence and development of professional identity were all elements that change and developed across the duration of the LIC. In the LIC setting continuity does not only refer to continuity with patients, or continuity with a primary preceptor, but also to continuity with a community and continuity as part of the healthcare team. This broad concept of continuity seemed to be an enabler of professional identity formation, with multiple learners describing how time in the community allowed them to understand themselves, take on progressive levels of responsibility, and achieve readiness for their next stage of training as residents.

Overall applying Bronfenbrenner's ecological systems theory to the learning experience of the LIC reveals a layered, interconnected, and complex experience. Use of the model helps to unpack the LIC, expanding the range of recognized participants and interest holders in the process. While medical schools have been generally supportive of LICs, there may be an opportunity to better align exams and learning objectives more closely with the day-to-day experiences of rural generalist practice. Additionally, consideration should be given to engaging beyond the preceptors and healthcare workforce, facilitating a supportive learning environment within communities

that allows learners to become a part of the community over their time in the LIC.

## 5 Strengths and limitations

The high participation rate of the LIC cohort is a key strength of the study. With a majority of LIC learners participating there is greater likelihood that the full range of viewpoints was captured in the study. The breadth of experience of the research team, including individuals highly involved with LIC as well as individuals more distant from LIC ensured a range of perspectives on the team and is also a strength.

There are also limitations of the study that may limit generalizability. This is a single institution study and a single cohort. The LIC learners were a mature group of students, many with prior professional careers, which may limit generalizability to medical students who are younger, with less prior professional experience. The cohort's maturity and professional experience may have impacted their ability to interact broadly in the LIC setting and to form professional relationships beyond the primary preceptor relationship. Although we have tried to mitigate potential bias, the self-selected nature of the LIC cohort, and the rural medical education interests of the research team represent a group of people who likely have an overall positive outlook on rural medicine and rural medical education.

## 6 Conclusion

This qualitative analysis of the learning experience of a cohort of LIC learners revealed the complexity of the LIC learning environment. The centrality of the learner-preceptor relationship, highlighted in previous research, remains, but the importance of adjacent preceptors, the healthcare team, and integration into the community emerged as description of the entire learning experience. The importance of the primary preceptor as a connector to both the healthcare team and to the community deepened the understanding of the importance of this relationship. This analysis has broadened the concept of continuity in the LIC context, to also include community continuity alongside patient and preceptor continuity and emphasizes continuity as an enabler of professional identity formation in the LIC context.

The learners in this study demonstrated awareness of high-level issues including social and political factors impacting the healthcare environment and the challenges of UME administrative structures connecting to learners across significant geographic distances.

Bronfenbrenner's model of ecological systems applied to an LIC environment allows a deeper understanding of the interplay between factors at different levels, and for the development of an LIC specific model, which may be of interest to LIC leaders and researchers.

## Data availability statement

The datasets presented in this article are not readily available because of the nature of the placements. Only one or two LIC students are placed in the clinical sites, hence, the interactions and other situational experiences mentioned by the participants in the transcripts could make the individual personalities involved easily

identifiable, despite applying great amounts of anonymization. Further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by University of Calgary Conjoined Health Research Ethics Board, with approval certificate number REB23-0739. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because the participants were interviewed. At the beginning of the interview, the authors explained the purpose of the research and asked the participants if they agree. The participants provided expressed consent to be included in the study.

## Author contributions

MK: Writing – original draft, Visualization, Formal analysis, Validation, Methodology, Writing – review & editing. GP: Project administration, Formal analysis, Methodology, Data curation, Writing – original draft, Writing – review & editing, Conceptualization, Visualization, Validation. RR: Formal analysis, Conceptualization, Methodology, Validation, Writing – review & editing, Investigation. NB: Conceptualization, Writing – review & editing, Investigation, Data curation, Methodology, Formal analysis. AK: Formal analysis, Validation, Writing – review & editing. AJ: Supervision, Formal analysis, Writing – review & editing, Methodology, Conceptualization, Writing – original draft, Visualization, Funding acquisition, Validation.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1609051/full#supplementary-material>

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# Development and innovation in a new distributed medical programme: Scottish Graduate Entry Medicine (ScotGEM)

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**Introduction:** Addressing the shortage of primary-care physicians, especially in remote and rural areas, is a crucial target in many countries. This article introduces the Scottish Graduate Entry Medicine (ScotGEM) programme: a compressed, tailor-made curriculum designed to equip and enthuse its graduates to practice generalist and rural medicine in Scotland, within the ethos of socially accountable medicine.

**Methods:** This curriculum paper describes ScotGEM in sufficient detail for the reader to translate elements to their own context. It then collates findings from evaluations, research projects and many critical discussions about the programme. This work is used to describe and evaluate the curriculum design and delivery, with a focus on the distributed aspects.

**Results:** Three key innovations of the curriculum are explored in detail: the Generalist Clinical Mentor (GCM) role; the year-long primary care Longitudinal Integrated Clerkship (LIC); and the Agents of Change curriculum. There are early signs that ScotGEM is encouraging generalist, rural careers within Scotland. There is also growing evidence of the benefits ScotGEM faculty and students bring to the clinical workforce in the distributed settings.

**Discussion:** Distributed programmes require additional organization for students and faculty. Partnerships can be challenging but immensely rewarding. Healthcare partners in rural areas need to be involved early in planning and strong relationships fostered with local “champions.”

## KEYWORDS

distributed training, undergraduate medical education, rural and remote areas, Scotland, family medicine and general practice, social accountability

# 1 Introduction: background and rationale for the educational activity innovation

Addressing the shortage of primary-care physicians is a growing concern in many countries (1). In Scotland, United Kingdom, these shortages amount to a crisis (2). Recruitment into the specialty of General Practice (Family Medicine) is below sustainable levels (3, 4). Poor retention is also a key issue, with many General Practitioners (GP) taking early retirement or leaving the profession (5). Shortages are particularly stark in rural areas, where primary care is often very heavily relied upon (6). Increasing the GP workforce in Scotland across underserved areas is fundamental to the functioning of the state-funded National Health Service (NHS) and thus to maintaining the health of the nation.

Addressing workforce shortages, and the factors causing these, is central to Scottish health and social care policy (7). This response was strongly informed by two key reports that provided guidance and strategies for medical schools to encourage and support their graduates into general practice, including increasing the amount of GP teaching to undergraduate medical students (8, 9). In parallel, the government increased the number of medical places in primary-care focused courses in Scotland by 22% over 5 years (10).

Beyond activities to increase and retain the workforce, there has been a drive to make healthcare more compassionate, safe and sustainable for patients and staff. This is spearheaded in Scotland by the initiative of Realistic Medicine, introduced in 2014–15 (11), now in its eighth version “Taking Care” (12). This resonates with international initiatives such as “Prudent Healthcare” in Wales (13) “Slow Medicine Italy” (14) and “Choosing Wisely” in the United States (15). A foundation of this approach is developing a generalist medical workforce (16).

As part of all these directives, a Scottish Government initiative was launched in 2016 to create a new medical programme focused on educating students for generalist, rural practice in Scotland, who would also contribute to socially accountable and sustainable practice (17). From this, the Scottish Graduate Entry Medicine Programme (ScotGEM) was created and accepted its first intake in 2018 with the stated mission:

*To produce top quality, adaptable, compassionate, generalist doctors who will help drive change in the delivery of healthcare across Scotland.*

Scottish Graduate Entry Medicine is a distributed programme with students and faculty studying and working across four partner Scottish Health Boards (NHS Highland in the north, NHS Fife and NHS Tayside centrally, and NHS Dumfries and Galloway in the south) as part of a programme led by the University of St Andrews and the University of Dundee. It is also Scotland's first graduate-entry only medical programme and offers a compressed, tailor-made curriculum designed to equip and enthuse its graduates to practice generalist and rural medicine in Scotland, within the ethos of socially accountable and realistic medicine.

This article describes ScotGEM's novel curriculum to offer insight into how it utilizes distributed training innovations to achieve these aims, and to share practical considerations.

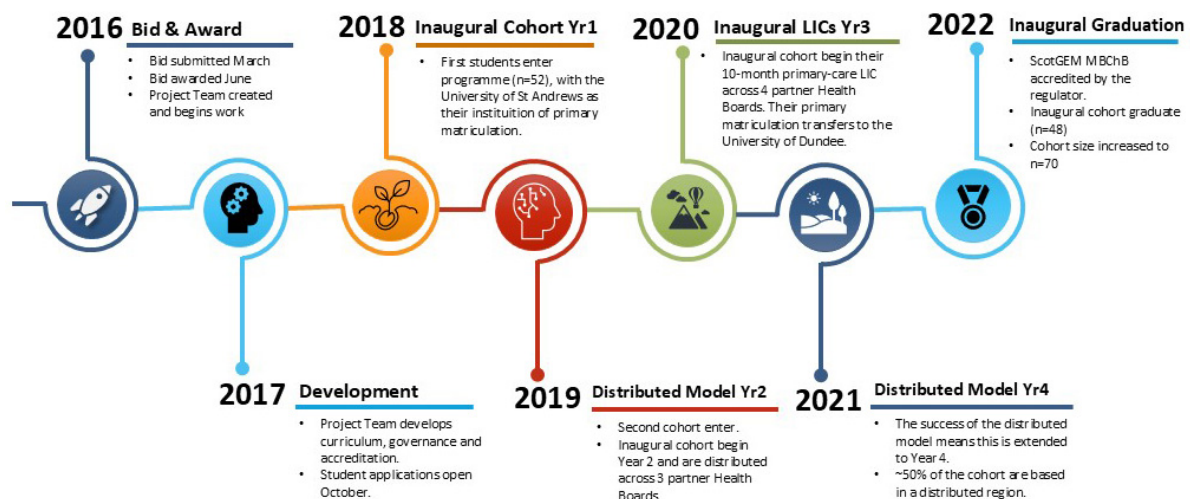
In doing so, we aim to contribute understanding about how innovative curricula for distributed programmes may be developed and implemented for the benefit of students, clinical practices, workforce distribution and rural communities.

## 2 Pedagogical framework(s), pedagogical principles, competencies/standards underlying the educational activity

The ScotGEM proposal was developed in response to the Scottish government's call for bids to provide a new 4-year graduate medical programme for Scotland. It was finalized over approximately 6 months, submitted to competitive tender in March 2016, and awarded in June 2016. Over the following 2 years, the detail of the curriculum was developed at unusual speed by a project team led by the two medical schools and in conjunction with the four partner NHS Health Boards and the University of the Highlands and Islands (UHI). At the Scottish Government's request, and with the support of the United Kingdom Medical Regulator the General Medical Council (GMC), standard approvals processes were expedited to accredit the course. Applications opened to students in October 2017, with the first cohort ( $n = 52$ ) entering in September 2018 (Figure 1).

Curriculum design and approval, as well as advertising and recruitment, were done under immense time pressure. Thus, drawing on existing expertise from external policies and existing curricula, as well as at the founding partner institutions, was essential to develop the cornerstones of the novel curriculum. For example, the community-led and rurally based educational approach drew heavily on recommendations within the aforementioned “By Choice Not Chance” report (8). Visits to learn about the University of Melbourne's and Flinders University's rural community based Longitudinal Integrated Clerkship (LIC) provided insight into how these ran in established settings and convinced the team to make this an integral part of the ScotGEM bid. Valuable learning from delivering these in the local context was also gained from the general practice curriculum at the University of Dundee, which already included an optional year-long rural LIC for a small number of students. This LIC was evaluated via staff and student feedback (18) as well as a published qualitative study using interviews and focus groups with students ( $n = 7$ ), health service staff ( $n = 4$ ), GP tutors ( $n = 21$ ) and reflective audio-diaries kept by all students (19). Later, a key supportive relationship was established with Prof Roger Strasser of Northern Ontario School of Medicine when it transpired that their well-established curriculum that had several strong similarities to ScotGEM (20, 21).

It was decided that the curriculum's underlying pedagogy should be constructivist, aiming to build students' learning based upon their existing knowledge, experiences in the course and reflection. A review of the literature and visits to the University of Warwick and University of Southampton graduate entry courses helped to select and develop Case Based Learning (CBL) as the best approach in the first 2 years. This was mapped into a framework of intended learning outcomes (ILOs) (22), which drew extensively on the GMC's required Outcomes for Graduates



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FIGURE 1

Timeline of ScotGEM development and inaugural cohort.

(23, 24) as well as all the United Kingdom medical Royal Colleges undergraduate learning outcomes lists [see, e.g., (25)]. This led to the development of an extensive 3D matrix from which 54 CBL scenarios and other activities were identified, with ILOs distributed systematically across them.

The original ScotGEM proposal presented a distributed approach in two key regards. First, with two universities offering a joint programme in which students enjoyed joint matriculation (and access to facilities) throughout, but primary matriculation lay with St Andrews in years one and two, Dundee in years three and four. This was key as it determined what regulations applied when. Secondly, the bid included partnerships with four geographically dispersed largely rural NHS Health Boards and a proposed full year GP LIC. This was well received by the Scottish Government. Although complex to establish, the resulting collaboration was also strongly supported by the NHS Education Scotland funding allocation process and promised to generate fresh enthusiasm and thus capacity for undergraduate teaching within these diverse locations.

The proposal submitted to the Scottish government bid for 40 student places on ScotGEM, and 55 were awarded when the bid was accepted. This increased again to 70 places in 2022. It was decided to accept graduates of any discipline, as the emerging evidence base supported this (26), leading to an admissions process that utilized two distinct components. Academic aptitude, including a scientific knowledge base, was assessed by the Graduate Medical School Admissions Test (GAMSAT). This was followed by a 10 station Multiple Mini Interview (MMI) that, in part, favored those seeking a generalist focused, distributed course and mature applicants. For an analysis of Dundee Medical School's experience of MMIs, see Dowell et al. (27).

For a new course in a highly regulated profession, appropriate standard setting and quality assurance was a key focus. For ScotGEM, this was facilitated by access to the two parent Medical Schools' examination question banks and assessment systems, including the existing progress test operated by the University of

Dundee Medical School. This enabled ScotGEM to operate annual stage appropriate summative exams and offer a yearly formative assessment to illustrate the standard required by the end of the programme to students. Once ScotGEM students reached the end of their third (penultimate) year it was possible to make direct performance comparisons with the fourth-year students on the standard-entry University of Dundee course (also completing their penultimate year). This is a key milestone of the course, when students are required to sit the Applied Knowledge Test (AKT) of the GMC Medical Licensing Assessment (28).

The regulatory burden on ScotGEM's development was significant. As a new programme developed under the aegis of two universities, it was subject to the review and approval of both, as well as the standard GMC regulatory processes and the NHS Education Scotland quality assurance procedures. These processes were onerous, but reassured stakeholders that the intended and actual educational delivery was appropriate and of an acceptable standard. Additional external guidance was provided by Prof Val Wass, Professor of Medical Education in Primary Care at University of Aberdeen, and Dr Paul Garrud, founding Director of the Derby Graduate Entry Medicine programme. They also engaged in a mock quality assurance panel in advance of the formal processes.

### 3 Distributed learning environment (setting, students, faculty); learning objectives; pedagogical format

The Distributed Learning environment for ScotGEM is important, not just for high quality learning, but to support the mission to develop generalist, rural clinicians through appropriate and sustained clinical exposure to these settings and the clinicians within them (29, 30). This ethos led to the development of the Generalist Clinical Mentor (GCM) role and the Agents of Change

curriculum, which are embedded within all years of the course (described below). Students also complete a portfolio across the 4 years with the support of one consistent faculty member as a supervisor, complementing ScotGEM's emphasis on longitudinal learning. The portfolio plays a key role in supporting students to develop as professionals and demonstrate professionalism.

Clinical exposure takes place from the first week of the course. In the context of CBL, a bespoke Clinical Interactions Course (CLIC) was developed to teach clinical and communication skills across the first 2 years of the programme. This is delivered on a weekly basis, largely by GCMs (see below) who then take their small group of ( $n = 6-8$ ) students into their own practice to apply and develop their knowledge in a real-world setting. In Year 1, weekly CLIC teaching is based in the Clinical Skills Center in the University of St Andrews. From Year 2, the students are dispersed across Scotland rotating between three of the four partner Health Boards: NHS Highland in the north, NHS Fife centrally, and NHS Dumfries and Galloway in the south. This exposes students to the myriad of settings where healthcare is delivered as well as to different approaches to learning (e.g., small rural Health Boards do not have purpose built Clinical Skills suites but have embraced the opportunity to develop effective learning using existing environments, including study and social spaces for students, often shared with postgraduate medical and other healthcare learners). Students report that the consistent and high volume of patient interaction helps to prepare them for their time as residents, and that exposure to the patient journey in a range of settings provides a more holistic view of patients, as reflected in this excerpt from an independent Visit Report by the United Kingdom medical regulator (GMC) on ScotGEM 2018–19.

*In particular, students value the contact they have with patients from the very beginning of the course and told us that they feel comfortable interacting with real patients already (31).*

A learning point for the delivery team was the appreciation of the additional communication, organization and logistics that distributed programmes require, and the importance of shared decision-making and open communication channels. Clear communication with applicants and entrants is also important: students need to be prepared for the implications of a distributed programme, including financial (see e.g., an independent student opinion piece (32)). To support with finances, all students are offered a bursary, and many are eligible for a fee reduction or waiver (33). Particularly during the initial years, whilst university and regional staff were getting used to the new curriculum, the feedback from students and clinicians was essential to refine the fit of processes and policies. For example, see this excerpt from an independent Visit Report by the GMC on ScotGEM 2020–21.

*Year two students told us that the clinical exposure they had so far had been fantastic. They stated that they were still going into practices to meet with their GCMs and they felt this experience was valuable. Students told us some placements felt slightly disorganized, with staff not knowing the students were supposed to be there when they arrived, they have fed this back to the schools and things improved (34).*

Except for their University of Dundee induction week, Year 3 students are based in an assigned general practice for the academic year (10 months) during their LIC. Integration into the practice environment and team is essential to successful learning and thriving, particularly in remote and rural settings. Students are dispersed across the country from the Orkney Islands in the north, to the south-west corner of Scotland (see Figure 2). The LIC experience is explored in detail below.

In the final year (Year 4), ScotGEM students follow the same curriculum as the students in the final year (Year 5) of the MBChB course at the University of Dundee. Although it was originally envisaged that all final year students would be based at the School of Medicine in Dundee, the success of the distributed model in the earlier years led to students requesting, and being offered, the opportunity to spend their final year in one of the other partner Health Boards. Around 50% of each cohort have chosen this option to date. The differences between the experience of students in the distributed settings and those centrally include:

1. Smaller groups in distributed settings can facilitate clinical experience, knowledge of individual students and possibly individualized support.
2. Preferences for clinical placements (Students Selected Components or SSCs) may be more effectively tailored to learning needs in distributed settings, because of the smaller numbers.
3. Centrally located students have a teaching hospital experience unlike the distributed students. All students have one 4-week Acute Care Block in a teaching hospital to help address this potential inequality.
4. Centrally located students can “benchmark” against their “equivalent” University of Dundee students. All settings may offer a similar opportunity in relation to students from other Scottish programmes.

## 4 Results to date/assessment (processes and tools; data planned or already gathered)

With an original curriculum, as well as clear mission and political drivers underpinning the establishment of ScotGEM, evaluation of the course is imperative. In this section, we consider the development of three key innovations through which ScotGEM's mission has been operationalized: the novel GCM role; a year-long primary care LIC; and the Agents of Change curriculum. We also report on the initial workplace impacts of the programme – careers intentions and decisions for the first cohorts, and the benefits ScotGEM faculty bring to the clinical workforce in the distributed settings.

We employed a dialogical approach to explore the development and impact of ScotGEM, and to build the claims presented in this paper. This involved regular interactions between the authors where we discussed and critiqued aspects of the course, collated evidence, and decided which elements to include. Within this process we were mindful of making assumptions, given that almost all authors are “insiders” to the programme. FG, JD, AO'M, RS,

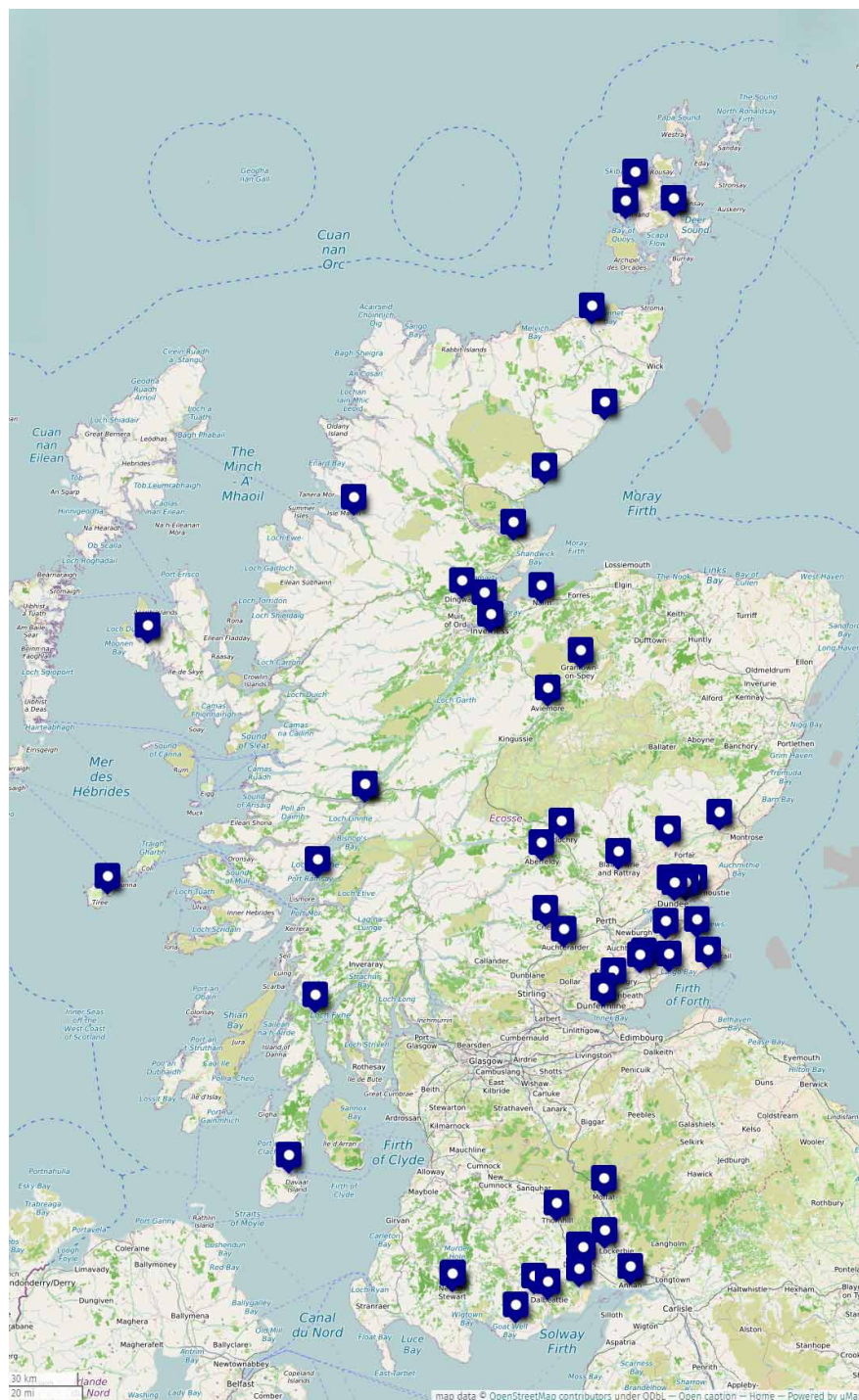


FIGURE 2

Distribution of ScotGEM LIC practices 2023–24.

LT, FS were deeply involved in the initial development and set up of ScotGEM, and FG, JD, AF, AO'M, RS, LT, KA contribute, or have contributed to, its current delivery and development. AMacF provides the perspective of a ScotGEM student from the inaugural cohort, who graduated in 2022 and is now in postgraduate training. Although this intimate knowledge of the programme permitted more nuanced understandings and analysis, we also acknowledge that our experiences inevitably influence our interpretations and

that an (unconscious) desire to present facts in a certain light might be at play. Thus, to mitigate potential bias, we practiced a reflexive approach. This involved regular discussions to critique others' claims and critical reading of each other's written contributions. SG provided an external view, as she is involved in medical education at the University of Dundee, but not within ScotGEM. We also required that citable evidence was provided to support claims and could ideally be triangulated. This evidence comes

from a variety of sources including published studies, independent regulatory reports, internal evaluations and informal feedback. When referencing this evidence, we have included brief details in the text to allow readers to judge its likely reliability and scope.

## 4.1 The generalist clinical mentor (GCM)

The GCM role, conceived for the ScotGEM programme, involves employing clinical generalists in a multi-dimensional clinical-academic role providing mentorship, teaching and clinical services within university and affiliated clinical teaching practice settings (35). This aims to leverage the positive impact that longitudinal mentorship (36) and role-modeling can have on students' eventual career decisions (37), whilst also helping make the programme socially accountable by supporting the local clinical services, which are often in underserved locations.

General Practitioners were targeted for the role as they exemplify community-embedded generalists, able to provide an authentic learning experience that aligned with the case-based curriculum (9). GCMs are supported to provide this multi-dimensional role, through enhanced induction, and continuous professional development opportunities. GCMs were recruited through open competition (interview, with Health Board and University representatives on the selection board), with the option of University, NHS or partnership contracts. This flexibility was felt to be important, but most applicants elected for NHS contracts due to pension considerations. Criteria for the role were broad, but all GCMs had to be established, independent clinicians, to enable effective embedding within host clinical sites. Formal medical education experience and qualifications was desirable, but not essential, recognizing the importance the programme placed on mentorship and role-modeling, which could be demonstrated through various means. To mitigate against the variable backgrounds of candidates, an 8-week induction programme was arranged for all GCMs, as well as fortnightly educational meetings (with hybrid options for colleagues in rural locations), an annual quality review meeting (in-person, with social and networking opportunities), generous CPD opportunities, and a half-day per week for discretionary development work. At steady state, forty-one GCMs were employed across the four partner Health Boards, all on less-than-full-time contracts. Retention in the role has been high, with formal and informal feedback crediting combined clinical academic contracts as the principle reason for this. A potential detractor from the sustainability of the role was an initial lack of progression relating to academic rank, however, some GCMs have now been appointed to medical education leadership roles e.g., in clinical skills and within partner Health Boards.

Students learn with their GCMs in small groups (4–8 students) throughout all years of the course, however, the group size, frequency, contact-time and duration of the sessions vary (see Table 1). Small groups provide students with significant time with their GCM (up to 40% of academic contact time in Years 1 and 2). Drawing on a master-apprentice model, GCMs provide weekly practice-based clinical contextualization during the compressed CBL medical curriculum (38).

In contrast to the literature on goal-orientated group mentorship, the ScotGEM GCMs are embedded within the programme and have a longitudinal interaction with small groups

of mentees, but with a general rather than a specific goal (36). The aim of this style of general mentorship is to provide longitudinal role-modeling in multiple settings (e.g., clinical skills laboratory, clinical practice, tutorials), whilst also developing a meaningful and trusted relationship with the mentee. The GCM model has received positive feedback since the inception of the course, and remains critical to the successful delivery of the programme. For example, see this excerpt from an independent Visit Report by the GMC on ScotGEM 2018–19.

*Generalist Clinical Mentors are a valuable part of the programme and students were very positive about their experience of learning with them (31).*

The GCM role changed as per the requirements of the programme. In Year 1 and 2, GCMs deliver clinical, communication and procedural skills teaching to small groups, whilst also contextualizing this learning with real patients each week in their host clinical environment. In Year 3, the GCMs provide weekly small group teaching, facilitation and support for students on longitudinal integrated clerkships. In Year 4, the GCMs provide monthly small group half-day release, with a focus on professionalism, preparedness for practice, and generalism (see Table 1 for frequency and duration of the small groups).

Throughout all years, the GCMs provide informal support to their students, as well as delivering multiple other functions including recruitment, assessment, career-advice and supervision, scholarship, research and programme evaluation.

## 4.2 The longitudinal integrated clerkship (LIC)

The LIC was integral to the ScotGEM bid, given the potential of LICs to aid the recruitment and retention of a sustainable workforce (39) and the increasing evidence that LICs provide high-quality education, build students' generalist skills and develop their sense of social accountability (40, 41). The continuity of care and long-term relationships with patients and mentors, and prolonged exposure to the challenges and rewards of living and working in these settings, are key factors contributing to these positive outcomes (42, 43). The ScotGEM LIC is a year-long primary-care placement, designed to fulfill the criteria of a "comprehensive LIC" (44), and includes practices in Scotland's most remote and rural areas (see Figure 2). The LIC in its current form began as a pilot project within the standard-entry University of Dundee Medicine Programme (18). The University and NHS teams worked closely together to identify and recruit local GP practices who could take part in the LIC model. With the advent of ScotGEM, the number of students in the LIC has increased from 8 students at the height of the pilot in 2018, to around 75 students in 2025. To support this significant increase in numbers, partner Health Board-based clinicians have been appointed to lead on practice recruitment, working closely and collaboratively with the university team. This local knowledge base and contact is crucial to the identification of suitable practices and to the processes of engagement and support in distributed settings.

Building and maintaining strong relationships with practices has been vital to the success of the LIC. Initial data from internal

TABLE 1 Generalist Clinical Mentor (GCM) group size, frequency and duration per academic year.

| Cohort | GCM group size | Frequency of small group     | Duration of small group | Duration of academic year |
|--------|----------------|------------------------------|-------------------------|---------------------------|
| Year 1 | 6–8            | Weekly, for 12 h over 2 days | 15 weeks                | 30 weeks                  |
| Year 2 | 4–8            | Weekly, for 12 h over 2 days | 6–18 weeks              | 36 weeks                  |
| Year 3 | 6–8            | Weekly, for 4 h              | 40 weeks                | 40 weeks                  |
| Year 4 | 6–8            | Monthly, for 4 h             | 40 weeks                | 42 weeks                  |

TABLE 2 Key themes and formats of assessment within Agents of Change.

| Key theme                    | Focus of student learning                                                                                                                                                                                                           | Format of assessment (Year of students)                                                                                                                                                                    |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Service learning             | To engage directly with the communities where they are based to develop a deeper understanding of community engagement and the social determinants of health, including access to care, health literacy, and environmental factors. | Year 1: Service-Learning placements and projects<br>Year 3: Community engagement projects                                                                                                                  |
| Healthcare informatics       | To learn how to harness data analytics, electronic health records, and other technologies to support clinical decision making and with whole systems thinking approaches.                                                           | Year 1: Prescribing audit<br>Year 2: Critical Appraisal Journal clubs                                                                                                                                      |
| Quality improvement          | To develop the skills and mindset to identify and implement continuous improvement in a range of healthcare settings.                                                                                                               | Year 2: Group quality Improvement project<br>Year 3: Individual healthcare improvement projects; Significant event analysis<br>Year 4: Healthcare improvement projects; Adverse event review               |
| Prescribing and therapeutics | To develop the skills and knowledge to reduce medication errors and improve therapeutic outcomes.                                                                                                                                   | Year 1: Prescribing project<br>Year 2: Quality Improvement project<br>Year 3: Healthcare improvement projects; Significant event analysis<br>Year 4: Healthcare improvement projects; Adverse event review |
| Public health                | To enable decision making based on evidence, patient circumstances, and clinical guidelines to address population-level health challenges                                                                                           | Year 1: Prescribing audit<br>Year 2: Critical Appraisal Journal clubs<br>Year 3: Healthcare improvement project<br>Year 4: Healthcare improvement project                                                  |

evaluation shows a high GP practice retention rate with an average of 85% of practices continuing to take students year on year. Practices particularly value the mentorship aspect of having a LIC

TABLE 3 A graduate perspective.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The geographical spread of the course is key in expanding the career horizon of students who live, work, learn and explore different regions of Scotland. It removes a strong negative factor in choosing rural generalism embedded in the traditional medical education course design – the unknown of working and living in a rural setting in Scotland. ScotGEM students know what living in a rural setting looks like, and the opportunities and benefits it can afford to their professional and personal life. Moreover, in the early years, students form communities of practice with their peers and are supported by a GCM who can act as a powerful positive role model in developing an interest in rural generalism. Although many ScotGEM students and recent graduates may still be undecided about their eventual career path, it may be that the choice to live and work rurally can be made with a confidence that graduates from other courses lack. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

student for the year, as well as positive patient experiences of being involved in medical education. As students develop their competence and skill over the LIC year, many practices feel that their LIC student positively contributes to clinical workload capacity as the year progresses. ScotGEM faculty undertake regular quality assurance visits to GP practices to identify areas of good practice and support any areas needing development. These visits form part of the wider, regular, interaction with GP tutors and practices, which includes in-person and online tutor development activities to build and maintain ongoing relationships.

The presence of LIC students in GP practices can also have a positive impact on patient and clinician experience. Evidence from a phenomenological, cross-sectional qualitative study involving semi-structured interviews with patients ( $n = 5$ ) who had experienced several contacts with LIC students via the Dundee LIC pilot, described how LIC students can empower the patient during consultations (45). The first cohort of ScotGEM students undertook their LICs during the height of the Covid-19 pandemic, which posed unprecedented new challenges with social distancing, significant changes to consultations and staff redeployment. A research study of the experiences of ScotGEM GP tutors during this turbulent time provides important lessons for the organization and delivery of LICs (see (46), an inductive thematic analysis of interview data with  $n = 8$  GP tutors across varied practices in Scotland). In keeping with the published literature, [see e.g., (47)] feedback from ScotGEM LIC practices report students becoming part of the practice team, leading to increased motivation among staff and an enthusiasm on teaching and learning [McElhinney et al., in preparation<sup>1</sup>, a qualitative research study drawing on interview data with LIC GP Tutors ( $n = 8$ )]. The inclusive, supportive relationship between

<sup>1</sup> McElhinney Z, Alexander K, Hoskison G, Barlett M. 2025. It makes you up your game, and so it should: The impact of hosting a LIC student on GP tutors clinical practice. School of Medicine, University of Dundee.

preceptors and students also reassured educators of the efficacy of the LIC for students during early external quality assurance of the programme. For example, see this excerpt from an independent Visit Report by GMC on ScotGEM 2021–22.

*Year three students spoke very highly of the support they have received on placements during their third year. Students told us that whilst they were initially nervous of the transition to the third year, they felt incredibly supported in the transition. Students praised the support they received from the clinical teams whilst on placement, for both primary and secondary care (48).*

The year, however, has required refinement. By design, LICs allow “white space” to allow students to independently direct their learning and focus on their own learning priorities and goals (49). When designing the course, the project team followed evidence that this flexible and self-directed structure would be the style of graduate-entrants well (50). Subsequently only 60% of the 40-hour work-week is timetabled, with students arranging their own secondary care placements, portfolio work and self-study in the remaining 40%. A published thematic analysis of interview data on how ScotGEM students ( $n = 13$ ) utilized their “white space” (51) revealed that although some students thrived on the opportunity to personalize their learning and juggle other commitments, others required more direction to effectively organize and make use of learning opportunities. Subsequently, the dedicated resource for support for students in the LIC year has been increased, whilst the amount of portfolio assessment during this year has been reduced. The intent is to allow students more time to use their “white space” effectively. We also plan to provide more direct organization of secondary care learning experiences, ensuring that students in each setting undertakes a broadly similar number and range of hospital-based learning experiences.

### 4.3 Agents of Change

ScotGEM’s underlying social accountability ethos led to the inclusion of an Agents of Change (AoC) strand of the curriculum. This aims to support students to develop the skills, knowledge and mindsets to drive positive change in diverse healthcare systems throughout their medical careers. AoC is spiral curriculum that revisits five key themes with increasing complexity: service Learning; Healthcare Informatics; Quality Improvement (QI); Prescribing and Therapeutics; and Public Health (see Table 2). By embedding these elements into medical training, ScotGEM aims for students to have the competence and confidence to become active agents of change in their medical careers.

The distributed nature of the programme provides a unique advantage in engaging healthcare providers and communities. Conducting AoC projects within real-world environments (e.g., GP practices, hospital wards, community settings), offers students the benefits of experiential learning (52): valuable insights into the realities of healthcare delivery across and beyond traditional clinical environments, and the varied challenges faced by healthcare systems and communities. For example, from the first semester of Year 1, students are introduced to the concept of Service Learning (see Table 1). During the LIC year, when students are distributed

across Scotland (see Figure 2), students are required to engage with the community in which they are based through a service-learning project which supports development of an understanding of the social determinants of health and a holistic approach to patient care (53). Students can follow their own interests and local health or social needs to choose a project and how to engage. ScotGEM students have run lifeboat stations, volunteered in youth groups, community fridges and LGBTQ + groups, supported community initiatives from cinemas to wild swimming and mentored aspiring doctors. The aim of these activities is to position students as role models and support essential services, helping revitalize these areas whilst they develop as holistic professionals. Working on projects with diverse patient populations may help students gain varied medical experience about individual patient care but also learn to tailor this care to meet the unique needs of various communities and improve community health outcomes. An ongoing mapping process facilitates a continuous and agile assessment of how the curriculum and its implementation meets its educational goals and adapts to the evolving healthcare landscape.

In line with the principles of Realistic Medicine (12), the competencies taught through AoC are vital to ensure that future doctors can lead efforts to reduce medication errors, improve therapeutic outcomes and deliver quality, value-based medicine. QI principles are embedded throughout the curriculum to help students develop a mindset focused on continuous improvement (see Table 1). QI project initiatives encourage students to design and implement projects that are practical, meaningful and responsive to the complexities of modern healthcare. In their LIC year, ScotGEM students are supported to undertake a mandatory, substantial healthcare improvement project whilst in their practice, which can also lead to evidenced improvements in clinical practice and patient care [see e.g., two published studies reporting findings from these projects (54, 55)].

### 4.4 Workforce impact

How close is ScotGEM to achieving its aims? In the United Kingdom, doctors must undertake 4–6 years of undergraduate education, 2 years of Foundation training and at least 3 years of postgraduate training before they are considered fully qualified specialists or GPs. Additionally, in the United Kingdom, a third of doctors plan to leave the NHS after completing their Foundation or postgraduate training (56). This further increases the duration between graduation and completion of specialty/GP training. Individuals from the first graduating cohort of ScotGEM, who have not experienced any delays or breaks, are only now eligible for specialty/GP training. Consequently, available data remains limited. However, early indications indicate significant positive impact in relation to the primary objectives of the ScotGEM programme.

Data from recent ScotGEM student surveys of career intentions indicate that 83% of graduates aim to remain in Scotland, 80% plan to pursue a career in General Practice, and 50% intend to work in rural or remote areas (57). These surveys are sent routinely throughout students’ time on the course to capture intentions longitudinally. Although the data also show students are commonly still undecided about their career, overall, 89% intend to pursue a

career aligned with one of the programme's three key performance indicators, which are to either remain in Scotland, work as a clinical generalist, or practice in remote/rural environments.

Initial graduate destination data collected by the United Kingdom Foundation Programme (UKFPO) similarly supports these trends: so far, each year 87%–90% of ScotGEM graduates remain in Scotland for the subsequent year for Foundation Training. In comparison, a retrospective cohort study (58) indicates 73% (613/841) of Scottish medical schools' graduates remain in Scotland at this point. Unpublished data suggests that these trends continue, with data from 2024 showing 90% of ScotGEM graduates remained to work in Scotland, in comparison to 74% from all Scottish Schools. Furthermore, among graduates from the inaugural cohort who were contactable 2 years after completing foundation training ( $n = 27$ ; response rate 64%), 90% continued their training in Scotland. 44.4% “strongly agreed” or “agreed” that living and working in a rural area was important to them (*we thank the UKFPO, personal communication, 2024, for sharing this data*).

Longer term follow-up using the United Kingdom Medical Education Database (UKMED) (59) will enable us to better understand the patterns and complexities of ScotGEM students' career intentions and destinations.

One aim of ScotGEM, to drive change in the delivery of healthcare in Scotland, extends beyond positive outcomes for the students. The distributed nature of ScotGEM has supported the development of academic clinicians in remote and rural areas across primary and secondary care which is a policy goal (60). The development and appointment of GCMs as the lynchpin of student learning has led to a new cohort of educators in the partner Health Boards, who are simultaneously supporting the clinical workforce. For example, in NHS Fife (serves a population of 370, 000, with no major urban center), the GCM model currently provides an additional 4.2 full-time equivalent of GP service into the health system (across 20 GP practices) alongside additional contributions to secondary and unscheduled care.

As of 2025, the LIC engages 78 medical educators as GP tutors in 57 GP practices across Scotland. Scores of primary and secondary care clinicians have become involved in ScotGEM as block leads, specialty leads, Student Selected Component supervisors, portfolio supervisors, professionalism tutors and QI Project supervisors. Additionally, many more clinicians in rural areas have become involved in teaching, examinations and admissions, and are planning, or undertaking, professional development such as qualifications in medical education.

## 5 Discussion on the practical implications, objectives and lessons learned

The innovative ScotGEM programme is proving successful in producing flexible, compassionate, high-quality graduates. There are early signs of its effectiveness in encouraging generalist, rural careers within Scotland. For a programme grounded in the principles of social accountability, we are also proud that ScotGEM's distributed model positively impacts on rural communities beyond the aim of increasing rural doctors.

Distributed medical programmes require “more” of their students in relation to additional organization, travel, accommodation and adapting to a large variety of learning environments. Regular communication and feedback between students and faculty in the Health Boards and the universities has been imperative in refining the curriculum, distinguishing roles, embedding points of contact and supporting students. In Table 3, a recent ScotGEM graduate reflects on the student experience.

Another success of the distributed model is the fostering of clinical educators in “non-traditional” settings, in this case rural Scotland. In the past a medical education or academic career necessitated living near a medical school, usually in a city. The GCM initiative demonstrates that clinical academics not only teach and nurture future doctors but can also support the local clinical service more immediately. This has relevance for partnerships between clinical authorities and higher education institutions. ScotGEM has appointed educators in rural areas to substantive roles but has also facilitated involvement in medical education for a far greater number of clinicians in areas such as selection, examination and mentorship as well as teaching. At a time when medical careers are increasingly demanding, and recruitment and retention is at critical levels, we might postulate that this initiative has an important role to play in increasing job satisfaction and preventing burnout. With respect to the challenges of the programme, two major factors emerged. The first was the relative expense of the programme compared to more traditional models. Students are dispersed around the country from Year 2 thus travel and accommodation costs are high. In Year 3, when many are based in rural areas, this has had a significant fiscal impact. Students also must contend with a higher cost of living, limited accommodation and longer distances to travel, for example, between their practice and the secondary care placement provider. These expenses may represent the biggest practical risk to the programme in the longer term although it has remained in surplus since its inception. The second factor has been the small number of students who professed an interest in joining a generalist, remote and rurally focused course at interview but were subsequently unhappy about rural placements. Whilst most subsequently had successful placements, it was disappointing that the admission processes were sometimes unable to identify authentic motivation. This has led to a review of the admissions processes, including consideration of interviews being based in rural areas and delivered by rural practitioners, to emphasize the importance of the distributed model and the programme mission, and active efforts to attract applicants from remote and rural areas.

Like Scotland, other countries are actively looking to mission-led medical education programmes to address shortages in primary care and rural physicians. When establishing ScotGEM, we drew on the experiences of other programmes (see section “2. Pedagogical framework(s), pedagogical principles, competencies/standards underlying the educational activity”). Now, when comparing the challenges and success of the programme to that of others, our findings suggest that aspects are translatable to other contexts. For example, introducing a distributed elements to a programme can bring additional clinicians to rural communities, as well as develop the existing workforce [see e.g., (53, 61)]; and building active community engagement and healthcare improvement into the curriculum can be challenging but allows understanding and mutual benefit [see e.g., (62–64)].

Key lessons from ScotGEM for other settings:

1. Distributed programmes require faculty to pay particular attention to relationship building, communication and additional organization, travel, accommodation and learning environments.
2. Partnerships can be challenging (e.g., regulation, communication) but bring significant rewards when the strengths of all organizations are harnessed.
3. Healthcare providers in rural areas (in this case Health Boards) need to be involved early in planning distributed programmes and strong relationships fostered with local “champions.” Local leadership is essential to key programme areas e.g., recruitment of teaching staff and LIC practices.
4. Educator involvement in a wide variety of activities, e.g., portfolio supervision, examination, block leadership etc., helps foster a sense of belonging in a distributed programme and allows rural clinicians to tailor their involvement to the time available.
5. Ambitious initiatives such as the Agents of Change Programme take time to embed. Clarity of aims are important as well as dissemination of successful student projects.

## 6 Acknowledgment of any conceptual, methodological, environmental, or material constraints

As a “Curriculum, Instruction, and Pedagogy” contribution, this paper does not adhere to the traditional scientific format of introduction, methods, results and discussion. Rather, it collates a summary of evaluations, research projects and many discussions conducted over time. It aims to describe and evaluate the curriculum design and delivery, with a focus on the distributed aspects. This article references research and evaluation undertaken on the ScotGEM programme. Many studies were authored by ScotGEM staff and conducted with the rigor required to be published as original research. Others are primarily attributable to ScotGEM students. However, we also draw on Visit Reports by the GMC which were conducted independently of ScotGEM staff. We have striven for a reflexive, balanced approach in the article, using strong quality evidence where this exists. However, we acknowledge that additional independent assessment of ScotGEM would be beneficial. We highlight ongoing challenges to the programme in this paper and prioritize its ongoing evaluation.

Given the wide scope of this descriptive paper, we have not reported the methodological detail for each study individually in the text, rather have signposted readers to the publication type and methodology. Readers who wish to assess rigor and/or see further detail to enable them to replicate included aspects in their own context can do so in the following ways: (1) The majority of studies are published, cited accordingly and can be accessed in the published domain; (2) ongoing research and evaluation that is currently in preparation or under consideration and is not yet

publicly available may be obtained from the authors via request to the corresponding author.

## Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions. Restrictions for institutional evaluative data. Requests to access these datasets should be directed to [FGraham001@dundee.ac.uk](mailto:FGraham001@dundee.ac.uk).

## Author contributions

FG: Conceptualization, Writing – original draft, Writing – review and editing. JD: Writing – original draft, Writing – review and editing. AF: Writing – original draft, Writing – review and editing. SG: Writing – original draft, Writing – review and editing. AM: Writing – original draft, Writing – review and editing. AO’M: Writing – original draft, Writing – review and editing. RS: Writing – original draft, Writing – review and editing. FS: Writing – original draft, Writing – review and editing, Conceptualization. LT: Writing – original draft, Writing – review and editing. KA: Writing – original draft, Writing – review and editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The authors declare that no Generative AI was used in the creation of this manuscript.

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# Support from start to finish—a collaborative primary medical program in rural Victoria, Australia

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Australia faces a persistent shortage of doctors in rural and regional areas, exacerbating health disparities between urban and rural communities. Traditional medical education models, which have been largely centralized in metropolitan areas, often result in rural-origin students needing to relocate to cities for training, thus disrupting community connections and reducing the likelihood of their return to rural practice. To address this challenge, the University of Melbourne and La Trobe University have collaborated to establish Victoria's first end-to-end rural medical pathway, an innovative model that enables students to complete both their undergraduate ["Bachelor of Biomedical Science (Medical)"] and Doctor of Medicine (MD) entirely within regional and rural settings. This paper explores the implementation, practical considerations, and evaluation mechanisms of the end-to-end rural medical pathway, highlighting its place-based curriculum, and fully distributed medical education model. Although this program is yet to be evaluated, it is intended that by embedding students in primary care clinics and regional hospitals throughout their training, the program will foster long-term professional and personal ties to rural communities. This initiative represents a scalable and evidence-based model for addressing rural medical workforce shortages, offering insights that could inform national and international medical education policy.

## KEYWORDS

distributed medical education, rural, Australia, rural medical education, medical workforce shortage, health workforce policy

## 1 Introduction

### 1.1 Context

Australia faces persistent challenges in providing equitable healthcare access to its rural and regional communities, which encompass approximately 28% of the population. These areas are characterized by vast geographical distances, smaller population densities, and limited healthcare infrastructure, all of which contribute to significant health disparities (1). Rural Australians experience poorer health outcomes, including higher rates of chronic diseases, mental health conditions, and preventable hospitalizations, compared

to their urban counterparts (1, 2). Additionally, these communities face a higher burden of disease and mortality (1), further underscoring the need for targeted interventions. One way of identifying areas in need of such targeted interventions is by the use of the Modified Monash Model (MMM), which classifies rural and remote areas in Australia into seven categories based on factors such as population size, accessibility to services, and geographical remoteness (3).

Medical workforce maldistribution persists as one of the major challenges in providing equitable healthcare access in rural and regional communities. This challenge is compounded by the centralization of medical education in metropolitan areas, which often necessitates the relocation of rural students to urban centers for training. Such movement disrupts connections to rural communities, a factor known to reduce the likelihood of these individuals returning to practice in rural settings (4). Moreover, rural healthcare providers often encounter unique challenges, including professional isolation, limited access to resources, and broader scope of practice demands, which can deter potential rural doctors (5).

## 1.2 The problem

Despite significant government investment in initiatives aimed at bolstering the rural healthcare workforce, many communities remain underserved. Current national statistics reveal stark inequalities: while approximately 28% of Australians live in rural areas, only about 16% of doctors practice in these regions (1). This disparity is particularly pronounced in remote and very remote areas, classified as MMM6 and MMM7 under the Modified Monash Model, where healthcare access is severely limited (1).

The traditional undergraduate degree and/or Doctor of Medicine (MD) models of medical education, heavily concentrated in metropolitan centers, exacerbate these issues by creating barriers for students from rural backgrounds (6). Evidence suggests that students with rural origins are more likely to return to rural practice after graduation, but many face challenges in accessing medical training close to home (4, 7). Furthermore, the lack of continuity between most undergraduate degrees and MD programs disrupts the rural training pipeline, making it difficult for students to seamlessly progress through their medical education without relocating to urban centers. This fragmentation weakens the effectiveness of rural workforce initiatives and limits the number of doctors undertaking or remaining in rural practice (8–10).

## 1.3 The solution

To address these systemic challenges, the University of Melbourne's Department of Rural Health and La Trobe University Rural Health School have collaborated to establish Victoria's first end-to-end rural medical pathway (Figure 1). This innovative program seeks to address both the shortage of rural healthcare professionals and the challenges faced by rural-origin students in accessing medical training. By leveraging the Victorian regional footprint of both institutions (Figure 2), this program provides a comprehensive training pathway that spans both undergraduate

degree and Doctor of Medicine and eliminates the need for rural students to relocate to metropolitan areas for their medical training. This program also limits eligibility so that only students from regional and rural backgrounds can participate. By embedding regional and rural students in rural communities throughout their training, the program intends to foster long-term relationships with local healthcare providers and patients, strengthening commitment to rural practice (2, 4, 11).

The program's structure emphasizes place-based education, integrating the training environments of primary care clinics, and regional hospitals. Students benefit from hands-on learning opportunities tailored to the specific needs of rural populations, including management of undifferentiated health problems, chronic disease care, and preventive health strategies. Moreover, the curriculum incorporates cultural competence training and interprofessional collaboration; essential skills for addressing the unique challenges of rural healthcare delivery.

Leveraging smaller cohort sizes, in comparison to the metropolitan cohort, is just one way the program ensures personalized attention and mentorship, enhancing medical students' confidence in clinical, procedural, and community health skills. This approach aligns with findings from Ellaway and Bates (12), who emphasized the transformative potential of distributed medical education (DME) in fostering a culture of learning and resilience among medical trainees.

## 1.4 Objective

This paper aims to provide insights into the program's implementation, practical considerations, and evaluation mechanisms. By showcasing the potential of this program as a scalable model, the paper also aims to inform national and international discussions on rural medical education and workforce planning. The program's collaborative approach to spanning both undergraduate degree and Doctor of Medicine may serve as a blueprint for similar initiatives globally, addressing one of the most pressing challenges in rural healthcare.

## 2 Pedagogical frameworks, pedagogical principles, competencies/standards underlying the educational activity

The end-to-end rural medical pathway integrates elements from four pedagogical frameworks; competency-based education (CBE) (13, 14), distributed medical education (DME) (15), place-based learning (16), and social accountability (17–19). Adoption of these principles aligns the medical education, provided by the program, with the unique needs of rural healthcare settings.

### 2.1 Competency-based education

The end-to-end rural medical pathway is underpinned by a Competency-Based Education (CBE) framework, designed

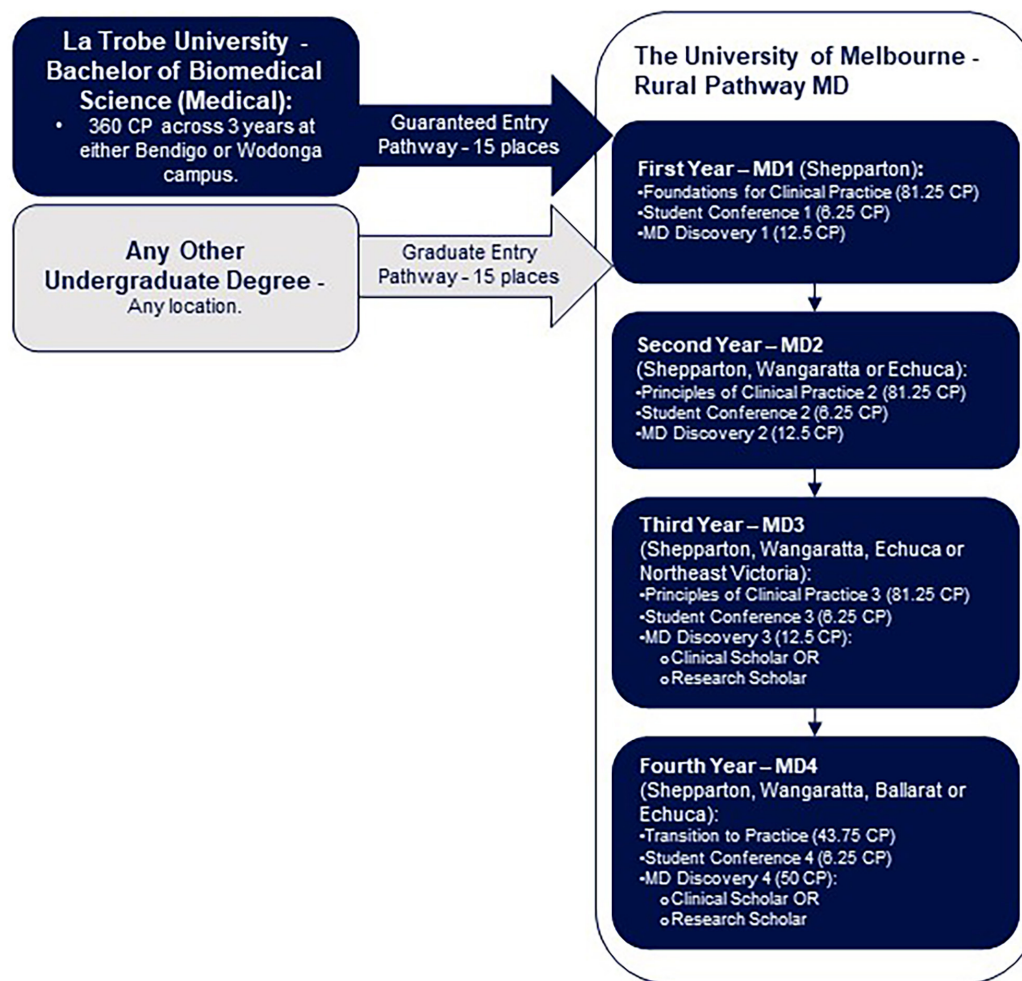


FIGURE 1

Visual representation of the end-to-end rural medical pathway, including possible locations of study. The Bachelor of Biomedical Science (Medical) at La Trobe University (Bendigo or Wodonga), including joint recruitment efforts with The University of Melbourne, forms the guaranteed entry pathway (15 places). Students may also enter the Rural Pathway MD via the graduate entry pathway, after completing any other undergraduate degree (15 places). Abbreviations: Credit points (CP); MD (Doctor of Medicine).

to ensure the systematic development of students' knowledge, skills, and professional attitudes essential for effective medical practice (14, 20). The program's intended learning outcomes (Supplementary Tables 1–3) and graduate attributes (Table 1) are aligned with the standards set by the Australian Medical Council (AMC), including competencies related to population health, health inequities, and the broader socio-economic and environmental determinants of health (21). While the AMC standards do not explicitly focus on rural and remote contexts, the program incorporates principles of distributed medical education (DME), place-based learning, and social accountability to address the specific health needs of rural communities.

## 2.2 Distributed medical education (DME): aligning education with rural needs

Distributed Medical Education provides a decentralized model of medical training, offering students prolonged and

immersive exposure to rural healthcare environments (15). This model facilitates the development of generalist clinical competencies, enhances students' understanding of rural health systems, and fosters interprofessional collaboration (15, 22). Through DME, students acquire essential skills in patient assessment, clinical reasoning, and team-based care—attributes particularly critical in rural settings, where medical practitioners frequently undertake a broad scope of practice within resource-constrained environments (23).

## 2.3 Place-based learning: connecting education with rural communities

Place-based learning grounds students' education in the specific social, cultural, and healthcare contexts of the rural communities in which they train (16). This approach enables students to engage directly with health challenges commonly faced by rural populations, including geographic isolation, limited access to care,



FIGURE 2

The end-to-end rural medical pathway—consisting of the Bachelor of Biomedical Science (Medical) at La Trobe University, and the Rural Pathway MD at The University of Melbourne—study locations across rural Victoria.

and the higher prevalence of chronic disease and mental health conditions. By developing a contextualized understanding of these issues, students are better prepared to deliver patient-centered care, build sustained therapeutic relationships, and tailor health interventions to community needs—directly supporting graduate competencies related to patient care and professional identity formation (16, 24).

## 2.4 Social accountability: ensuring education meets community needs

Social accountability is embedded throughout the Rural Pathway MD, ensuring that the program remains responsive to the health priorities of rural communities (17–19, 25). This commitment is operationalized through:

- Graduate tracking initiatives, which monitor career trajectories and the extent to which graduates contribute to rural health workforce capacity.
- Sustained community partnerships, which provide students with mentorship, clinical exposure, and curriculum relevance.

- An explicit focus on health equity, equipping students to identify and address social determinants of health and advocate for underserved populations.

Through the integration of social accountability, the program aims to produce graduates who not only demonstrate clinical competence but also serve as agents of change in rural health systems—fulfilling the graduate attributes aligned with societal contribution and equity in healthcare.

## 3 Learning environment (setting, students, faculty); learning objectives; pedagogical format

The University of Melbourne's Rural Pathway Doctor of Medicine was developed through a collaboration between the University of Melbourne and La Trobe University as part of the Murray-Darling Medical Schools Network (MDMSN) (26). This program integrates what was an existing Bachelor of Science undergraduate degree, now a specific Bachelor of Biomedical Science (Medical) degree at La Trobe University, with the University of Melbourne's accredited postgraduate Doctor of Medicine. A key aspect of program design was a collaborative

consultation process to refine curriculum alignment, from undergraduate to Doctor of Medicine, facilitating a seamless transition between the two.

Given the separate accreditation requirements for the rural delivery of the Doctor of Medicine, specific accreditation processes were undertaken to ensure compliance with the Australian Medical Council, while maintaining program flexibility.

The Rural Pathway MD is specifically designed for domestic students from rural backgrounds who intend to complete their medical training entirely in rural settings and pursue future practice in regional or rural areas, thereby strengthening the non-metropolitan medical workforce. This program offers 30 bonded Commonwealth Supported Places (CSP) (27), equally distributed across two entry pathways. The bonded CSP funding model subsidizes students' course fees in exchange for a commitment to work in a rural or regional area for a minimum of 3 years, within 18 years of graduation (27). Fifteen places are reserved for graduates of La Trobe University's Bachelor of Biomedical Science (Medical) degree—based in Bendigo and Wodonga—selected at entry to this undergraduate degree and subject to satisfactory academic performance. The second potential entry point into the Rural Pathway MD and remaining 15 places are open to graduates from any discipline who can demonstrate rural origin and a strong commitment to rural practice. Notably, applicants for this graduate-entry pathway are not required to sit the Graduate Medical School Admission Test (GAMSAT) (28). Both the La Trobe undergraduate program and the University of Melbourne Rural Pathway MD use Multiple Mini Interviews (MMIs) as part of their selection processes, with participation from university staff and community representatives (29, 30). Eligibility and selection criteria are summarized in Table 2.

### 3.1 Setting

The Bachelor of Biomedical Science (Medical) is a 3-year undergraduate degree. Offered at La Trobe University's Wodonga and Bendigo campuses, students are able to express a preference for studying in Bendigo or Wodonga, with the result being either 7 or 8 students commencing at both campuses each year (Figure 2). Designed as a pre-medicine course (Figure 1), it utilizes subjects in several subdisciplines of biomedical science, including biochemistry, pharmacology, physiology and immunology, to provide a comprehensive understanding of the human body, its structure, and its functions (Table 3). The course intended learning outcomes are presented in Supplementary Table 1.

The University of Melbourne's Rural Pathway MD (Figure 1 and Table 3) offers a rural-focused medical education, beginning with a first year in Shepparton (Figure 2) that introduces foundational biomedical science and clinical skills through a body systems approach (Table 3). Students engage in blended learning with online modules, small-group tutorials, and clinical placements, focusing on building both scientific knowledge and clinical competencies. The second year immerses students in full-time clinical rotations across Shepparton, Wangaratta, and Echuca, where they further develop their clinical reasoning and diagnostic

skills in hospital settings (Table 3). In the third year, students gain extensive rural experience through longitudinal primary care placements and hospital mini blocks, deepening their clinical skills and understanding of rural healthcare systems (Table 3). The final year focuses on preparing students for internship roles through full-time clinical placements across multiple regional locations, integrating prior learning with real-world practice (Table 3). The course intended learning outcomes are presented in Supplementary Table 2.

Building on the diverse experiences in the MD programs, students can tailor their medical education experience by exploring diverse topics beyond the curriculum in the MD Discovery program (Figure 1 and Table 3). Discovery subjects are undertaken in each year of the MD (Table 3 and Supplementary Table 3), progressively building knowledge, skills, and professional experience. The development and implementation of Discovery topics exploring Rural Health and Rural Generalism have been detailed previously (32); however, these topics have not yet been evaluated.

Students spend the entirety of their education in rural communities, where they engage with community-based healthcare teams and patients in hospitals, general practices, and primary care centers. This model of Distributed Medical Education (DME) allows students to engage with rural healthcare systems in a practical and immersive manner, enhancing their understanding of local health needs (15). This is essential for developing the Patient and Medical Practitioner graduate attributes, which emphasize the ability to establish trust with patients, apply sound clinical reasoning, and deliver effective, individualized care in rural settings. Students can decide to remain within the same rural community across multiple years, establishing stronger continuity, which is often the preference (anecdotally).

Rural settings reinforce the Systems of Health Care graduate attribute by building students' understanding of interdisciplinary roles and developing skills in teamwork, leadership, and systems thinking within smaller, collaborative teams.

### 3.2 Students: Rural background and rural commitment

The student body in the end-to-end rural medical pathway is composed of students from rural areas, who have a strong commitment to working in rural healthcare settings. The small cohort size allows for individualized attention and a supportive learning environment. Each student is actively engaged in their learning, with a focus on self-regulated learning as outlined in the Professional and Leader graduate attribute. Students are encouraged to reflect on their learning progress, identify areas for improvement, and seek feedback to enhance their clinical practice.

### 3.3 Faculty: experienced educators and rural healthcare professionals

The program is delivered by a diverse faculty, which includes academic staff from both La Trobe University and The University

TABLE 1 Rural pathway doctor of medicine—graduate attribute framework.

| Attribute domain                                                                | Graduate attribute statement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Self—In building their relationship with self, students will develop:           | <ol style="list-style-type: none"> <li>1. An understanding of the principles of empathy, compassion, honesty, integrity, altruism, resilience and lifelong curiosity; the ability to demonstrate them and a recognition of their importance in health care</li> <li>2. An understanding of the principles of reflective practice, the ability to apply them, and a recognition of their importance in health care</li> <li>3. An understanding of the principles of self-awareness, the ability to recognize when clinical problems exceed their knowledge and skill, and a willingness to seek help</li> <li>4. The ability to identify and address their own learning needs</li> <li>5. The ability to respond constructively to appraisal, performance review or assessment</li> <li>6. The ability to manage uncertainty</li> <li>7. The ability to apply effective time management and organizational skills</li> <li>8. The ability to recognize and manage emotion in themselves and others</li> <li>9. The ability to maintain their own physical, emotional, social and spiritual health and a recognition of the importance of professional support in this process</li> <li>10. A recognition of their own personal, spiritual, cultural or religious beliefs and an awareness that these beliefs must not prevent the provision of adequate and appropriate care to the patient</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Knowledge—In building their relationship with knowledge, students will develop: | <ol style="list-style-type: none"> <li>1. An understanding of the scientific method relevant to biological, behavioral and social science</li> <li>2. An understanding of research methods and their applications</li> <li>3. An understanding of normal structure, function and development of the human body and mind at all stages of life</li> <li>4. An understanding of the molecular, biochemical and cellular mechanisms that are important in maintaining the body's homeostasis</li> <li>5. An understanding of normal life processes including conception, development, birth, aging and death</li> <li>6. An understanding of the factors that might disturb normal structure, function and development</li> <li>7. An understanding of the etiology, pathology, symptoms and signs, natural history and prognosis of important physical and mental illnesses in all stages of life</li> <li>8. An understanding of the management (pharmacological, physical, nutritional, behavioral and psychological) of important medical conditions</li> <li>9. the ability to access new knowledge from all sources, to analyze and interpret it in a critical manner, and to apply it appropriately to their provision of health care</li> <li>10. The ability to learn from patients, health professionals and the community in a broad range of settings</li> <li>11. An appreciation of the responsibility to contribute toward the generation of new knowledge</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Patients—In building their relationship with patients, students will develop:   | <ol style="list-style-type: none"> <li>1. An understanding of and respect for the rights of patients including patient choice, dignity and privacy</li> <li>2. The ability to communicate with patients from diverse backgrounds including the ability to listen to, respond to, inform and understand the patient's perspective</li> <li>3. The ability to advocate appropriately on behalf of the patient</li> <li>4. An understanding of factors affecting human relationships and the psychological, cultural and spiritual wellbeing of patients</li> <li>5. An understanding of principles of rehabilitation in the amelioration of suffering from acute or chronic disability</li> <li>6. An understanding of the principles of the care of the dying and a commitment to ease pain and suffering in all patients</li> <li>7. An understanding of chronic illness and disability and its impact on the patient, their carers and communities</li> <li>8. The ability to construct with the patient an accurate, thorough, organized, medical history and to perform an accurate physical and mental state examination</li> <li>9. The ability to integrate and interpret clinical findings and apply rigorous reasoning to arrive at an appropriate diagnosis or differential diagnosis</li> <li>10. The ability to recognize serious illness</li> <li>11. The ability to select and interpret the most appropriate and cost-effective diagnostic procedures</li> <li>12. The ability to formulate an evidence-based and cost-effective management plan in collaboration with the patient</li> <li>13. The ability to perform relevant medical procedures effectively and safely, with due regard for the patient's comfort including important emergency and life-saving procedures</li> <li>14. A recognition that it is not always in the interests of the patient to do everything that is technically possible to make a precise diagnosis or to attempt to modify the course of an illness</li> </ol> |

(Continued)

TABLE 1 (Continued)

| Attribute domain                                                                                          | Graduate attribute statement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Medical Profession—In building their relationship with the medical profession, students will develop:     | <ol style="list-style-type: none"> <li>1. An understanding of the continuum of medical training and the diverse roles and expertise of doctors</li> <li>2. An understanding of the potential conflicts of interest that may confront doctors</li> <li>3. An understanding of and ability to apply the principles of ethics in the provision of health care and research.</li> <li>4. An understanding of organizational governance, the ability to be an active participant in professional organizations, and an appreciation of the benefits of this participation</li> <li>5. An understanding of the principles of mentorship and the ability to apply them with colleagues</li> <li>6. The ability to give effective feedback to colleagues in order to help them improve their performance</li> <li>7. An understanding of educational theory and practice and the ability to teach</li> <li>8. An appreciation of the responsibility to maintain standards of medical practice at the highest level throughout a professional career</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Systems of Health Care—In building their relationship with systems of health care, students will develop: | <ol style="list-style-type: none"> <li>1. An understanding of the roles, responsibilities and expertise of all health professionals, and how they work in teams to deliver health care</li> <li>2. A respect for the roles and expertise of other health care professionals and the ability to communicate effectively with them</li> <li>3. An understanding of the principles of teamwork and the ability to work effectively in a team, including as a leader</li> <li>4. An appreciation of the responsibility to contribute to the education of all health professionals</li> <li>5. An understanding of the principles of quality and safety in health care systems</li> <li>6. The ability to work effectively as a doctor within a quality and safety framework including the ability to recognize, respond to and learn from adverse events and medical errors</li> <li>7. An understanding of the principles of effective record keeping and the ability to maintain high quality medical records</li> <li>8. An understanding of the principles of continuity and coordination of health care</li> <li>9. An understanding of the structure of the Australian health care system and health care systems globally</li> <li>10. An understanding of the principles of efficient and equitable allocation and use of finite resources in health care systems, locally and globally</li> <li>11. An understanding of the role of political systems in shaping health care systems locally, nationally and internationally</li> </ol>                                                                                                                                                                                                                                                                                                                   |
| Society—In building their relationship with society, students will develop:                               | <p>In building their relationship with society, students will develop:</p> <ol style="list-style-type: none"> <li>1. An understanding of the interactions between humans and their social and physical environment</li> <li>2. An understanding of the determinants of a well society and the economic, political, psychological, social and cultural factors that contribute to the development and persistence of health and illness</li> <li>3. An understanding of the principles of health promotion including primary and secondary prevention</li> <li>4. An understanding of the health of Aboriginal and Torres Strait Islander peoples including their history, cultural development and the impact of colonization and the ongoing health disparities of Indigenous people in this country and globally</li> <li>5. An understanding of the burden of disease in differing populations and geographic locations</li> <li>6. An understanding of the differing requirements of health care systems in a culturally diverse society</li> <li>7. The ability to respect community values, including an appreciation of a diversity of backgrounds and cultural values</li> <li>8. An understanding of the principles of health literacy and a willingness and ability to contribute to the health education of the community</li> <li>9. The ability to consider local, regional, national and global ramifications of health care issues</li> <li>10. The ability and a willingness to contribute to the community</li> <li>11. A commitment to contribute to the resolution of health inequities locally and globally</li> <li>12. An understanding of the relationship between environmental issues and the health of local communities and society</li> <li>13. A commitment to practice medicine in an environmentally responsible way</li> </ol> |

of Melbourne, along with practicing rural healthcare professionals who serve as clinical supervisors and mentors. This mix of educators ensures that students receive a blend of theoretical knowledge and practical, real-world experience.

Faculty members are not only experts in their fields but also have a deep understanding of the challenges and rewards of rural practice. Clinical supervisors, who are

experienced rural practitioners, provide ongoing mentorship and feedback, allowing students to develop the competencies required for effective rural healthcare delivery. These mentors also help students navigate the complexities of rural medical practice, including resource constraints, patient diversity, and the interdisciplinary nature of rural healthcare teams.

TABLE 2 End-to end rural medical pathway—eligibility and selection information.

| Selection criteria               |                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Number of common wealth-supported places |
|----------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| End-to-End Rural Medical Pathway | Bachelor of Biomedical Science (Medical)—La Trobe University (Guaranteed Entry Pathway) | <ul style="list-style-type: none"><li>• Resided for at least 5 years consecutively or 10 years cumulatively in remoteness areas classified as Modified Monash Model (MMM) 2–7 (3).</li><li>• Minimum Australian Tertiary Admission Rank (ATAR) of 80.00 (31).</li><li>• Multiple Mini-Interviews (MMI) consisting of questions on advocacy, collaboration, critical thinking, empathy, ethical reasoning, motivation, and regional identification.</li><li>• Applicants will be assigned to one of the following three rurality tiers before proceeding to the next stage of the selection process, prioritized according to tiers 1 through 3.<ul style="list-style-type: none"><li>◦ Tier 1: evidence of rural background in MMM2-7 postcodes part of either the Murray Primary Health Network or the Murrumbidgee Primary Health Network.</li><li>◦ Tier 2: evidence of rural background in MMM2-7 in other areas of rural Victoria and rural NSW.</li><li>◦ Tier 3: evidence of rural background in MMM2-7 in other areas of rural Australia.</li></ul></li></ul> | 15                                       |
|                                  | Rural Pathway MD—The University of Melbourne (Graduate Entry)                           | <ul style="list-style-type: none"><li>• Domestic student currently living in Australia.</li><li>• Completed an undergraduate degree in any discipline within the past 10 years.</li><li>• Resided for at least 5 years consecutively or 10 years cumulatively in remoteness areas classified as MMM2 to MMM7 (3).</li><li>• Minimum GPA of 5.</li><li>• No Graduate Medical School Admission Test (GAMSAT) requirement (28).</li><li>• MMI consisting of questions on advocacy, collaboration, critical thinking, empathy, ethical reasoning, motivation, and regional identification.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 15                                       |

3.4 Learning objectives: alignment with AMC standards for assessment and accreditation

The intended learning outcomes of the end-to-end rural medical pathway (Supplementary Tables 1–3) are carefully structured to align with the Standards for Assessment and Accreditation of Primary Medical Programs by the Australian Medical Council (21). Although, revised AMC standards have since come into effect as of the start of 2024 (21), the 2012 AMC standards have been used here as these were the standards being maintained at the time of developing this program. These standards are organized into a thematic framework with four domains:

1. Science and Scholarship: the medical graduate as a scientist and scholar.
2. Clinical Practice: the medical graduate as a practitioner.
3. Health and Society: the medical graduate as a health advocate.
4. Professionalism and Leadership: the medical graduate as a professional and leader.

While the intended learning outcomes for the undergraduate degree place less of an emphasis on the Clinical Practice and Health and Society domains, these learning objectives are designed to guide students through the process of acquiring the knowledge and competencies necessary for progression into the Doctor of Medicine. Mapping all learning objectives from the undergraduate degree and Doctor of Medicine to

the AMC standards ensures that each stage of the program builds upon the previous one, with students progressively developing the skills and knowledge required. In addition to the intended learning outcomes, the program also outlines a set of graduate attributes (Table 1), which are collated into a six-domain thematic framework: Self, Knowledge, Patients, Medical Profession, Systems of Healthcare, and Society. The integration of these graduate attributes with the intended learning outcomes provides a comprehensive structure, ensuring that students not only meet the AMC standards but are also equipped to address the multifaceted challenges of rural healthcare practice.

3.5 Pedagogical format: integrated learning approaches

Across various phases of the end-to-end pathway the program employs a combination of blended learning, problem-based learning (PBL) (33), simulation, skills workshops, and clinical placements (which include interprofessional education), to ensure students are prepared for the realities of rural medicine.

The program uses a blended learning model, where students access online learning materials and engage in face-to-face sessions. This allows students to learn at their own pace while participating in interactive sessions that deepen their understanding of rural medical issues. PBL is used to foster critical thinking and clinical reasoning skills, encouraging students to engage with real-world medical cases that are directly relevant to rural practice. Through PBL, students learn to synthesize clinical findings, evaluate patient data, and develop management plans.

TABLE 2 Curriculum details for the end-to-end rural medical pathway.

|                                  | Course                                                        | Year | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                  | Study location options                                 |
|----------------------------------|---------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| End-to-End Rural Medical Pathway | Bachelor of Biomedical Science (Medical)—La Trobe University. | 1    | Students build a solid foundation in biomedical sciences through subjects such as, Human Biosciences, Chemistry, and Foundations of Biomedical Sciences. These subjects introduce the basic principles of human biology, chemistry, and the social determinants of health.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                  | Bendigo or Wodonga.                                    |
|                                  |                                                               | 2    | Students delve deeper into biomedical science disciplines, with a focus on, Molecular and Cellular Biology, Biochemistry, Anatomy, Physiology, and Immunology. Students also begin developing research skills, preparing them for evidence-based practice and scientific inquiry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                  |                                                        |
|                                  |                                                               | 3    | Students engage with advanced topics and prepare for clinical settings through subjects like Pathophysiology, Applications of Biotechnology in Pharmacy and Medicine, Clinical Hematology and Biochemistry (the course's capstone subject), and Infectious Disease Epidemiology. The curriculum emphasizes critical thinking and problem-solving, essential for medical practice.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                  |                                                        |
|                                  | Rural Pathway MD—The University of Melbourne.                 | 1    | Students focus on building foundational biomedical science and clinical skills during the first year at the University of Melbourne's Rural Clinical School in Shepparton. The curriculum integrates body systems, clinical communication, and examination skills while emphasizing early professional identity development. Students engage in problem-based learning to explore the structure and function of body systems and their impact on patient health. Learning is delivered through a blend of webinars, interactive modules, tutorials, and clinical placements in both hospital and community settings. Clinical skills are further supported by peer learning, simulation exercises, and hands-on practice in primary care and hospital environments.                                                                                                                                                                              |                                                                                                                                                                                                                                                                  | Shepparton.                                            |
|                                  |                                                               | 2    | Students further develop their applied biomedical knowledge, advanced clinical skills, and clinical reasoning. Students rotate through adult medicine, surgery, anesthesia, and emergency medicine, enhancing diagnostic and therapeutic skills. Learning activities include case-based modules, simulation exercises, and clinical skills coaching, which foster critical thinking, communication, and decision-making. The curriculum also emphasizes professional practice, teamwork, ethics, and the physician's role within the healthcare system.                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                  | Shepparton, Wangaratta, or Echuca.                     |
|                                  |                                                               | 3    | Students build on their clinical exposure across rural and regional health services. Students have the option to maintain continuity by staying embedded in either Shepparton, Echuca, or Wangaratta, or to pursue clinical exposure at alternative sites, including smaller facilities throughout Northeast Victoria. Rural pathway students undertake longitudinal primary care placements, complemented by hospital mini blocks in areas like aged care, child and adolescent health, mental health, and women's health. These placements develop diagnostic, communication, and management skills while promoting rural generalism as a career path. Students also deepen their understanding of health systems, interprofessional collaboration, and rural care transitions. Learning activities focus on clinical reasoning, risk assessment, and preventative care, with additional professional practice and procedural skills training. | <b>MD Discovery—Research Scholar subjects:</b> Students can collaborate on research projects with local clinicians and healthcare providers, addressing issues such as chronic disease management, health disparities, workforce retention, and healthcare gaps. | Shepparton, Wangaratta, Echuca, or Northeast Victoria. |
|                                  |                                                               | 4    | The final year serves as a clinical capstone, consolidating students' knowledge and preparing them for their transition to internship. The curriculum includes four 4-week clinical placements, where students are fully embedded within healthcare teams across Shepparton, Wangaratta, Ballarat, and Echuca. Through full-time clinical immersion, students actively contribute to patient management and gain independence in clinical decision-making. Teaching activities, including simulation-based training, small group tutorials, online learning, and practical sessions, integrate prior learning with real-world practice. By the end of the year, students will have developed the necessary competencies to transition into internship roles, with a strong commitment to rural healthcare.                                                                                                                                       |                                                                                                                                                                                                                                                                  | Shepparton, Wangaratta, Ballarat, or Echuca.           |

The program includes simulation-based learning, where students practice medical procedures and clinical decision-making in a controlled environment. Skills workshops allow students to refine their abilities in specific areas, such as emergency response, patient communication, and technical procedures.

## 4 Results to date/assessment (processes and tools; data planned or already gathered)

To systematically evaluate the effectiveness of the end-to-end rural pathway in addressing rural workforce shortages, Kirkpatrick's Four-Level Model of Training Evaluation has been adopted (34). This model provides a structured approach to assessing program outcomes, ranging from student satisfaction, and learning, to behavioral change and long-term workforce impact. By applying this framework, the evaluation ensures a comprehensive analysis of how well the program prepares rural-origin students for medical practice in rural settings, facilitates their transition into the workforce, and contributes to broader healthcare improvements in underserved areas. The first cohort of students will graduate at the end of 2025; hence, evaluation data are incomplete and not ready for reporting. However, the following sections outline the program's evaluation plan at each level of Kirkpatrick's model.

### 4.1 Level 1: reaction—student satisfaction and perceptions

To assess initial engagement and satisfaction with the program, longitudinal surveys are conducted to track students' motivations for rural practice at entry and throughout their training. These surveys capture student perceptions of the curriculum, clinical placements, and overall preparedness for rural medical practice. Additionally, qualitative feedback is collected on their experiences in the end-to-end rural pathway to identify areas for improvement in program delivery and support services.

### 4.2 Level 2: learning—knowledge, skills, and competency development

Student academic performance is systematically tracked to ensure they develop the competencies required for medical practice in rural settings. This includes assessment of coursework, clinical placement performance, and licensing examination results. Progression rates from La Trobe University's Bachelor of Biomedical Science (Medical) into the University of Melbourne's Rural Pathway MD are reviewed annually, along with time-to-completion analyses to monitor any delays in training. These data help identify academic or structural barriers that may impact student success.

### 4.3 Level 3: behavior—application of learning in clinical and training environments

The behavior level evaluates how students apply their learning in real-world clinical settings, focusing on their ability to transfer knowledge and skills from the classroom to practice. Experienced rural clinical mentors assess students during placements, observing their integration of clinical knowledge, management of complex cases, teamwork, and communication with diverse patients—core competencies for rural practice.

Students are also required to engage in reflective practice throughout their training. They maintain learning portfolios and participate in self-assessment exercises that encourage them to evaluate their strengths, areas for improvement, and progress toward achieving their learning goals. This process helps to develop self-awareness and a sense of professional responsibility.

Data from ongoing clinical placements, including mentor evaluations and student reflections, will be tracked over time to assess students' behavioral development and application of learned skills. This will aid in identifying any ways in which the program could better prepare its graduates for rural practice.

### 4.4 Level 4: results—impact on workforce and rural healthcare systems

A key objective of the program is to strengthen the rural medical workforce by increasing the number of graduates practicing in rural areas. Internship positions are available in rural areas, and students are strongly encouraged to seek placements in these regions. To quantify the program's impact on rural workforce, graduates are tracked longitudinally to assess their practice locations, with a focus on those commencing clinical practice in rural or remote areas (MMM3–7). Particular attention will also be paid to evaluating the place-based impact on workforce, quantifying the proportion of graduates that practice in the same region as the program. Retention rates are monitored yearly up to post-graduation (PGY10) to evaluate long-term workforce distribution. Another key variable is graduates' medical specialty choice, which will be assessed alongside practice location to provide a more comprehensive understanding of the program's impact on the workforce and healthcare systems.

Beyond individual graduate outcomes, the program's broader impact on rural communities and healthcare services is assessed through both qualitative and quantitative measures. This includes evaluating the extent to which the program enhances healthcare service capacity in rural areas, improves access to medical care, and addresses local workforce shortages.

### 4.5 Using evaluation findings for continuous improvement

Findings from these evaluation measures inform curriculum refinements, student support strategies, and targeted incentives to encourage long-term rural practice. The data will also

contribute to national policy discussions on rural medical education, providing insights into effective strategies for addressing workforce shortages in underserved areas. By systematically tracking rural practice intentions, training experiences, and workforce outcomes, this evaluation framework ensures the end-to-end rural medical pathway remains responsive to community needs while strengthening the sustainability of the rural medical workforce. Longitudinal tracking of graduates' practice locations and specialty choices will also help determine whether end-to-end training and rural internship placements contribute to longer-term rural workforce retention.

## 5 Discussion on the practical implications, objectives and lessons learned

### 5.1 Practical implications

The end-to-end rural medical pathway is a significant step toward addressing rural healthcare workforce shortages in Australia. Its innovative, cross-institutional model—developed by La Trobe University and The University of Melbourne—offers an integrated and immersive approach to rural medical education that could be adapted to other underserved regions nationally and internationally. Replicating this model elsewhere would require strategic partnerships tailored to local capacities, ensuring a consistent, rural-focused educational journey. The program's rural immersion approach embedding students in rural settings from the outset, builds essential competencies in real-world contexts. However, implementation in other areas must consider local infrastructure and ensure access to diverse clinical experiences through partnerships with healthcare providers across primary care, emergency medicine, and public health.

By enabling students to train entirely in rural areas, the program reduces barriers for rural-background students and enhances workforce retention. For other regions, success would depend on the availability of clinical placements, academic support, and local mentors committed to rural practice. Sustainability of the rural workforce is a core objective. For successful adaptation elsewhere, programs must be aligned with the specific health needs of each region whether that's a demand for generalists or specific specialties. Finally, the program's social accountability framework grounded in community engagement ensures relevance and responsiveness to rural health priorities. Similar programs should build strong relationships with local stakeholders to co-design curricula, involve community voices in admissions, and foster graduates who are both clinically skilled and committed to health equity.

### 5.2 Objectives

The pathway's first objective was to provide a seamless rural medical education pathway, via guaranteed entry from the undergraduate degree at two of La Trobe University's regional campuses into the Rural Pathway MD at The University of Melbourne. This unique feature eliminates the uncertainty that

students often face in entering MD programs, particularly those from rural backgrounds. This guaranteed pathway is designed to increase the number of medical professionals working in rural areas, ensuring a stable and reliable pipeline of future healthcare providers. Continued evaluation will determine the full impact of the initiative, but evidence suggests that it is well-positioned to significantly enhance rural healthcare delivery and address workforce shortages across Victoria (4, 6, 7, 9, 35).

The program's second objective was to immerse students in rural and regional areas from the outset of their studies, utilizing features of DME and place-based learning. This ensures that students are not only academically prepared but also experience the day-to-day realities of rural life and rural practice. This model also reduces the barriers to rural medical education, making it more accessible and appealing to students from rural backgrounds, and it directly addresses the issue of workforce retention in rural healthcare. Once students reach the Doctor of Medicine, this rural immersion also facilitates the development of critical competencies for generalist roles and rural-specific healthcare delivery. This approach aligns with the CBE framework, which emphasizes the mastery of competencies that are particularly relevant to rural medical practice.

### 5.3 Lessons learned

The end-to-end rural medical pathway has provided valuable insights that will inform ongoing program improvement. While the end-to-end rural education model provides unparalleled immersion by providing authentic, real-world learning experiences, a lesson learned is that students must be well-supported during their placements in rural settings. This includes regular contact with faculty, access to mental health resources, and peer networks, to thrive academically and emotionally. Mentorship is also essential. Rural clinicians, often managing heavy workloads, benefit from formal mentorship structures that support both teaching and clinical responsibilities. Similarly, peer support, whether in-person or virtual, helps students stay connected, share experiences, and maintain well-being. Academic support must also be accessible throughout placements. Regular check-ins and flexible access to faculty help students stay aligned with learning outcomes and feel connected despite geographic distance. These supports are critical for developing professional competencies such as teamwork and self-regulated learning, and for fostering long-term commitment to rural practice.

Another key lesson is the need for curriculum flexibility. Rural settings are diverse and dynamic, with varying health needs and resource constraints. Place-based learning, which encourages students to engage directly with rural communities, not only enhances their practical experience but also allows the curriculum to adapt to local health issues and resource constraints. The flexible curriculum is also supported by the Competency-Based Education (CBE) framework, allowing students to progress based on demonstrated competencies. In rural settings, where scope of practice varies, this flexibility ensures students develop essential skills—particularly in generalist roles—aligned with the Medical Practitioner, Health Advocate, and Systems of Health Care graduate attributes. Students may have varying levels of access to resources, healthcare facilities, and learning opportunities, depending on

their location. Therefore, the curriculum must provide alternative learning methods, such as online resources, remote mentorship, and virtual learning platforms, to ensure that all students receive the same high-quality education, regardless of where they are placed. This approach not only makes the program accessible to students in diverse rural locations but also allows the program to be more resilient to unexpected challenges.

## 6 Acknowledgment of any conceptual, methodological, environmental, or material constraints

### 6.1 Conceptual constraints

A core assumption is that rural-origin students trained in rural settings will undertake, and remain in, rural practice. While supported by research, this assumption is not without risks, as factors like career opportunities, lifestyle, and family may influence decisions.

The program adapts a national medical curriculum for rural contexts, where healthcare delivery often involves generalized care and resource limitations. While incorporating rural-specific content through DME and place-based learning, challenges remain in balancing standardization with rural realities. Continuous curriculum adaptation is necessary to meet rural healthcare needs while maintaining academic rigor.

### 6.2 Methodological constraints

With placements across diverse rural settings, consistent evaluation is challenging. The variability in healthcare infrastructure and clinical experiences necessitates adapting standardized assessment tools to local contexts. Enhanced coordination across sites is required for reliable, comparable data to inform program improvements.

Tracking graduates' long-term impact on rural workforce retention is complex, influenced by factors like economic incentives and work-life balance. Effective longitudinal data collection requires sustained engagement with alumni and partnerships with rural health organizations.

### 6.3 Environmental constraints

Rural placements often occur in isolated areas with limited infrastructure, posing challenges for students and faculty. Remote healthcare facilities may offer fewer clinical experiences, and students may struggle with access to academic resources. The program mitigates these issues with subsidized accommodation and remote support services, but further mechanisms are needed for more remote placements.

Collaboration between universities poses challenges in coordinating curricula and resources. Faculty shortages in rural areas also hinder program delivery. The program addresses this by investing in faculty development but maintaining a sustainable faculty supply remains a challenge.

## 6.4 Material constraints

The financial challenges associated with medical education and rural placements may discourage students from rural or disadvantaged backgrounds, particularly as part-time study options are not available. Financial support mechanisms, such as scholarships and subsidized housing, are crucial, but additional funding is needed to ensure accessibility.

Many rural areas lack the necessary technological infrastructure for remote learning and telemedicine. Despite investments in digital resources, ongoing efforts are required to ensure rural placement sites are equipped to meet the program's needs.

## 7 Conclusion

The Rural Pathway MD represents a transformative approach to addressing rural workforce shortages by embedding students in regional and rural healthcare settings from the outset of their training. By integrating DME principles, eliminating the need for metropolitan placements, and providing structured academic and financial support, the program is designed to maximize rural workforce retention. Institutions aspiring to expand their capacity in DME may consider cross-institutional collaboration, such as outlined here.

As the program continues to evolve, ongoing longitudinal evaluation will be critical in maximizing its full impact on workforce distribution and rural healthcare outcomes. This model has the potential to reshape medical education globally, providing a scalable solution to one of the world's most persistent healthcare challenges. With sustained policy support and investment, the Rural Pathway MD could serve as a blueprint for training, retaining, and empowering the next generation of rural doctors.

## Data availability statement

The original contributions presented in this study are included in this article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

## Ethics statement

This article presents a descriptive account of curriculum and pedagogical practice. It does not report on research involving human participants, identifiable data, or data collected through evaluation or intervention. As such, ethics approval was not required.

## Author contributions

WH: Conceptualization, Project administration, Writing – original draft, Writing – review & editing. LVS: Conceptualization,

Writing – original draft, Writing – review & editing. TD: Conceptualization, Writing – review & editing. ZA: Conceptualization, Writing – review & editing. CH: Writing – review & editing. JW: Conceptualization, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Generative AI statement

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1585017/full#supplementary-material>

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# Immersion to impact: does one or three years of rural immersion influence graduate clinical practice intentions and locations?

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**Background:** Addressing rural healthcare workforce shortages requires evidence-based strategies in medical education. Extended rural immersion programs offer a potential solution, but the optimal duration for fostering long-term regional and rural practice remains unclear.

**Methods:** This retrospective study evaluates the impact of one-year versus three-year rural immersion experiences at the University of Melbourne's Rural Clinical School (RCS) on graduate clinical practice locations of the 2016–2023 graduating cohorts. Using logistic regression analysis, we assessed key predictors of regional and rural practice, including rural immersion duration and intent to practice regionally or rurally.

**Results:** Graduates who completed the three-year rural immersion program were significantly more likely to practice in Modified Monash Model (MMM) 2–7 areas than those with only one year of rural immersion. Intent to practice regionally or rurally and completing a regional/rural internship emerged as strong predictors of regional/rural practice. However, regional/rural intent did not appear to be a strong indicator for students who only completed 1-year of rural immersion. This highlights the importance of the duration of immersion.

**Conclusion:** The study demonstrates the effectiveness of extended rural immersion in increasing regional and rural workforce retention. Findings support further investment in rural medical education, including end-to-end rural training models, which integrates rural exposure across the entire medical education journey. Future research should examine long-term workforce retention and strategies for sustaining rural career pathways.

## KEYWORDS

rural medical workforce, medical education, rural immersion, workforce retention, rural clinical school

## Introduction

Australia has many sparsely populated rural communities, with around 28% of the Australian population living in rural and remote areas (1). However, despite Australia's highly trained workforce, equitable access to healthcare remains a critical issue in rural Australia (2).

The ongoing issue of health workforce maldistribution, particularly primary care practitioners, is the foremost challenge associated with health service delivery in many rural communities. This has a compounding effect on health outcomes for rural patients with increasing burden of disease based on remoteness and population size (3, 4). The Modified Monash Model (MMM) is used as a measure of remoteness and population size. These range from MMM1 to MMM7, where MMM1 is a major city and MMM7 is a very remote community (5). The distance and travel time have been implicated in adverse health outcomes and increasing mortality rates for rural communities (1, 6). In response, The Department of Health acknowledged the chronic shortage of rural health workforce and in its 2021–2023 Australian Medical Workforce Strategy report, one of the priorities identified was the rebalancing of supply and distribution of the workforce (2). In addition, a key policy recommendation by World Health Organization (WHO) adduced that student selection and education opportunities are some of the ways to address this global issue.

One concrete strategy being employed to influence the distribution of healthcare workers to rural areas is through rural clinical placements. Integrating these placements, as part of a nursing or allied health degrees, can positively affect students' intent for future regional or rural practice (7). Additionally, rurally based clinical placements that are integrated into a medical degree have a positive impact on regional/rural practice intent (8), hence rural educational opportunities form key policy focuses for the World Health Organization (9), Australian government, and medical schools. Embedding students in rural communities, with full immersion in placements, goes one step further and is a strong predictor of rural practice (10). This is corroborated from student tracking data from nine Australian medical programs with rural clinical schools (RCS), with graduates who undertook extended RCS placements 2.93 and 1.76 times more likely to be a general practitioner (GP) or non-GP specialist, respectively, in a non-metropolitan area (MMM2–7) (4).

The extended rural placement of students (rural immersion) at the University of Melbourne's Rural Clinical School (RCS) was an immersive program designed to provide clinical placements and community integration to students that had an interest in rural health (11). Existing University of Melbourne Doctor of Medicine (MD) Students submitted an expression of interest to join the rural cohort and were not required to meet any prerequisite criteria relating to rurality or academic performance. Students accepted into the cohort (Figure 1) could preference placement location from several primary healthcare settings across regional and rural Victoria (MMM2–MMM5) (Figure 2). The breadth of exposure allowed students to experience a diversity of clinical educational opportunities including skills in general practice, women's health, child and adolescent health, aged care, and mental health. The program was designed with central theme of rural immersion, intended to further strengthen the long-term positive outcomes on medical workforce within these regional and rural communities. This paper aims to retrospectively assess duration of rural immersion (1 or 3 years), together with intent for future regional or rural practice, in order to determine their impact on influencing graduates between 2016–2023 to undertake regional or rural clinical practice.

## Methods

### Participants

The study design and analysis were approved by the University Human Ethic Committee (HEC30266). Administrative data was collected by survey (distributed via institutional email lists) between 2016 to 2023 to inform the RCS of graduates' place of internship, their future intentions of location for employment (expressed as MMM) and their interests in regional/rural practice. Participant consent was implied through voluntary completion of the survey. The participants were graduating medical students.

### Data collection

Data collected were full name, MD4 locations and MMM classification, internship location along with preference number. In addition, graduating students were also asked of their intent, particularly about their future training interests, whether they were interested in a regional/rural career following the rural immersion programme and a potential 10-year plan.

Australian Health Practitioner Regulatory Agency (AHPRA) data were cited via the online site (12). Each graduate was individually searched, and the following data was recorded: AHPRA number, date of registration, profession, registration type and status, principal place of practice and any specialist registration and year followed.

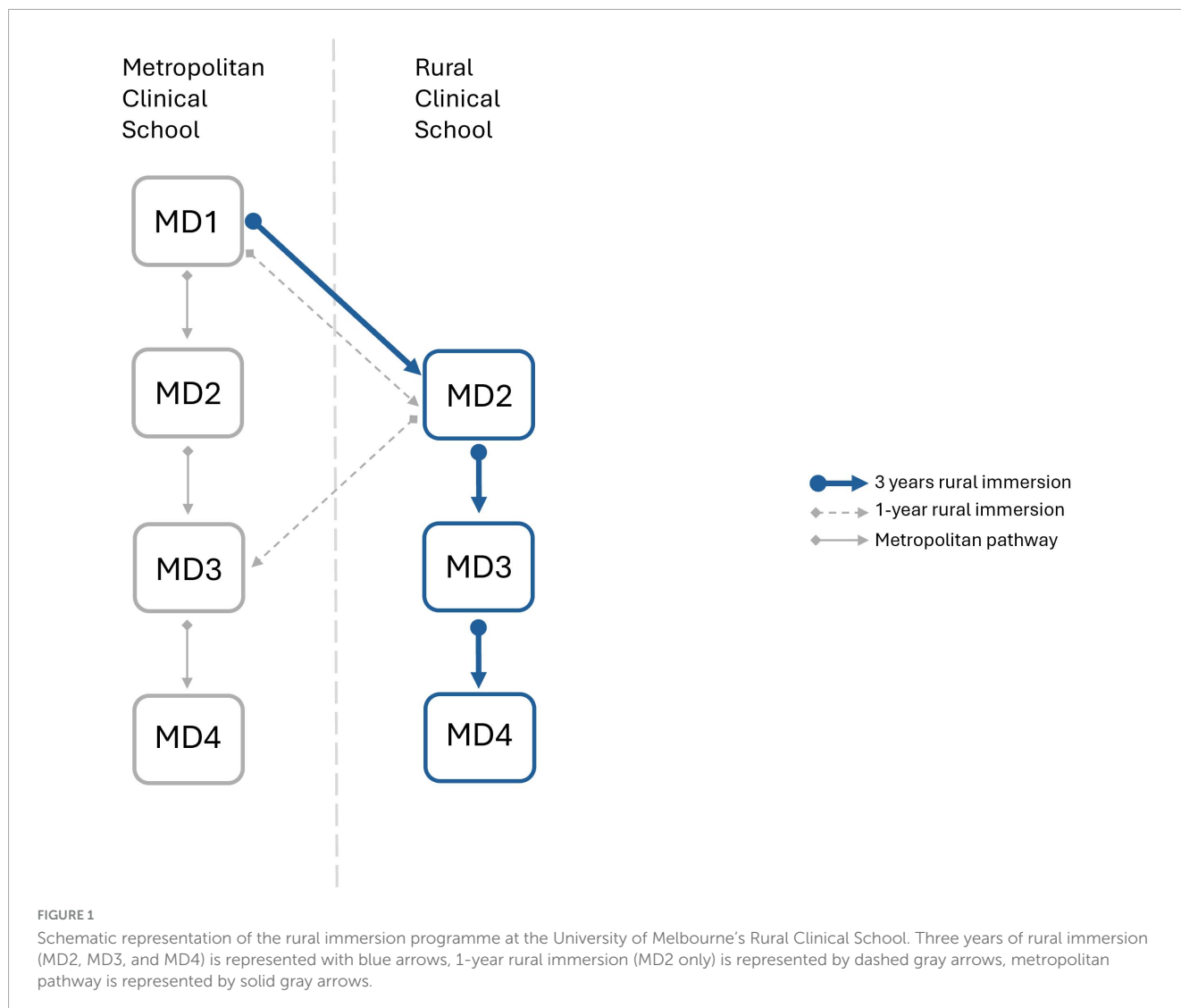
Subsequently, MMM classifications were also assigned to graduates' MD4 location, internship location and principal place of practice (as of October/November 2024), identified via the AHPRA website.

### Data analysis

Primary data analysis and generation of descriptive statistics was performed in Microsoft Excel [Microsoft 365 MSO (Version 2411 Build 16.0.18227.20082) 64-bit]. Logic checks were performed, and crosstabs generated to ensure data accuracy. Binomial logistic regression was performed in SPSS [Version 30.0.0.0 (172)] on raw data output from Excel. Using the data, the model was used to assess the effect of independent variables: association between enrolment in the rural immersion cohort, graduating year and intent, on whether graduates ultimately, practiced in a metro or regional/rural location.

Further, assessment of performance of the binomial logistic regression model was done using the ROC curve. Figures and the two-way ANOVA analysis was generated in GraphPad Prism [Prism 10 for Windows 64-bit Version 10.3.1(509)] to assess the effects of individual independent variables against dependent variable. The alpha was set at 0.05.

Descriptive statistics (percentages calculated for each cohort, mean calculated from percentages, variance represented by Standard Error of Mean; SEM) was used to illustrate the demographics of students surveyed. The responses elucidated diversity of students, distribution of gender during each graduating year and intent in regional or rural practice. The surveys also



identified their MD4 location, however, for 2021 cohort, specific MD4 locations were not recorded (of internship towns). Hence, this independent variable was collapsed to inform whether the graduates completed 1-year or 3 years of the rural immersion programme (Figure 1). Graduates also listed their internship preference level on a numerical scale, “1” being their first preference and increasing numbers indicating decreasing levels of preference. Data extracted from APHRA were the registration type, principal place of practice and speciality attained.

For all locations, the Modified Monash Model was identified based on the 2019 classification (5).

## Variable overview for binomial logistic regression model

For anonymity, data was converted to numbers with levels nested in each variable. For “graduate year,” variable was collapsed into two levels:  $PGY \geq 5$  and  $PGY < 5$ . Response to “Intention to practice rurally” was adjusted to three levels; “Yes,” “No” and “Maybe/Unsure.” “Duration of rural placement” was collapsed

into binary levels: 1-Year rural immersion or 3-Years rural immersion. MMM classification of MD4 location, internship placement location (represented as MMM) was also binarised to “Metro” (MMM1) and “Rural” (MMM2-7) levels of variables. While MMM2 locations are classified by the Department of Health and Aged Care as “regional” rather than “rural,” they are commonly included in rural medical workforce initiatives, and thus have been grouped with MMM classifications 3 to 7. Independent variables such as “Gender” had two levels Male and Female; “Registration type” had five levels (Provisional, General, General Specialist, Specialist, and non-practising), with “Speciality” also recorded from AHPRA. “Principal place of practice” was the dichotomised (Metro/Rural) dependent variable.

## Results

### Demographics

This retrospective study focused on exit survey data of eight cohorts of medical students, who graduated in 2016 to 2023, and

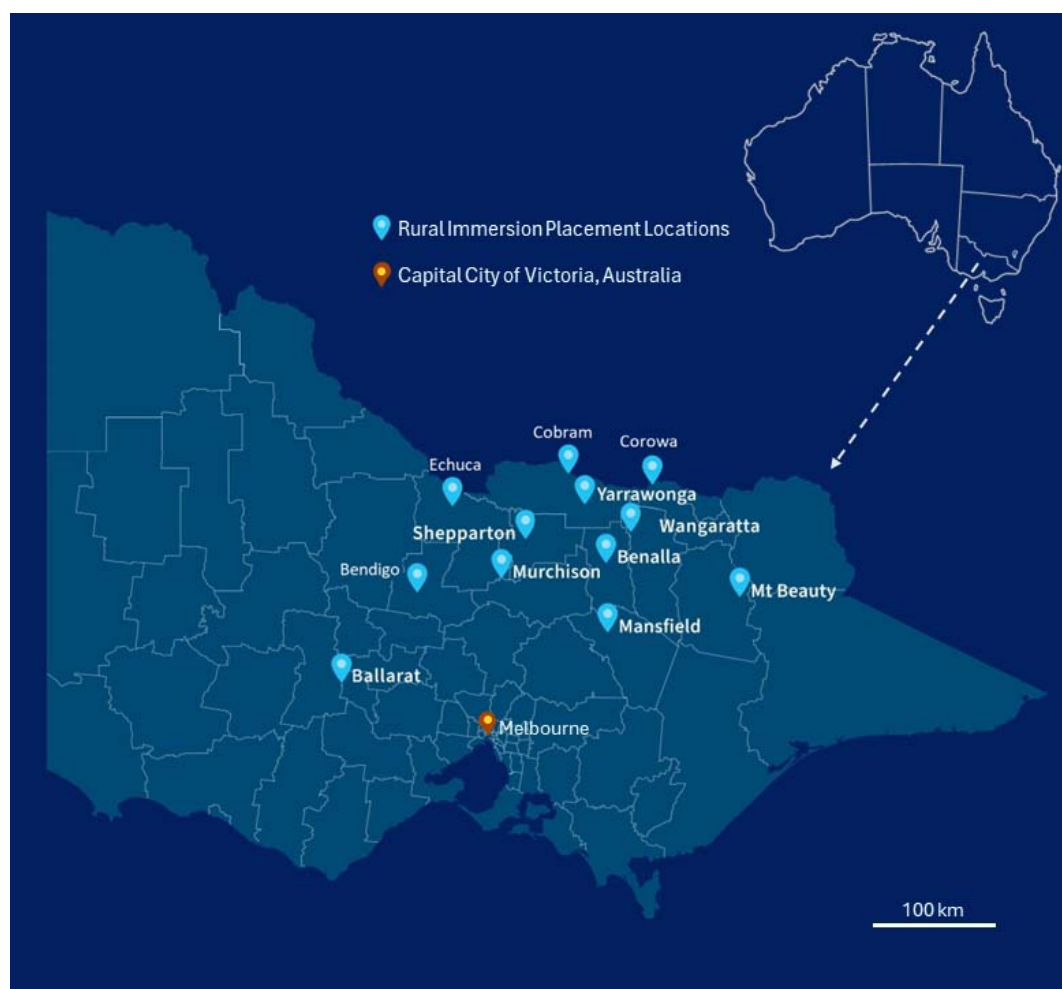


FIGURE 2

The University of Melbourne, Doctor of Medicine rural immersion program placement locations across rural Victoria (MMM2–MMM7). 2019 MMM Classifications of Rural Immersion Placement Locations; Ballarat (MMM2), Benalla (MMM4), Bendigo (MMM2), Cobram (MMM4), Corowa (MMM4), Echuca (MMM3), Mansfield (MMM5), Mt Beauty (MMM5), Murchison (MMM5), Shepparton (MMM3), Wangaratta (MMM3), Yarrawonga (MMM4) (5).

had undertaken a minimum of 1-year rural placement during their degree. This yielded a total of 537 graduates across the eight cohorts. At the time of this study, four of these eight cohorts were postgraduate year (PGY) 5 or greater ( $n = 266$ ), and the remaining four cohorts were < PGY5 ( $n = 271$ ) (Figure 3B). Given the limited time since graduation, only a small proportion of graduates had completed specialty training (5.8%). The majority of graduates possessed a general (73.6%) or provisional (12.8%) registration (Figure 3C). Of the total graduates 47.9% were male and 52.1% were female (Figure 3A), 54.9% completed three years of rural immersion (3 years rural immersion) and 45% completed one-year of rural immersion. AHPRA records could not be located, and hence a principal place of practice could not be determined, for 42 of the 537 graduates.

## Binomial logistic regression outcome

The logistic regression model was statistically significant [ $\chi^2(24) = 138.472$ ,  $p < 0.001$ ], indicating that the predictor

variables as a group reliably distinguished between medical graduates practicing in regional/rural versus metropolitan areas. The model explained 30.8% of the variance in practice location based on the Cox & Snell  $R^2$  and 45% based on the Nagelkerke  $R^2$ . The overall classification accuracy was 84.8%, with a sensitivity of 62.6% (correctly identifying regional/rural practitioners) and a specificity of 92.8% (correctly identifying metropolitan practitioners).

The performance of the logistic regression model was also evaluated using a receiver operating characteristic (ROC) curve (Supplementary Figures 1–3, Supplementary Tables 1–4). The area under the curve (AUC) was 0.857 (Supplementary Table 2), indicating very good discrimination between regional/rural and metropolitan practice locations. The ROC curve analysis supports the utility of the logistic regression model in identifying significant predictors of regional/rural practice location, with sensitivity and specificity aligning with the overall classification accuracy presented earlier (84.8%).

Among the predictor variables, internship location [ $B = 2.174$ ,  $\text{Exp}(B) = 8.793$ ,  $p < 0.001$ ] and intention to practice

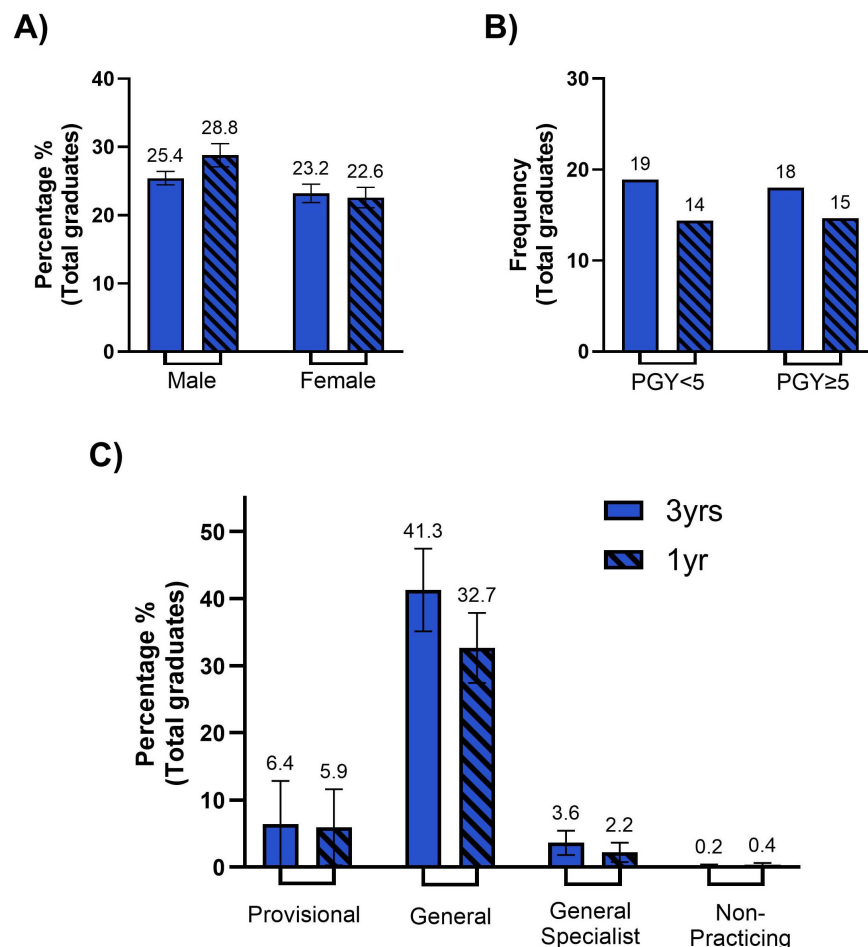


FIGURE 3

Demographics of our student cohort. (A) Bar chart representing the percentage of our student cohort separated by those who were in the 3-year immersion program (solid color) versus those who were in the 1-year immersion program (diagonal lines), that are male (dark blue) and female (light blue). The percentage of males (left) and females (right) amongst are statistically comparable across the 3-year and 1-year immersion programs. Error bars represent the standard error of the mean (SEM). (B) Bar chart representing the frequency of 3-year immersion (solid color) and 1-year immersion (diagonal lines) student cohort that are currently identified as being in a post graduate year (PGY) < 5 years (dark blue) or PGY ≥ 5 years (light blue). Whilst the total frequency of 1-year immersion graduates for PGY < 5 and PGY ≥ 5 were slightly lower than 3-year immersion graduates, they are statistically comparable. (C) Bar chart representing the percentage of total graduates that are currently registered as provisional (dark blue), general (medium blue), general specialist (light blue) or non-practicing (gray), divided by 3-year immersion (solid color) and 1-year immersion (diagonal lines) cohorts. No statistical significance is seen between 3-year and 1-year immersion cohorts for any registration type (provisional, general, general specialist, non-practicing). Although not depicted on the graph significance is seen between the percentage of total graduates registered as general and all other registration types (for both 3-year immersion and 1-year immersion cohorts). Error bars represent the standard error of the mean (SEM).

regionally/rurally [ $B = 1.789$ ,  $\text{Exp}(B) = 5.984$ ,  $p = 0.026$ ] emerged as significant contributors (Table 1). Graduates who completed their internship in a regional/rural location were nearly nine times more likely to currently practice in a regional or rural area compared to those who interned in metropolitan areas. Similarly, graduates who had expressed an intention to practice regionally/rurally during their studies were approximately six times more likely to be practicing regionally or rurally.

Registration type was significant overall ( $p = 0.016$ ), however, no individual registration type was found to be a useful predictor of practice location [Provisional (1):  $B = -1.277$ ,  $\text{Exp}(B) = 0.279$ ,  $p = 0.443$ ] [General (2):  $B = -1.758$ ,  $\text{Exp}(B) = 0.172$ ,  $p = 0.270$ ] [General Specialist (3):  $B = 0.082$ ,  $\text{Exp}(B) = 1.086$ ,  $p = 0.961$ ]. Other variables, including gender ( $p = 0.347$ ), placement duration ( $p = 0.947$ ), and MD4 placement location ( $p = 0.730$ ), did not significantly predict regional/rural practice. Internship preference

levels showed variability, but extreme coefficients in some categories (e.g., preference levels 6, 9, 10 and 11  $B \approx 20$ ) reflect data sparsity. The odd ratios and 95% confidence intervals (CI) for all variables included in the logistic regression are presented in Table 1.

## ANOVA, Mann–Whitney test and simple linear regression

### Two-way ANOVA

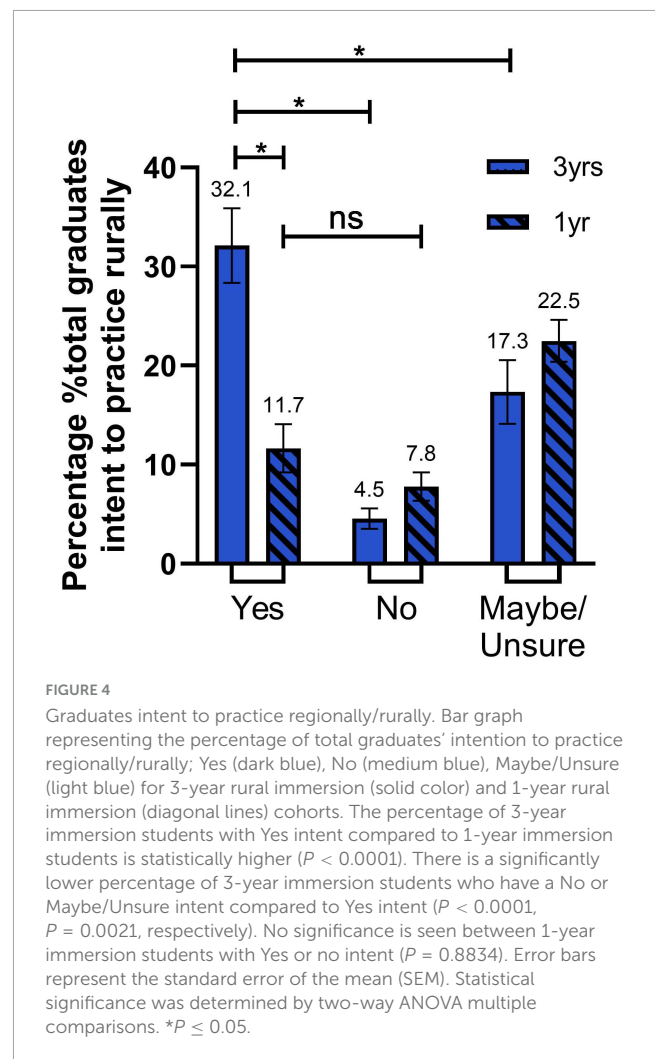
In conjunction with the logistic regression, a two-way ANOVA was conducted to examine the effects of the duration of rural placement (1-year vs. 3-years) and intention for regional/rural practice (yes vs. no vs. maybe/unsure) on the principal place of

**TABLE 1** Results of binomial logistic regression analysis for predictors of rural practice location.

| Variable                                      | Odds ratio (95% CI) | p-value (alpha set at 0.05) |
|-----------------------------------------------|---------------------|-----------------------------|
| Placement duration (3 years, rural immersion) | 1.03 (0.40–2.66)    | 0.947                       |
| Internship location (regional/rural)          | 8.79 (4.47–17.29)   | < 0.0001*                   |
| <b>Regional/rural intent (overall effect)</b> | –                   | <b>0.01*</b>                |
| Regional/rural intent (yes)                   | 5.98 (1.24–29.01)   | <b>0.026*</b>               |
| Regional/rural intent (unsure)                | 2.25 (0.47–10.85)   | 0.314                       |
| Registration type (overall effect)            | –                   | <b>0.016*</b>               |
| Registration type (provisional)               | 0.28 (0.01–7.26)    | 0.279                       |
| Registration type (general)                   | 0.17 (0.01–3.92)    | 0.172                       |
| Registration type (general specialist)        | 1.09 (0.04–28.43)   | 0.961                       |
| PGY ( $\geq 5$ years)                         | 0.52 (0.25–1.08)    | 0.081                       |
| Gender (female)                               | 1.35 (0.73–2.50)    | 0.347                       |
| MD4 location (overall effect)                 | –                   | 0.73                        |
| MD4 location (1)                              | 0.94 (0.35–2.52)    | 0.91                        |
| MD4 location (2)                              | 0.98 (0.32–2.99)    | 0.974                       |
| MD4 location (3)                              | 0.84 (0.26–2.81)    | 0.778                       |
| MD4 location (4)                              | 2.02 (0.63–6.46)    | 0.225                       |
| Internship preference (overall effect)        | –                   | 0.914                       |
| Internship preference (1)                     | 1.02 (0.42–2.48)    | 0.96                        |
| Internship preference (2)                     | 0.23 (0.06–0.89)    | <b>0.034*</b>               |
| Internship preference (3)                     | 0.69 (0.16–2.97)    | 0.616                       |
| Internship preference (4)                     | 0.76 (0.15–3.73)    | 0.734                       |
| Internship preference (5)                     | 0.61 (0.13–2.93)    | 0.536                       |
| Internship preference (6)                     | 0.00 (0.00–0.00)    | 1                           |
| Internship preference (7)                     | 0.49 (0.04–5.99)    | 0.574                       |
| Internship preference (8)                     | 1.00 (0.07–13.42)   | 0.997                       |
| Internship preference (9)                     | 0.00 (0.00–0.00)    | 0.999                       |
| Internship preference (10)                    | 0.00 (0.00–0.00)    | 1                           |
| Internship preference (11)                    | 0.00 (0.00–0.00)    | 1                           |
| Constant                                      | 0.19                | 0.358                       |

\* $p < 0.05$ . Bold font is to help emphasise statistically significant  $p$ -values.

practice (metro vs. rural) of graduates. Tukey's *post-hoc* test was used for pairwise comparisons. In a univariate model the main effect of placement duration (3-years vs. 1-year) was not statistically significant,  $F(1, 42) = 3.828$ ,  $p = 0.057$ , indicating that graduates from the 3 years rural immersion were not more likely to choose regional or rural practice compared to those who completed only 1 year. The main effect of intention for regional/rural practice was significant (in a univariate model),  $F(2, 42) = 23.15$ ,  $p < 0.0001$ , with graduates who expressed positive intent for regional/rural practice more likely to practice in regional/rural areas compared to those who were unsure or had no intention to practice regionally/rurally. The interaction between duration and intent was also significant,  $F(2, 42) = 16.06$ ,  $p < 0.0001$ , suggesting that the



effects of the 3 years rural immersion program and intention for regional/rural practice were dependent on each other.

### Tukey's multiple comparisons test

Following the significant main effect for intent and interaction effect, Tukey's multiple comparisons test revealed the following differences:

- Graduates of the 3 years rural immersion who expressed positive intent for regional/rural practice were significantly more likely to choose regional or rural practice compared to the 1-year rural immersion graduates who had also indicated positive intent ( $p < 0.0001$ ) (Figure 4).
- Graduates of the 3 years rural immersion who expressed positive intent for regional/rural practice were significantly more likely to choose regional or rural practice compared to graduates of the 3 years immersion who indicated they were unsure ( $p = 0.0021$ ) or that did not intend to practice regionally/rurally ( $p < 0.0001$ ) (Figure 4).
- 1-year rural immersion graduates who expressed positive intent for regional/rural practice were not more likely to practice regionally or rurally compared to 1-year rural immersion graduates that indicated no intention for regional/rural practice ( $p = 0.8834$ ) (Figure 4).

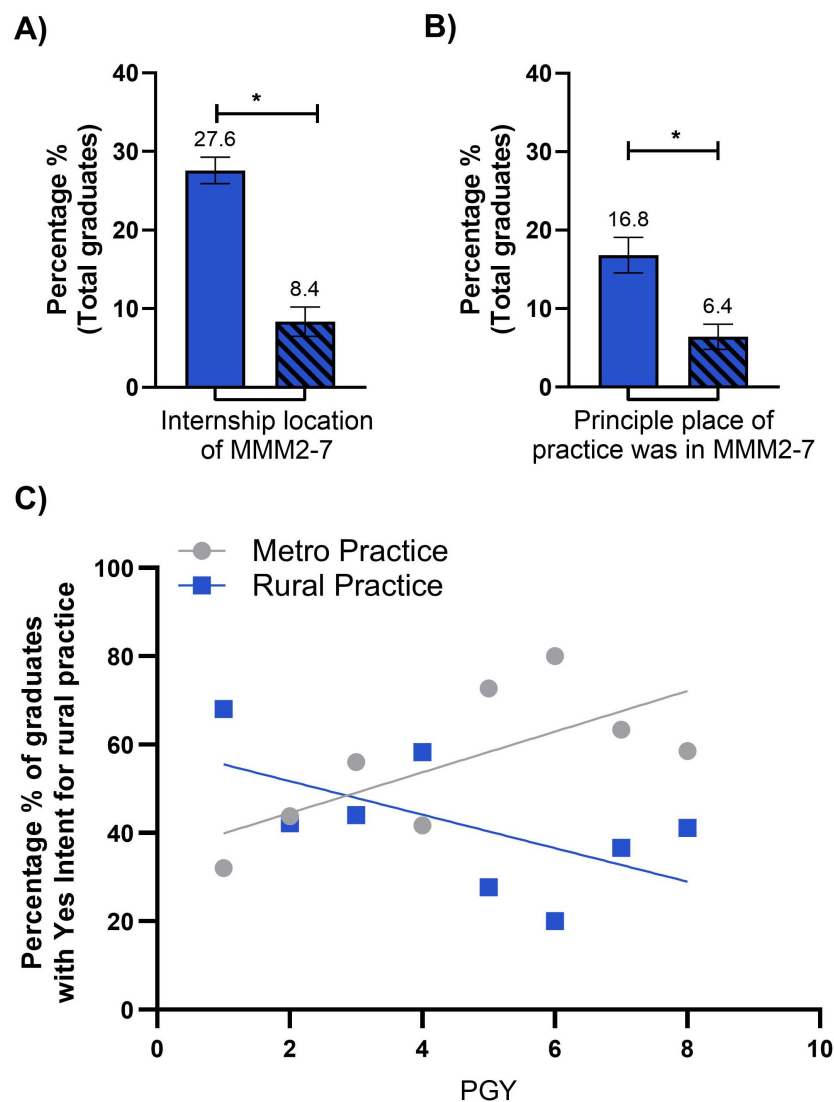


FIGURE 5

(A) Bar graph representing the percentage of total graduates in the 3-year rural immersion (solid color) and 1-year rural immersion (diagonal lines) cohorts whose internship location was zoned within MMM2-7. The percentage of 3-year immersion students with an internship location in MMM2-7 was significantly higher than 1-year immersion students ( $P = 0.0006$ ). Error bars represent standard error of the mean (SEM). (B) Bar graph representing the percentage of total graduates in the 3-year immersion (solid color) and 1-year immersion (diagonal lines) cohorts whose principal place of practice was zoned within MMM2-7. The percentage of 3-year immersion students whose principal place of practice was located within MMM2-7 was significantly higher than 1-year immersion students ( $P = 0.0019$ ). Error bars represent standard error of the mean (SEM). Statistical significance for (A,B) was determined by Mann-Whitney test.  $*P < 0.05$ . (C) Linear regression highlighting those students who are metro (gray circles) and rural (blue squares) practicing who had a Yes intent for regional/rural practice, across the 8 post graduate years (PGY). Metro practicing students across the PGY's shows a positive trend and Rural practicing shows a negative trend across PGY's, statistical analysis revealed no significant difference between the slopes of the two regression lines ( $P = 0.0559$ ,  $P = 0.1141$ , respectively). Statistical significance was determined by Mann-Whitney test of percentage.  $*P < 0.05$ .

### Mann–Whitney U test

A Mann–Whitney U test was conducted to compare the regional/rural internship location between graduates of the 3 years rural immersion program and those who completed only a 1-year rural immersion placement. Results showed a significant difference in rural internship locations between the two groups ( $U = 0$ ,  $p = 0.0006$ , two-tailed) (Figure 5A). Graduates with 3 years rural immersion had a higher sum of ranks (77) compared to graduates who completed a 1-year rural placement (sum of ranks = 28). The median regional/rural internship location for 3 years rural immersion graduates was 29.58 ( $n = 7$ ), significantly greater

than the median of 7.14 for 1-year rural immersion graduates ( $n = 7$ ). The actual difference in medians was  $-22.44$ , with the Hodges–Lehmann estimate of the difference being  $-19.24$ , further highlighting the disparity in regional/rural internship locations between the two groups.

A Mann–Whitney U test was conducted to compare principal place of practice (metropolitan or regional/rural) between graduates with 3 years rural immersion and those who completed only 1-year of rural immersion. Results showed a significant difference in practice locations between the two groups ( $U = 4$ ,  $p = 0.0019$ , two-tailed) (Figure 5B). Graduates with 3 years of rural

immersion had a higher sum of ranks (96) compared to graduates who completed a 1-year rural immersion (sum of ranks = 40). The median regional/rural internship location for 3 years rural immersion graduates was 17.47 ( $n = 8$ ), significantly greater than the median of 5.66 for 1-year rural immersion graduates ( $n = 8$ ). The actual difference in medians was  $-10.81$ , with the Hodges–Lehmann estimate of the difference being  $-10.57$ . These results highlight the disparity in principal place of practice between the two groups, albeit this is not as pronounced as internship location.

### Simple linear regression

Graduates with intention for regional/rural practice (regardless of placement duration) were grouped and their principal place of practice was presented as a function of time since graduation (Figure 5C). These data demonstrate a potential trend of rural attrition (Slope =  $-3.772$ ,  $R^2 = 0.3566$ ) and metropolitan accumulation (slope =  $4.609$ ,  $R^2 = 0.4826$ ). However, neither slope was statistically significant ( $p = 0.118$  and  $p = 0.056$ , respectively).

## Discussion

The findings from the extended rural placement of students (rural immersion) at the University of Melbourne's Rural Clinical School (RCS) provide evidence of the program's success in addressing regional and rural healthcare workforce shortages. By implementing rural immersion and emphasizing regional and rural placements, the 3-year rural immersion program has achieved significant outcomes. Graduates who were part of the full 3-year immersion were significantly more likely to intend on practicing in a regional or rural location, than those who only completed 1-year (Figure 4). Additionally, graduates who indicated intention for regional/rural practice were almost 6 times more likely to be currently practicing in a regional or rural location (Table 1). These results highlight the program's effectiveness in encouraging medical graduates to serve in rural and remote areas, thereby contributing to goal of equitable healthcare distribution. The results highlight that intent to practice regionally/rurally, and regional or rural internship (MMM2-MMM7) are significant predictors of eventual regional or rural practice (Figures 4, 5A, B). This aligns with previous studies that have demonstrated the correlation between rural exposure during clinical training and rural workforce retention (4, 13). Interestingly, there is evidence to support strategies to enhance intention to practice rurally in nursing and allied health students that are not simply restricted to rural origin students in order to build rural workforce. The results of this study support findings from other studies assessing whether rural clinical placements influence a change in intention to practice regionally or rurally. Glenister et al. (7) report that rural origin and rural training are significant predictors of working regionally or rurally, and that metropolitan based students can change their intention to practice rurally after a rural placement. This is in-line with our results that intent to practice regionally/rurally and internship placement in regional/rural settings are significant predictors of eventual regional or rural practice. We do not have data on what proportion of graduates are of rural origin, however, our new end-to-end training program admits prospective students based on rural origin, among other variables.

As seen in Figure 5C, our data demonstrate a potential rural attrition rate and metropolitan accumulation. It could be argued

that there is a loss of rural graduates to metropolitan areas for specialist vocational college-led training. General practice (GP) specialty has largely had a good uptake from our 3 years rural immersion graduates (Figure 3C). In a study of associations between specialty type and practice location at PGY10 from a cohort of nine Australian universities (4), at PGY10, two thirds (820/1220) had achieved fellowship. Furthermore, GP's were 2.8 times more likely to be in non-metropolitan practice than graduates with all other specialist qualification (4). In terms of rural medical workforce, there continues to be limited numbers of general practitioners and medical specialists in rural and regional Australia. The growing trend toward sub-specializations is resulting in a shortage of generalists, particularly in regional and rural Australia (14, 15). There is a need for funded rural and regional internships, rural generalist and specialist training posts and pathways. Government initiatives are well-placed to increase the delivery of vertically integrated medical education. Examples include the Murray to the Mountains intern program, the Mt Gambier community-based junior doctor program, and the Monash Gippsland health education model. To address the shortage of training opportunities in rural and regional Victoria, the University of Melbourne, Deakin University, and Monash University have worked to develop these cost-effective and sustainable solutions. However, in addition to this, there is a need for the medical colleges in Australia to continue increasing the number of specialist vocational training opportunities to be undertake regionally and therefore increase rural training opportunities. As there is a clear relationship between the importance of regional and rural training pathways to longer term work outcomes, and a need to expand specialist vocational training that supports more rural training opportunities. This will lead to the much-needed increase in regional and rural medical workforce after the internship years.

The statistical methodology employed in this study demonstrates its strength and reliability. By utilizing a logistic regression model that accounts for multiple variables simultaneously, the analysis effectively captures the intricate and multifaceted factors influencing regional/rural practice intentions. This approach is critical for mitigating the effects of confounding variables, ensuring that the associations identified are robust and meaningful. Unlike methods such as ANOVA or the Mann–Whitney test, logistic regression also allows for the assessment of model performance, including sensitivity and specificity, providing a more comprehensive evaluation of predictive accuracy.

However, the lower predictive performance of our model in determining regional or rural practice highlights a persistent challenge for institutions: selecting and admitting the most suitable candidates into rural medical programs. While individual institutions may strive to identify students with strong rural intent, national workforce outcomes are unlikely to improve without broader collaboration. Rural medical programs must therefore prioritize data sharing to enhance the translation of intent into actual regional or rural practice. At the same time, it remains essential to preserve other key selection priorities, such as diversity in student backgrounds and experiences, as personality plays a part in an individual's future practice location (16). This highlights the need for continued refinement of recruitment strategies to ensure rural programs attract and support students most likely to commit to, and thrive in, regional and rural practice.

This rigorous methodology enables nuanced insights into key predictors, such as regional or rural internship placements and intent to practice regionally or rurally, both of which are strongly linked to long-term regional/rural workforce retention (Figures 4, 5A, B). These attributes provide a solid foundation for evidence-based decision-making and highlight the importance of employing advanced statistical techniques when evaluating the impact of programs like the extended rural immersion. Unfortunately, this level of methodological rigor has not always been achieved in previous studies assessing rural placements.

The University of Melbourne's new end-to-end medical program, funded through the Australian Government's Murray-Darling Medical Schools Network (MDMSN), builds upon the rural immersion program's foundation. This initiative offers several advancements such as, comprehensive training, enhanced support, and potentially improve outcomes in terms of workforce retention, as evidenced by the higher proportion of 3 years rural immersion students with regional/rural intent then converting to rural practice (Figures 4, 5A, B). Additionally, the novel approach to medical education is it being entirely within regional/rural settings, therefore program eliminating any transitional phases that could disrupt regional/rural practice intentions. Additionally, the now MDMSN-funded program aligns with the latest national priorities to address regional and rural workforce shortages in Australia, and in doing so ensures sustainable support for its objectives. It is too early to know the end-to-end model may further improve retention rates in regional and rural practice compared to the rural immersion program, however it undoubtedly integrates rural exposure throughout the entire medical education journey, and data collection evaluating the impact of the MDMSN is currently underway (17). It is clear that retention of medical graduates is key in increasing a sustainable rural medical workforce (13), thus increasing opportunities for extended rural placement is most likely critical in achieving this aim. The 3 years rural immersion program demonstrated an interaction effect, as evidenced in Figure 4 on 3 years participation and regional/rural intent. This suggests two key dynamics, either the program was strengthening students' intent to practice regionally or rurally, or students with stronger pre-existing regional/rural intent were more likely to self-select into the 3 years programme. Building on these findings, the new end-to-end program strategically recruits students with strong pre-existing regional/rural intent. It then leverages the program structure to nurture, reinforce, and strengthen this intent while simultaneously fostering connections with regional and rural practices. This approach aims to facilitate a seamless transition into regional and rural internships, further solidifying the pathway to a sustained rural medical workforce. As such, the introduction of end-to-end rural medical training is a major step forward in terms of workforce retention.

The findings of this study suggest that sustained and comprehensive rural exposure, as provided by the rural immersion model, may support the development of continuity in students' training experiences and professional relationships. This exposure appears to positively influence students' intent to practise in regional or rural settings. The inclusion of a range of clinical disciplines within the rural curriculum is intended to prepare students for the diverse demands of rural healthcare delivery, although this was not directly assessed in this study. Additionally, the program's approach of allowing students to express placement

preferences may contribute to higher levels of engagement and commitment to rural training pathways.

A limitation of this study is the reliance on data from AHPRA and administrative sources presents potential inaccuracies in identifying graduates' principal places of practice. This is due to AHPRA data potentially not reflecting the most current practice locations due to delays in updating principal practice information. This could misrepresent the graduates' actual regional/rural or metropolitan practice distribution at any given time. Additionally, this could lead to missing data. Although this has not had a significant impact on this study, due to small numbers of missing data, but it could potentially impact previous studies with much larger cohorts. However, in Australia, AHPRA remains the best option logistically to do this. A closer working relationship with AHPRA may be required for future studies to ensure the best possible quality data.

Another important limitation relates to the use of the Modified Monash Model (MMM) in a binary form. In this study, MMM categories 2 to 7 were combined into a broader "regional/rural" grouping, which risks masking important distinctions between regional centers (MMM2), rural communities (MMM3–6), and remote areas (MMM7). These locations vary markedly in healthcare access, education access, employment opportunities for partners, infrastructure, and workforce retention challenges. Future research with larger sample sizes, or through collaborative data sharing across institutions, should aim to examine these categories separately to provide more nuanced insights.

Furthermore, the self-reported nature of intent data introduces an element of subjectivity and may not fully capture the multifactorial and evolving nature of decisions about future practice location. Mixed-methods approaches that incorporate both quantitative data and qualitative insights may better reflect the complexity of these decisions. Finally, the retrospective design of the study limits the ability to infer causality between training experiences and subsequent practice location.

The transition from the rural immersion program to the MDMSN-funded end-to-end medical program represents a strategic evolution in rural medical education. By addressing systemic barriers such as professional isolation and limited career development opportunities, the new program aims to create a resilient and regionally distributed healthcare workforce. Future research should evaluate the long-term impacts of this model, and longitudinal integrated clerkship (LIC) models more broadly. In particular, future work should examine their effectiveness in retaining graduates in regional and rural practice and its scalability to other institutions. Additionally, exploring the interplay of factors such as mentorship quality and community integration could provide deeper insights into shaping practice intentions. As addressing systemic barriers to rural practice, such as professional isolation, spousal opportunities, schooling options for children etc., remains essential.

## Conclusion

These findings demonstrate the evidenced based approach that can be taken to evolving and optimizing rural medical education programs and their impact on meeting the healthcare needs of regional and rural communities. A critical aspect of our study's

robustness lies in the statistical methodology employed. Utilizing a logistic regression model that controlled for multiple variables simultaneously, significant associations emerged regarding practice intent. This methodological distinction is crucial as it captures the complexity of factors influencing regional and rural practice decisions and underscores the importance of using advanced statistical methods to control for confounding variables. Future studies should adopt similar approaches to ensure accurate and meaningful interpretations of program outcomes.

Outcomes from the rural immersion program demonstrates its value in influencing medical graduates to practice in regional or rural areas. By integrating comprehensive rural immersion into medical education, the program addresses critical workforce shortages and contributes to the equitable health outcomes for those living in rural communities. These findings support continued investment in, and expansion of, rural clinical programs. Encapsulated by the new, evidenced-based end-to-end program, is designed to improve retention rates in regional and rural practice compared to the rural immersion program, as it recruits for rural origin students, with a strong intent for regional/rural practice, and now integrates regional and rural exposure throughout the entire medical education journey.

## Data availability statement

The datasets presented in this article are not readily available because although raw data have been anonymized, group sizes are such that there may be a risk of reidentification of participants. As such, the dataset will not be made available. Additional ethical approval must be sought for use of this dataset, outside of the analyses presented here. Requests to access the datasets should be directed to [w.harvey@unimelb.edu.au](mailto:w.harvey@unimelb.edu.au); [lachlan.vanschalk@unimelb.edu.au](mailto:lachlan.vanschalk@unimelb.edu.au).

## Ethics statement

The studies involving humans were approved by The University of Melbourne–Human Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because all data have been completely de-identified and pooled. The following steps were undertaken to assess the risks associated with this project; Identify any risks, Gauging their probability and severity, Assessing the extent to which they can be minimized, Determining whether they are justified by the potential benefits of the research, Determining how they can be managed. Through consideration of the above points outlined in the National Statement Chapter 2.1, it was deemed that there are negligible risks and burdens associated with this research project. It was determined that there is no risk of; physical or psychological harm, exposure of illegal activities, economic harm, discrimination, stigma, social harm, devaluation, harassment, familial distress, harm to a member of a vulnerable population, or reputational harm. It was, therefore, deemed that

a waiver of consent was appropriate, rather than retrospectively seeking individual, written, informed consent.

## Author contributions

WH: Conceptualization, Formal Analysis, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review and editing. ZA: Data curation, Formal Analysis, Methodology, Writing – original draft, Writing – review and editing. LV: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review and editing. TD: Conceptualization, Formal Analysis, Methodology, Visualization, Writing – original draft, Writing – review and editing. JW: Conceptualization, Methodology, Writing – review and editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The authors declare that no Generative AI was used in the creation of this manuscript.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1587912/full#supplementary-material>

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# Place-based rural health professional pre-registration education programs: a scoping review

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**Introduction:** With an increasing focus on social accountability in program design in response to a shortage of rural healthcare professionals, emerging approaches in pre-registration health professional education (HPE) offer 'place-based' solutions. This review assesses the adoption of these approaches by the international HPE community and describes how programs are designed to recruit and train students 'in place'.

**Methods:** Utilizing a global scoping review, a search strategy of relevant HPE databases was developed based on the review's eligibility criteria and key search terms. Titles and abstracts of all articles were screened against the review's inclusion criteria, followed by full text review of articles retained. Reporting followed the Preferred Reporting Items for Systematic Reviews and Meta-analysis extension for scoping reviews (PRISMA-ScR) checklist.

**Results:** Database searches identified 4,215 articles (1,526 duplicates). Title and abstract screening were completed, with 319 retained for full text review. Of these, 138 met the inclusion criteria, with 50 unique HPE programs from 12 countries identified, predominantly from medicine or nursing and midwifery. Programs often had a dual purpose to provide a rural workforce and increase access to HPE for under-represented groups. Recruitment strategies included preferential admission of local students, identifying students with rural or primary care intentions, community involvement in selection, and pre-entry programs. A typology of four training models was identified: short-term rural placements, extended rural placements, rural campuses, and distributed blended learning. Distributed blended learning occurred primarily in nursing and midwifery programs, enabling students to train in their home rural communities. Outcomes evaluated by programs focussed on graduates' work locations, the effectiveness of widening access measures, and academic results.

**Discussion:** Despite heterogeneity of design and context, place-based programs were characterized by three common features closely aligned with social accountability: widening access to HPE, comprehensive program design and a community-engaged approach. Key considerations for place-based HPE program design are the geographical scale of the program, strategies for student recruitment from the target region, provision of continuity with rural communities through longitudinal training experiences, engaging communities in the design and delivery of the program, and alignment of evaluation with the goals of the program and the communities served.

## KEYWORDS

place-based, social accountability, health professional education, rural workforce development, comprehensive program design, scoping review, rural medical education, widening access

## Introduction

A shortage of rural healthcare professionals is a global phenomenon that crosses economic, geographic, and health professional discipline boundaries (1–5). There is a need to identify and adopt evidence-based strategies to address this challenge, including through health professional education (HPE) program design (1, 6, 7). Universities act as gatekeepers to the majority of HPE pre-registration training (undergraduate and post-graduate pathways prior to professional registration) and play a critical role in determining who is selected by these programs. High levels of competition for course places and an emphasis on academic attainment favor students of metropolitan origin, largely due to their relative educational, resource and socio-economic advantage (8, 9). Traditionally, universities have also been based in more populated settings, thus reducing access for rural-based applicants, although there have been deliberate policy initiatives this century, such as Australia's Rural Health Multidisciplinary Training (RHMT) Program, supporting increased rurally-based health professional training (10, 11).

In such an environment, the focus of rural workforce recruitment has often been, understandably, on 'attract and retain', with a myriad of strategies focused on enticing a population of predominantly metropolitan based, and trained, graduates into rural practice (1, 12). At the pre-registration level, such strategies have included mandatory periods of rural training, bonded return of service schemes, financial incentives linked to rural practice, and rural curricula (1, 4, 5, 7). In Australia, targeted recruitment of rural background students into pre-registration HPE (particularly in medicine) has been a longstanding strategy aiming to improve rural workforce outcomes, yet this measure alone has not been sufficient to address the maldistribution in that country (13).

There is a substantial body of empirical research that provides guidance on the individual factors associated with enhanced rural health workforce outcomes such as rural origin and longitudinal rural training (14–18). However, there is less evidence available to inform how these individual variables might interact within a complex system, or how programs have been designed and evaluated that incorporate multiple elements. The 2021 WHO guidelines on rural and remote health workforce development included a recommendation for 'bundling' of initiatives, as a more effective strategy than isolated interventions (1). Similarly, within medical education there has been increasing discourse on the importance of comprehensive approaches to program design, where several design elements are included (such as rural student selection, extended rural training, and rural curricula) with the expectation of an enhanced outcome (6, 19–21).

The role and importance of social accountability in HPE has gained prominence since the beginning of the 21st century (22–24). Social accountability of educational institutions is defined as 'the obligation to direct their education, research and service

activities toward addressing the priority health concerns of the community, region, or nation that they have a mandate to serve' (25). The increasing focus on social accountability is reflected in the strengthened recommendations in the 2021 WHO guidelines. Notably, they state that all health workforce education institutions are 'obliged' to adopt social accountability as a core part of their mandate to develop a relevant and appropriate workforce (1).

With an increasing focus on both social accountability and comprehensive program design, emerging alternatives to 'attract and retain' in HPE have been described as 'growing your own' or 'place-based' solutions (26–29). These two phrases convey different emphases but share an overlapping purpose to recruit and train students *from* and *for* a specific place. 'Growing your own' emphasizes the recruitment of students already embedded in rural communities and providing them with access to training opportunities, ideally in the local area (26, 27). 'Place-based' approaches recognize that education is inexorably grounded in the place and context in which it occurs (29). Place-based education (PBE) seeks to strengthen students' connections with their location and community through the context, content, and pedagogy of curriculum delivery (30–32).

The purpose of this scoping review is to assess the extent of adoption of these approaches by the international HPE community and describe how programs are being comprehensively designed to achieve these goals. A synthesis of the literature on program design in place-based HPE will provide a summary of this evolving field, that will inform contemporary program design and evaluation. Following a search of completed and in-progress reviews, including contacting authors of two reviews in progress on rural PBE, it was determined that the proposed review was substantially different in focus.

## Objectives

This scoping review will identify rural pre-registration HPE programs in the international literature that are adopting a place-based approach to recruiting and training students in a defined geographic region. The review will synthesize the literature to answer the following research questions:

1. What is the global distribution of rural place-based pre-registration HPE programs and how is their concept and purpose described?
2. How is this concept translated into HPE program design?
  - a) How is place defined geographically?
  - b) How is place-based student recruitment occurring?
  - c) How are place-based training and recruitment co-occurring?
  - d) What program outcomes are being investigated?

## Methods

This scoping review was conducted using Arksey and O'Malley's scoping review guidelines (33) and follows the Preferred Reporting Items for Systematic Reviews and Meta-analysis extension for scoping reviews checklist (PRISMA-ScR) (34) (Supplementary file 1). The review protocol was registered with Open Science Framework (osf.io/56dcf) on 29th May 2024.

## Inclusion criteria

The population, context, and concept framework was used to construct the review's inclusion criteria (Table 1).

TABLE 1 Inclusion criteria and exclusion criteria.

|            | Include                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Exclude                                                                                                                                                                                                                                                                                                                             |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Population | <p>Must include <b>both</b> of the following:</p> <ul style="list-style-type: none"><li>health professional education (HPE) program: e.g. medicine, nursing, dentistry, allied health - all types</li></ul> <p><b>AND</b></p> <ul style="list-style-type: none"><li>primary HPE: entry to practice degree (either undergraduate or graduate entry)</li></ul>                                                                                            | <ul style="list-style-type: none"><li>non-HPE training programs</li><li>post-graduate training (beyond entry to professional qualification)</li></ul>                                                                                                                                                                               |
| Context    | <ul style="list-style-type: none"><li>rural/remote/non-metropolitan setting (as stated or defined in the study)</li></ul>                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"><li>metropolitan setting or setting not stated</li></ul>                                                                                                                                                                                                                                          |
| Concept    | <p>Includes each of the following elements:</p> <ul style="list-style-type: none"><li>identifies a focus on a rural region at a scale smaller than national (e.g. region, state, province, territory, town)</li></ul> <p><b>AND</b></p> <ul style="list-style-type: none"><li>recruits students from this region</li></ul> <p><b>AND</b></p> <ul style="list-style-type: none"><li>provides some element of training in the same rural region</li></ul> | <ul style="list-style-type: none"><li>student selection from a region but not linked with training in the same region</li><li>training in a region but not linked with student selection from the region</li><li>neither student selection nor training linked to a region</li><li>distance education on a national scale</li></ul> |

No restrictions were placed on the type of evidence sources considered for inclusion, with evidence syntheses, editorials and conference presentations considered along with all types of original research study design. There were no restrictions placed on publication date, to allow for a historical perspective on this topic. Only articles available in English were included.

## Information sources

Databases were chosen due to their relevance to HPE: Medline, Cumulative Index of Nursing and Allied Health Literature (CINAHL) and ERIC (Ebscohost), Scopus, and Excerpta Medica database (Embase). Due to the large number of papers identified for screening by the primary database search, the pragmatic decision was taken not to widen the search to grey literature, snowball or hand searching of references, to keep the review size manageable.

## Search strategy

A search strategy was developed based on the review's eligibility criteria and key search terms identified in papers known to the authors. Search terms were developed using relevant index search terms, keywords, and truncation symbols translated to each individual database and searched separately (Supplementary file 2). Search terms relating to the allied health professions were developed based on terminology used by representative bodies of allied HPE in Australia, United States of America, United Kingdom, and peer-reviewed literature.

Several reference papers known to the authors were used to validate the search strategy. The search strategy was trialed and refined to extract relevant papers from the literature.

## Study selection and data charting

Citations of all articles identified by the database search were exported to Endnote 21 reference library (Clarivate™) and then imported to Covidence™ (Veritas Health Innovation, Melbourne, Australia) for screening. Duplicates were identified and removed by Covidence software, and any remaining duplicates were manually removed during the screening process. Two reviewers (LF and JB) independently screened the title and abstract of all articles against the review's inclusion criteria. Full text review was then performed independently by the same two reviewers, with reasons provided when articles did not meet the review's inclusion criteria. Conflicts were resolved by discussion between JB and LF periodically during the screening process.

A data extraction template and guidance document were developed and piloted by two authors (LF and JB), following which data were charted for each included article (LF and JB). Categorical outcomes for extracted data where relevant, were determined during the trialing phase. Data charted by each reviewer were compared during the synthesis of the results, with discrepancies resolved by referring to the primary information source (LF).

For evidence sources that included both rural and metropolitan programs, only rural program information was charted. For literature such as reviews that included multiple programs, only data for programs that met the review's inclusion criteria were charted. First or corresponding authors were contacted during full text review if additional information was required to determine whether programs met the review's inclusion criteria. Quality appraisal of articles was not undertaken, consistent with scoping review methodology (33).

## Data items

The following data were extracted to answer the review's questions:

**Population:** program name, program provider, program description, year of commencement, health profession, entry level (undergraduate/post-graduate), return of service requirements.

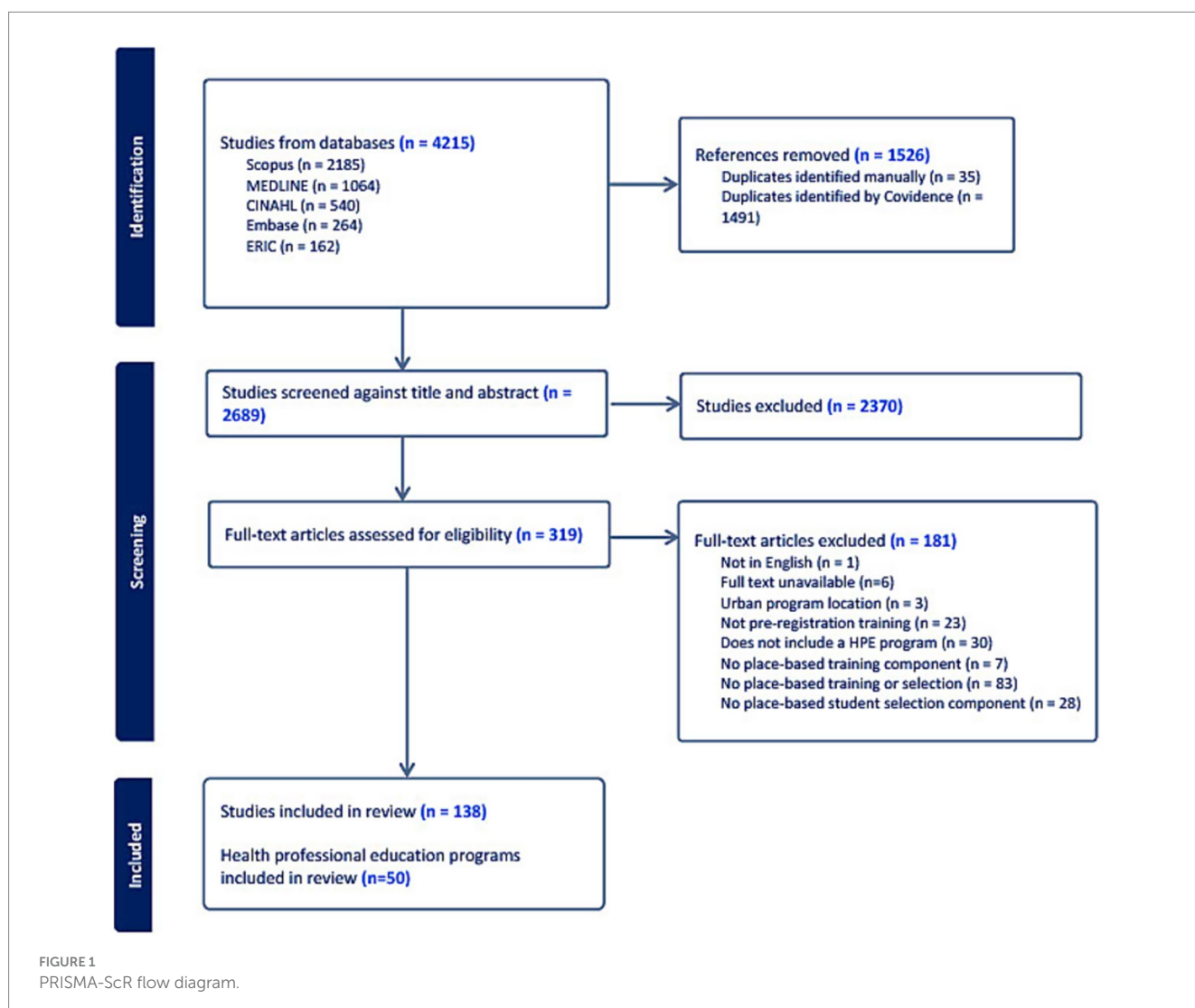
**Context:** country, state/province/location, rurality classification of program.

**Concept:** terminology used to describe program's concept, program purpose, place definition, student selection/recruitment methods, rural training delivery (duration, context, clerkship model), outcome measures.

Metadata of included studies reported included authors, evidence source and year of publication.

## Results

Database searches conducted on 4th October 2023, identified 4,215 articles. Following the removal of 1,526 duplicates, 2,689 studies were screened by title and abstract against the inclusion criteria, with 2,370 excluded at this stage. Full text review of 319 articles was completed, with 181 studies excluded for the following reasons: no place-based training or selection ( $n = 83$ ), no place-based selection ( $n = 28$ ), not a HPE program ( $n = 30$ ), not pre-registration training ( $n = 23$ ), no place-based training component ( $n = 7$ ), full text unavailable ( $n = 6$ ), urban program location ( $n = 3$ ), not available in English ( $n = 1$ ) (Figure 1 PRISMA-ScR flow diagram).



One hundred thirty-eight information sources met the review's inclusion criteria, relating to 50 unique programs. Information sources included journal articles ( $n = 129$ ), organizational reports ( $n = 4$ ), symposium/conference proceedings ( $n = 2$ ), a thesis ( $n = 1$ ), a book chapter ( $n = 1$ ), and a WHO bulletin ( $n = 1$ ).

## Research question 1: What is the global distribution of rural place-based pre-registration HPE programs and how is their concept and purpose described?

### Global distribution

Of the 50 included programs across 12 different countries, 28 were in the USA, with smaller numbers in Canada ( $n = 4$ ), Thailand ( $n = 4$ ), Australia ( $n = 3$ ), Norway ( $n = 3$ ), the Philippines ( $n = 2$ ) and single programs in Japan, New Zealand, Sweden, South Africa, Sudan and Namibia (Figure 2). Programs were included from seven high income countries ( $n = 41$ ) and five low and middle income countries ( $n = 9$ ) (35) and from five of the six WHO regions, the Eastern Mediterranean Region being the exception (36). Forty programs related to a single educational institution (27 medicine, 9 nursing, 1 dental, 3 allied health), six to a collaborative of more than one institution (1 medicine, 1 nursing, 1 dental, 3 allied health) and four to national level government initiatives (medicine).

The commencement dates of programs ranged from 1967 to 2017. Programs in medicine preceded programs in the other health professional disciplines (Figure 3). Programs are listed in order of commencement date in Table 2 (medical programs) and Table 3 (non-medical programs).

### Conceptualisation and purpose

The concept of a 'place-based' approach was evident in terminology used by many programs, although only one used this precise term (29). Concepts used to describe place-based programs

included 'learn where you live' (37) and 'grow your own' (28, 38). Other place-related language included 'sense of place' (acknowledging the existence of place connection, importance of access and opportunity and approaches to strengthening place connection through training) (37, 39), 'local' [usually with reference to the location of the medical school] (40–44), 'home' or 'hometown' (in relation to allowing students to study in or near their home communities (38, 45–47) or evaluating the retention of students or graduates in their home areas (47–51)] and 'place-bound' referring to rural nursing or allied health students with reduced geographic mobility restricting educational access (52–55).

All 50 programs had a clear purpose related to improving rural workforce outcomes. Programs with a predominant workforce purpose used terminology such as 'rural pipeline' (20, 21, 39, 44, 56–60) or 'rural track' (57, 61, 62) to describe a deliberate approach to provide a separate stream of recruitment and training specifically focussed on achieving rural workforce outcomes. Programs were also described as being 'comprehensive' (20, 21, 57, 63, 64) when they included multifaceted, coordinated initiatives including targeted recruitment, admissions, curriculum, support, and evaluation components spanning the training continuum to achieve workforce goals.

There was an equity-driven purpose identified in many programs, underpinned by a social accountability framework. This was evident through the frequent use of the term 'underserved areas' (5, 39, 43, 53, 54, 56, 59, 65–72) to describe priority areas for workforce improvements. The term 'underserved' was often not precisely defined but was frequently inclusive of rural areas (rural underserved) but also extended the program's focus beyond rural areas alone (rural and underserved). Underserved areas were sometimes defined by medical programs as having low physician to population ratios (61, 73, 74).

The majority of programs ( $n = 38/50$ ) demonstrated a social accountability mandate through a concurrent purpose to address both rural workforce needs and widen access to their educational programs for students from rural areas or other under-represented

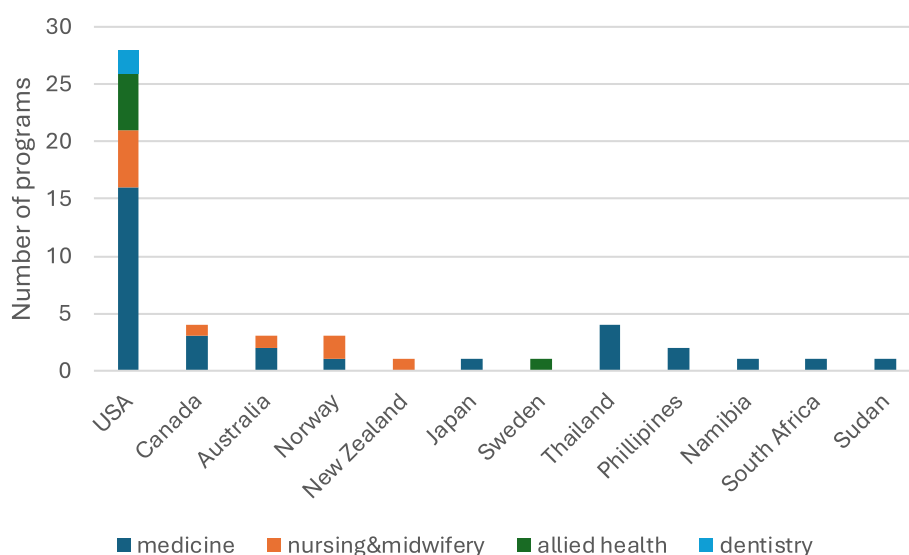


FIGURE 2  
Geographical distribution of health professional education programs.

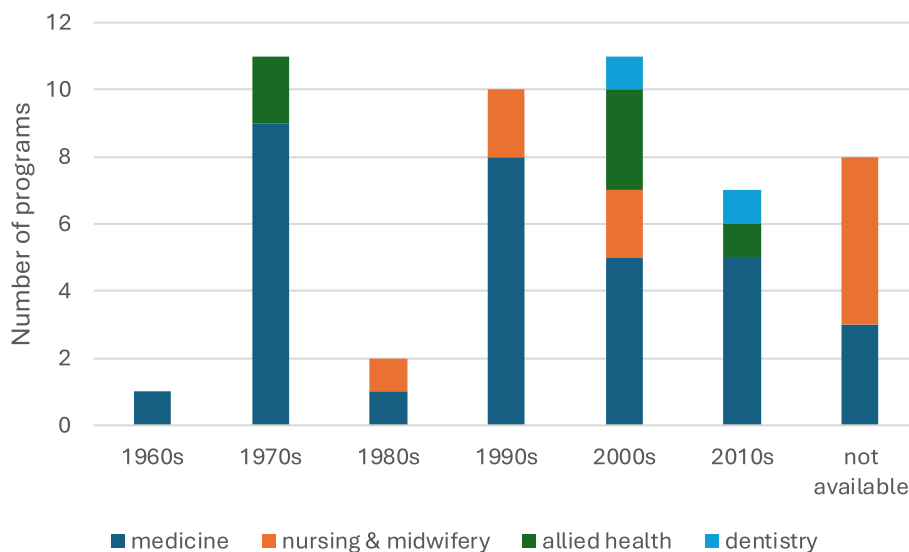


FIGURE 3  
Decade of program commencement by health profession.

populations. Population groups that were targeted under widening access measures related to each program's context, and included Indigenous populations (Australia, Canada, USA), Francophone speakers (Canada), and those experiencing socio-economic or socio-cultural disadvantage (USA) (75). A dual focus on widening access and workforce outcomes was more prevalent in the non-medical programs.

Social accountability was also evident in terminology applied to community-centered educational models, including community-'engaged' (29, 37, 76), 'oriented' (77) or 'based' (76–78). Educational models that emphasized rural community-based learning to increase access for rural students were described as 'distributed' (37, 58, 79–83), 'decentralised' (43, 58, 77, 78, 81, 84–87), 'distance education' (37, 38, 41, 47, 53, 54, 67, 88, 89), 'learn where you live' (37) or as a 'flipped model' (49).

## Research question 2: how is this concept translated into pre-registration HPE program design?

### How is 'place' defined geographically?

Often very large jurisdictional sub-divisions, such as states, territories, and provinces were used by programs in the USA ( $n = 12$ ), Canada ( $n = 1$ ), and Australia ( $n = 2$ ) to define a program's place of focus. This approach was particularly evident in the USA where the workforce purpose of programs was frequently stated in terms of providing a workforce for rural areas of the state in which the program was based, for example, 'training Kentuckians in Kentucky to practice in Kentucky' (90). Reference to one or more rural counties was also used to further clarify geographic focus, evident in the USA (43, 90, 91) and European programs (47, 86). For example, Umea University's web-based pharmacy program focussed on three rural counties in Northern Sweden in which local study groups were established (47). Countries smaller in land mass tended

to use smaller geographic areas to define their place-based focus, assisted by higher resolution national-level geographic subdivisions such as provinces in Thailand (92), and prefectures in the Philippines (93) and Japan (94).

Approximately one-third of programs ( $n = 16$ ) employed descriptive approaches alone to define their region of focus, specific to their context and with an absence of reference to any political or geographical rural subdivisions. Examples include 'northern' (37, 38, 95) 'western' (39) or 'southern' (41, 43) areas of a state or province, or the description of geographical landmarks or boundaries defining an area (53, 70, 82). For example, the University of California Davis Programs in Medical Education (PRIME) describes their region as 'rural Northern California regions from Sacramento to the Oregon and Nevada borders' (70).

The rurality of program locations was inconsistently defined, often without reference to a formal geographic classification system. When provided, descriptors included the proportion of the region defined as rural by statistical measures, population density, population and/or size of the region or training site, distance of training sites from major campuses or cities, and physician-to-population ratios (Tables 2, 3).

### How is place-based student recruitment occurring?

Although all programs included some form of rural student recruitment, detail was often lacking to determine precisely how this was occurring, and the extent to which this was place-based. At a strategic level, the establishment of rural campuses in areas of workforce shortages was a mechanism used to attract local applicants to programs (39, 69, 90). It was observed that the location of rural learning sites for distance education programs heavily influences who participates in these programs (20, 22, 47, 70).

Recruitment in many cases began some years ahead of health professional training commencement, through the provision of formal

TABLE 2 Characteristics of included medical programs, by year of commencement.

| Program name, location                                                                                                                                                       | Year of commencement, program description            | Purpose                                                                                                   | Place definition                                                                                                                                                                                | Place-based selection methods                                                                                                                                              | Place-based rural training                                                                                                                                                               | Evidence sources/ Citations                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Memorial University of Newfoundland and Labrador (MUN), Canada.                                                                                                              | 1967, 4-year graduate entry.                         | To meet the workforce needs of the province.                                                              | Rural areas of Newfoundland and Labrador province. 52% rural province based on Statistics Canada Subdivision (<10,000).                                                                         | Reserved places for residents of province. Holistic admissions process to recruit Aboriginal, rural and remote and economically disadvantaged students.                    | Recurrent short rural clinical placements years 1-4 (2-4 weeks each) and longitudinal rural rotation (3 months).                                                                         | Tesson et al. (66), Mathews et al. (133), Curran et al. (111), Mathews et al. (134), Rourke (22), Strasser et al. (64), Rourke et al. (58, 99, 106), Grierson et al. (159)                                                                                                                       |
| Regional quota scheme (chikiwaku) and prefecture scholarship schemes (both national) Jichi Medical University, Shimotsuke and Asahikawa Medical University, Asahikawa, Japan | 1972, 6-year undergraduate.                          | To produce rural doctors and distribute them nationwide.                                                  | Prefecture. Rural area defined by municipality with either <5 physicians OR physician/population ratio. of 50/100000 or less OR population <20,000 and physician/population ratio <100/100,000. | Admission quota from each prefecture.                                                                                                                                      | Some weeks in home rural prefectures in year 5. Elective rural internship in year 6.                                                                                                     | Hsueh et al. (87), Kataoka et al. (71, 72), Kawamoto et al. (51), Matsumoto et al. (45, 165), Yoshida et al. (164), Ozeki et al. (40), Figueiredo et al. (5)                                                                                                                                     |
| University of Tromsø Medical School, Tromsø, Norway                                                                                                                          | 1972, undergraduate.                                 | To train graduates preferring to work in rural areas of Northern Norway.                                  | Rural areas of Northern Norway (region). Population density 4/ km <sup>2</sup> .                                                                                                                | Admission quota from northern Norway, 50%.                                                                                                                                 | Rural training duration/timing not specified.                                                                                                                                            | Magnus et al. (48), Hsueh et al. (87)                                                                                                                                                                                                                                                            |
| Rural Physician Associate Program (RPAP), University of Minnesota Medical School, Duluth, Minnesota, USA                                                                     | 1972, 4-year graduate entry Doctor of Medicine (MD). | To train physicians serving rural Minnesota, emphasizing family medicine and American Indian communities. | Rural areas of Minnesota (state). Internal classifications used for rural Minnesota preceptorships defined as communities with populations less than 20,000 outside of major urban centres.     | Preferential admission of students with personal and background traits indicating a high potential for becoming a family physician in a small town, rural setting.         | Students live for 3 days each quarter with a rural family medicine preceptor during 2 pre-clinical years, and complete an extended rural community-based placement in year 3 (9 months). | Verby et al. (157), Lampert (105), Keyes-Welch et al. (110), Rabinowitz et al. (156), Geyman et al. (77), Hsueh et al. (87), Crump et al., (39), Rabinowitz et al. (19), Fuglestad et al. (135), Figueiredo et al. (5)                                                                           |
| Physician Shortage Area Program (PSAP), Jefferson Medical College, Philadelphia, USA                                                                                         | 1974, 4-year graduate entry MD.                      | To increase the number of family physicians in rural and underserved areas of Pennsylvania.               | Rural areas of Pennsylvania (state).                                                                                                                                                            | Preferential admission of applicants from rural areas who are committed to rural and family medicine practice. Cooperative arrangements with 6 undergraduate institutions. | Short rural clinical placements, 6 weeks in years 3 and 4 weeks in year 4.                                                                                                               | Rabinowitz et al. (74), Rabinowitz et al. (136), Rosenthal (154), Rabinowitz et al. (137), Keyes-Welch (110), Geyman et al. (77), Rabinowitz et al. (156), Hsueh et al. (87), Crump et al. (39), Rabinowitz et al. (138), Rabinowitz et al. (19), Rabinowitz et al. (160), Figueiredo et al. (5) |

(Continued)

TABLE 2 (Continued)

| Program name, location                                                                                       | Year of commencement, program description                         | Purpose                                                                                                       | Place definition                                                                   | Place-based selection methods                                                                                                                                                                                        | Place-based rural training                                                                                                                                                                                          | Evidence sources/ Citations                                                                                                          |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Upper Peninsula Program (UPP), Michigan State University college of Human Medicine, Michigan, USA            | 1974, 4-year graduate entry MD.                                   | To improve the physician supply in rural areas of Michigan.                                                   | Rural areas of Michigan (state). Distance from main campus 400 miles.              | Preferential admission of rural students of Michigan expressing an interest in primary care.                                                                                                                         | 2 years of urban pre-clinical training followed by relocation to one of six community-based campuses for 2 years of rural clinical training. Includes continuous ambulatory training experience in family medicine. | Brazeau et al. (101), Rosenthal et al. (154), Crump et al. (39), Hsueh et al., (87), Rabinowitz et al. (156), Rabinowitz et al. (19) |
| University of Gezira, Faculty of Medicine, Gezira State, Sudan                                               | 1975, 5-year undergraduate, community-oriented program.           | To meet the workforce needs of rural underserved areas in Gezira region.                                      | Rural areas of Gezira (state).                                                     | 50% of places reserved for students from underprivileged deprived areas of Gezira State.                                                                                                                             | 25% curriculum community based.                                                                                                                                                                                     | Larkins et al. (100, 141), Woolley (125), Johnston et al. (75)                                                                       |
| School of Health Sciences, University of Philippines Manila (UPM-SHS), Palo, Leyte, Philippines              | 1976, 5-year post-graduate MD.                                    | To meet the needs of rural underserved populations in central Philippines archipelago and Indigenous peoples. | Central Philippines archipelago (region). Population density 358/km <sup>2</sup> . | Students are nominated and endorsed by communities. Preferential selection from lower socio-economic strata and rural and remote communities.                                                                        | 6-month rural community placement in year 2 and community internship in final year (12 months).                                                                                                                     | Paul (62), Siega-Sur et al. (103), Reeve et al. (76), Woolley et al. (117, 119), Larkins et al. (141), Johnston et al. (75)          |
| Medical Education for Students from Rural Areas Project (MESRAP) program, Chulalongkorn University, Thailand | 1978, 6-year undergraduate program.                               | Community-oriented curricula track to meet the need for more physicians in rural areas.                       | Province.                                                                          | Candidate should have lived in the rural province for 5 years, they are identified 2 years before medical school entry, posted to work in provincial hospital, evaluated by staff and short listed for application.  | First 3 years at urban campus with community experience during years 2-6 for 3–12-week rotations. 3 clinical years based at provincial hospitals.                                                                   | Suwanwela et al. (183) Paul (62), Sirisup (146)                                                                                      |
| West Virginia School of Osteopathic Medicine (WVSOM), West Virginia, USA                                     | 1978, 4-year graduate entry, Doctor of Osteopathic Medicine (DO). | To provide primary care physicians for rural Appalachia.                                                      | Rural Appalachia (region).                                                         | Consortium with other rural Appalachian states. Select students from rural Appalachia (live outside of a Metropolitan Statistical Area (MSA) or in a small town within an MSA) or those motivated to practice there. | Medical school located rurally, fully rural-based program.                                                                                                                                                          | Roberts et al. (104), Geyman et al. (77)                                                                                             |

(Continued)

TABLE 2 (Continued)

| Program name, location                                                                                                     | Year of commencement, program description | Purpose                                                                                                              | Place definition                                                                                                                 | Place-based selection methods                                                                                                                | Place-based rural training                                                                                                                              | Evidence sources/ Citations                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Walter Sisulu Medical School (WSU), Faculty of Health Sciences, South Africa                                               | 1985, 6-year undergraduate program.       | To meet the workforce needs of rural underserved areas of Eastern Cape and KwaZulu natal provinces.                  | Eastern Cape and KwaZulu natal provinces. Population density 48/km <sup>2</sup> .                                                | Quota system to support Indigenous African enrolments (80%) and those from rural Eastern Cape and KwaZulu Natal provinces (75%).             | Rural experiences in years 1-3 and extended placement in year 5 (6 months).                                                                             | Celletti et al. (158), Larkins et al. (100, 141), Reeve et al. (76), Rourke et al. (58, 99, 106), Johnston et al. (75)                                                               |
| Rural Medical Education track (RMED), University of Illinois College of Medicine, Rockford, Illinois, USA                  | 1993, 4-year graduate entry MD.           | To reduce health disparities through producing family physicians for rural Illinois.                                 | Rural areas of Illinois (state). 84 rural counties (population<60,000) in Illinois.                                              | Applicants selected based on rural background, leadership experience, community involvement, and expressed commitment to rural primary care. | Required rural community-oriented clerkship in year 4 based in primary care (4 months).                                                                 | Keyes-Welch et al. (110), Stearns et al. (21, 61), Rabinowitz (19, 156), Crump et al. (39), Hsueh et al. (87), Glasser et al. (20), Soliman et al. (97), Figueiredo (5)              |
| Ateneo de Zamboanga University School of Medicine (ADZU-SOM), Zamboanga, Philippines                                       | 1994, 4-year graduate entry MD.           | To meet the needs of rural and underserved populations.                                                              | Mindanao in Southern Philippines; especially Zamboanga peninsular and outlying islands. Population density 358/km <sup>2</sup> . | Select local applicants from lower economic strata in Western Mindanao province.                                                             | Years 1-3: 1 month each semester living in small rural communities, year 4: entire year in rural community program.                                     | Strasser (152), Larkins et al. (100, 141, 144), Cristobal et al. (93), Halili et al. (118), Reeve et al. (76), Rourke (58, 99, 106), Woolley et al. (117, 119), Johnston et al. (75) |
| Collaborative Project to Increase Production of Rural Doctors (CPIRD) program, Ministry of Public Health (MOPH), Thailand. | 1994, 6-year undergraduate program.       | National initiative to increase the production of doctors for rural and remote areas.                                | Province.                                                                                                                        | Students are recruited from high schools in rural domiciles in provincial areas.                                                             | Urban pre-clinical training followed by 3 years of clinical training outside major cities and near their hometowns.                                     | Putthasri et al. (107), Thammatacharee et al. (121), Nimkuntod et al. (120), Arora et al. (92), Techakehakij et al. (96, 130), Somporn (60, 182), Figueiredo et al. (5)              |
| Rural Track Pipeline Program (MU-RTPP), University of Missouri School of Medicine, Missouri, USA                           | 1995, 4-year Graduate entry MD.           | To increase the supply and retention of physicians in rural and underserved Missouri.                                | Rural areas of Missouri (state). Town<50000 considered rural by program.                                                         | Selected from 'Rural scholars' pre-admission program. Requires Missouri residence, graduation from a rural high school.                      | 4-8 week summer community program between first and second year, 6-month rural track clerkship (year 3), 1-month rural track elective program (year 4). | Crump et al. 2004 (39), Quinn et al. (56)                                                                                                                                            |
| Rural Medical Scholars Program (RMSP), University of Alabama, Alabama, USA                                                 | 1996, 4-year graduate entry MD.           | To demonstrate increased production of rural physicians by admitting rural students and emphasizing family medicine. | Rural areas of Alabama (state).                                                                                                  | Students must demonstrate 8 years of residence in rural Alabama and have generalist aspirations.                                             | Third-year clerkships in rural family and community medicine.                                                                                           | Wheat et al. (44, 142)                                                                                                                                                               |

(Continued)

TABLE 2 (Continued)

| Program name, location                                                                               | Year of commencement, program description     | Purpose                                                                                                                                                          | Place definition                                                                              | Place-based selection methods                                                                                               | Place-based rural training                                                                                                                            | Evidence sources/ Citations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scholars in Primary Care Program (SPCP), University of Kansas School of Medicine, Kansas, USA        | 1997, 4-year graduate entry MD.               | To increase the number of students who choose to practice primary care medicine in rural Kansas.                                                                 | Rural Kansas (state). 88 of 105 Kansas counties classified as rural.                          | Regional quota system for graduates from Kansas rural high schools and College/Universities.                                | Longitudinal rural track planned for year 3 (9 months).                                                                                               | Keyes-Welch (110), Kallail (46), Kallail (73)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Trover campus rural pathways program, University of Louisville School of Medicine, Madisonville, USA | 1998, 4-year graduate entry MD.               | To provide two years of rural clinical training and reduce urban disruption in the training pipeline.                                                            | Western Kentucky (state). Distance from main campus (150 miles), population 20,000.           | Rural scholars program for high school and college students.                                                                | Urban pre-clinical training followed by 2 rural clinical school years.                                                                                | Keyes-Welch et al. (110), Crump et al. (39)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| James Cook University (JCU), Queensland, Australia                                                   | 1999, 6-year undergraduate bachelor's degree. | To produce graduates who understand rural/remote, indigenous and tropical health issues, with the expectation that many will ultimately serve in those contexts. | Northern areas of Queensland (state). Population density 2.8/ km <sup>2</sup>                 | High school outreach program, selection system aims to favour applicants from local rural towns.                            | Fully rural program, main campuses in rural locations.                                                                                                | Hays et al. (109), Hays et al. (114), Tesson (66), Veitch (143), Sen Gupta et al. (145), Larkins et al. (144), Sen Gupta et al. (124), Sen Gupta et al. (95), Schauer et al. (81), Woolley et al. (132), Larkins et al. (100), Woolley et al. (126), Woolley et al. (84), Reeve et al. (76), Woolley et al. (166), Larkins et al. (141), Ray et al. (123), Rourke et al. (58, 99, 106), Sen Gupta et al. (149), Woolley et al. (117, 119), Woolley et al. (78, 122, 127, 128), Woolley et al. (78, 122, 127, 128), Woolley et al. (78, 122, 127, 128), Woolley et al. (78, 122, 127, 128), Johnston et al. (75), Woolley et al. (49), Woolley et al. (116, 131) |
| University of California (UC) Davis Programs in Medical Education (PRIME), California, USA           | 2003, 4-year graduate entry MD.               | UC Davis PRIME adopted a focus on underserved rural populations.                                                                                                 | Rural areas of Northern California from Sacramento to the Oregon and Nevada borders (region). | Rural outreach programs. Multi-faceted admission assesses rural background, rural exposure, primary care practice interest. | Short rural placements throughout 4 years of the course, deliberately in different communities, rural clinical clerkships in year 3 (total 5 months). | Eidson-Ton et al. (70)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

(Continued)

TABLE 2 (Continued)

| Program name, location                                                                                                 | Year of commencement, program description | Purpose                                                                                                                                                           | Place definition                                                                                                                       | Place-based selection methods                                                               | Place-based rural training                                                                                                                                                                                                                                                   | Evidence sources/ Citations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Northern Medical Program, University of British Columbia (UBC), British Columbia, Canada                               | 2004, 4-year graduate entry program.      | To admit and train future doctors who are more likely to locate their clinical practice in northern and rural settings.                                           | Northern and rural areas of British Columbia (region). Size of Northern British Columbia 500,000/km <sup>2</sup> , population 300,000. | Remote suitability score used to assess suitable applicants for northern program.           | 4 months at urban campus then rest of program between 2 rural campuses and on clinical placements in Northern BC including rural and remote.                                                                                                                                 | Bates et al. (98), Tesson et al. (66), Rourke (22), Snadden et al. (69), Snadden et al. (50)                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| One District One Doctor (ODOD) program, Ministry of Health, Thailand                                                   | 2005, 6- year undergraduate.              | National initiative to increase the production of doctors for rural and remote areas.                                                                             | Rural districts.                                                                                                                       | Students are recruited from high schools in remote rural areas/non-provincial cities.       | Urban pre-clinical training followed by 3 years of clinical training outside major cities and near their hometowns.                                                                                                                                                          | Putthasri et al. (107), Thammatacharee et al. (121), Nimkuntod et al. (120), Arora et al. (92), Techakehakij et al. (130), Somporn (60, 182), Techakehakij et al. (96), Figueiredo et al. (5)                                                                                                                                                                                                                                                                                                                                               |
| Northern Ontario School of Medicine (NOSM), Northern Ontario, Canada                                                   | 2005, 4-year graduate entry program.      | To serve the healthcare needs of the people of Northern Ontario.                                                                                                  | Northern Ontario (region). Statistics Canada Subdivisions: <10,000 people = rural. Population density 4/ km <sup>2</sup> .             | Preferences applicants from northern, rural, remote, Aboriginal or Francophone backgrounds. | Year 1 and 2 rural and Indigenous community placements (total 16 weeks), comprehensive community clerkship in year 3 (9 months).                                                                                                                                             | Tesson et al. (66), Rourke (150), Rourke (22), Curran et al. (111), Strasser S et al. (153), Strasser R et al. (88), Strasser R et al. (112), Strasser R et al. (113), Strasser R et al. (113), Couper et al. (63), Strasser R et al. (151), Hudson (83), Hogenbirk et al. (129), Strasser R et al. (64), Hogenbirk et al. (80), Mian et al. (65), Reeve et al. (76), Larkins et al. (141), Mian et al. (139), Johnston et al. (75), Ross et al. (29), Woolley et al. (49), Grierson et al. (159), Hogenbirk et al. (79), Wood et al. (163) |
| Washington, Alaska, Montana, Idaho (WWAMI) TRUST program, University of Washington School of Medicine, Washington, USA | 2008, 4-year graduate entry MD.           | To redress physician maldistribution by increasing the number of students from the states of Washington, Alaska, Montana and Idaho being trained in primary care. | Rural areas of Washington, Alaska, Montana and Idaho states.                                                                           | Preferential admission of students from rural areas or with substantial rural experience.   | Students are connected to a single rural continuity site during 18 month pre-clinical curriculum, 1 month rural underserved opportunities program between 1 <sup>st</sup> and 2 <sup>nd</sup> year, 18-24 week longitudinal clinical rotation in rural continuity community. | Yergan et al. (140), Keyes-Welch et al. (110), Geyman et al. (77), Rabinowitz et al. (156), Schwarz (155), Hsueh et al. (87), Tesson et al. (66), Rourke (22), Kardonsky et al. (102)                                                                                                                                                                                                                                                                                                                                                       |

(Continued)

TABLE 2 (Continued)

| Program name, location                                                                                                        | Year of commencement, program description                     | Purpose                                                                                                                             | Place definition                                                                                                | Place-based selection methods                                                                                                          | Place-based rural training                                                                                                                                                      | Evidence sources/ Citations                     |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Oklahoma State University Center for Health Sciences College of Osteopathic Medicine (OSU-COM), Oklahoma, USA                 | 2011, 4-year graduate entry, DO.                              | To produce primary care physicians for rural practice with the skills to be effective community leaders and rural health advocates. | Rural areas of Oklahoma (state).                                                                                | Early recruitment of rural high school students.                                                                                       | 3-week rural experience between first and second year, years 3 and 4: required and elective rural-based clinical rotations with opportunity to complete most rotations rurally. | Keyes-Welch et al. (110), Wheeler et al. (57)   |
| Northern Territory Medical Program (NTMP), Flinders University/Australia                                                      | 2011, 4-year graduate entry or 6-year undergraduate entry MD. | To develop a medical workforce for the challenging Northern Territory environment.                                                  | Northern Territory. Whole of territory classified as rural, area 1.3 mill/km <sup>2</sup> , population 200,000. | Tiered admission system prioritises Indigenous and Northern Territory residents.                                                       | Fully rural-based program, main campuses in rural locations.                                                                                                                    | McDonnel Smedts et al. (42), Worley et al. (28) |
| Wisconsin Academy for Rural Medicine (WARM), The University of Wisconsin School of Medicine and Public Health, Wisconsin, USA | 2015, 4-year graduate entry MD.                               | To increase the physician workforce by recruiting medical students who intend to practice in rural Wisconsin.                       | Rural areas of Wisconsin (state). 25% of state's population live in rural areas.                                | Selected based on backgrounds, aptitude for and commitment to careers that focus on serving Wisconsin's underserved rural populations. | Training based at rural campus in year 3.                                                                                                                                       | Landeck et al. (162), Golden (161)              |
| Uni of Kentucky College of Medicine (UK COM), Kentucky, USA                                                                   | 2015, 4-year graduate entry MD.                               | To address state physician shortages through the establishment of two 4- year regional campuses.                                    | Rural counties in Kentucky (state).                                                                             | Preferential admission of in-state applicants (goal 90%).                                                                              | Fully rural program at 2 rural campuses.                                                                                                                                        | Geyman et al. (77), Griffith et al. (90)        |
| Inclusive track, Ministry of Health, Thailand                                                                                 | 2017, 6-year undergraduate.                                   | National initiative to increase the production of doctors for rural and remote areas (adaptation of CPIRD/ODOD program).            | District/province.                                                                                              | Students are recruited from high schools in local remote rural areas.                                                                  | Urban centre pre-clinical training followed by 3 clinical years located outside major cities and nearby their hometowns.                                                        | Techakehakij et al. (96)                        |
| West Virginia University (WVU) School of Medicine West Virginia, USA                                                          | Commencement date not available, 4-year graduate entry MD.    | To provide primary care physicians who are trained to meet the medical needs of rural Appalachia.                                   | Appalachian counties, including all of West Virginia (state).                                                   | Recruits rural students from rural Appalachian counties.                                                                               | 4-week rural rotation in third year in family medicine and 4-week community/rural rotation in 4th year.                                                                         | Keyes-Welch et al. (110), Hedrick J (91)        |

(Continued)

TABLE 2 (Continued)

| Program name, location                                                 | Year of commencement, program description                  | Purpose                                                              | Place definition                                     | Place-based selection methods                                                                                     | Place-based rural training                                                                                                 | Evidence sources/Citations                   |
|------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| University of Namibia SOM (UNAMSoM), Namibia                           | Commencement date not available.                           | To capacitate the health care workforce in Sub-Saharan Africa.       | Unspecified geographical sub-regions of the country. | Regional quota system.                                                                                            | Rural experience year 1: 6 days, year 2: 3 weeks, year 3: once weekly for 36 weeks, year 5: extended placement (6 months). | Pasricha et al. (148), Eichbaum et al. (147) |
| University of New Mexico School of Medicine (UNM-SOM), New Mexico, USA | Commencement date not available, 4-year graduate entry MD. | Commitment to underserved urban and rural populations of New Mexico. | Rural areas of New Mexico (state).                   | Strong preference to recruit residents of New Mexico, minority groups and commitment to serve underserved groups. | 9-week rural practical immersion in 1st year and clinical rotations and electives in rural areas in later years.           | Geyman et al. (77), Tesson et al. (66)       |

pre-entry pathways (39, 44, 46, 56). Common in the USA, pre-entry pathways often included cooperative arrangements with undergraduate institutions in the state (39, 74), and offered guaranteed admission if academic standards were maintained (44, 46, 56). Further targeted pre-entry recruitment strategies were implemented by programs within their communities, including quota-based arrangements with local high schools (92, 94, 96) and active marketing and recruitment (41, 52, 53, 59, 67, 97). Pre-entry programs provided students with clear entry pathways to health professional training as well as often providing opportunities for rural and healthcare exposure to consolidate rural interest prior to course commencement (39, 56).

At the point of course entry, a wide range of approaches were used that attempted to identify and select students aligned with the goals of the program. There were only two examples of admission processes that aimed to identify suitability for a specific place: the Remote Suitability Score developed by the University of British Columbia for their Northern program (98), and Northern Ontario School of Medicine's (NOSM) context score, aligned with the admission of students reflecting Northern Ontario's population demographics (22). Other programs reflected on the influence of the learning locations on the students who participated, leading to the conclusion that study sites can be strategically located to recruit students from target areas of workforce shortage (47, 86).

Admission quotas were used on a national (94) or regional scale (40, 42, 46, 75, 87, 99, 100) to facilitate preferential admission for rural students. Preferential admission of students from the area of focus (28, 100, 101) or rural areas generally (21, 44, 102–104) was also mentioned without stating a specific quota requirement. Demonstration of rural residence or background in the region of focus was commonly a requirement, although detail was not always provided on how this was assessed. Mechanisms that were described included providing evidence of a minimum number of years spent living in a defined rural region (44, 62, 74), small hometown (21, 44, 104–106), or attending a rural high school (44, 46).

Tailored admission requirements were commonly observed across program types, including a reduced emphasis on academic attainment (39, 40, 44, 100), program-specific exams (40, 107), waiver of aptitude

tests (39, 108), and score adjustments for educational disadvantage (99, 109). Some medical programs retained the full admission requirements of the main medical program with additional requirements for the rural pathway, such as current or previous residence in a rural underserved area (74, 102), interviews (20, 70, 101, 102), and letters of recommendation (20, 74).

Several studies described mechanisms for community involvement in student recruitment, with their contributions including personal letters of recommendation (20, 74, 97), student nomination/endorsement (62, 103), involvement in interviews (100), and admission committees (20, 44).

Beyond seeking students from a rural background, admissions processes were often employed to identify students considered more likely to enter rural and/or primary care practice. Assessment of rural identity and intent for rural practice was sought through personal statements (22, 98, 109) and admissions committee interviews (20, 44, 46, 56, 59, 70, 74, 99, 100, 102, 109), by seeking pertinent life experiences and characteristics (104), and rural lifestyle/hobbies (44, 98). Several USA programs had a strong focus on recruiting students with an intention for family medicine practice (20, 46, 74, 110) or generalist practice (44, 70). Evidence of community service was sought as a characteristic of students suitable for program participation (20–22, 59, 70, 104) and, in medicine, this was deemed to be a trait associated with future family medicine practice (21, 77).

## How are place-based training and recruitment co-occurring?

The authors of this review have classified a typology of included programs according to four main models of rural training delivery (Table 4).

In *Type 1 programs: short rural placements* (medicine:  $n = 5$ , dentistry:  $n = 1$ , pharmacy:  $n = 1$ ), rural stream students are attached to a larger mainstream urban program and participate in one or more short term rural rotations. The duration varies from 8 weeks of clinical placement to multiple separate short-term rotations across all years of the course. For example, at the University of New Mexico (USA), students complete a practical rural immersion in their first

TABLE 3 Characteristics of included non-medical programs, by year of commencement.

| Program name, location                                                                                                  | Year of commencement, health profession; program description | Purpose                                                                                                                                                                       | Place definition                                                                                                                                             | Place-based selection methods                                                               | Place-based rural training                                                                                              | Evidence sources/ citations |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Alabama Junior College/School of Health-related professions linkage, The University of Alabama Birmingham, Alabama, USA | 1971, Allied Health; undergraduate.                          | Provide integrated Allied Health Professional training that is accessible to those living in rural areas of the state, to improve workforce outcomes.                         | Rural areas of Alabama (state).                                                                                                                              | Recruitment partnership with junior colleges                                                | First year at urban campus followed by full time clinical placement often in home rural area                            | Joiner 1992 (68)            |
| The Area Health Education Centre (AHEC), multi-agency consortia in 20 southern counties, Texas, USA                     | 1973, Allied Health; undergraduate.                          | To improve health manpower needs by decentralizing training for allied health and recruiting local students and training them in local areas.                                 | 20 southernmost counties of Texas (region).                                                                                                                  | Recruitment of students from local area.                                                    | Trains students at local sites.                                                                                         | Philips 1978 (43)           |
| University of Wisconsin-Eau Claire program, University of Wisconsin, Wisconsin, USA                                     | 1986, Nursing; undergraduate.                                | To prepare more baccalaureate prepared nurses for rural areas of central Wisconsin and to accommodate the educational needs of geographically bound non-traditional students. | Rural areas of central Wisconsin.                                                                                                                            | Designed to be accessible to geographically bound students.                                 | Blended learning/ distance education delivered to students at an off campus rural site.                                 | Ostmoe 1989 (55)            |
| Tromsø Distance Nursing Education (DNE), Tromsø University College, Tromsø, Norway                                      | 1990, Nursing; 4-year part-time undergraduate.               | To offer higher education to students living in rural communities and strengthen the workforce in selected municipalities.                                                    | Northern Norway, rural region of Tromsø.                                                                                                                     | Students document connection to one of the program's 18 rural municipalities.               | Blended learning/ distance education delivered to students in Troms region of Northern Norway.                          | Norbye 2013 (85)            |
| The Arctic University of Norway-Hammerfest, County, Norway                                                              | 1991, Nursing; 3-year undergraduate.                         | To recruit and educate nurses for Finnmark county                                                                                                                             | Finnmark County, population 75,860, area 48,631/km <sup>2</sup> , 18 of 19 local authority areas defined as rural with fewer than 2 people/km <sup>2</sup> . | Local recruitment: the location of the study sites determines where the students come from. | Blended learning/ distance education delivered in 9 rural communities in Finnmark.                                      | Eriksen 2019 (86)           |
| Ara Institute of Canterbury, Otautahi (Christchurch), Aotearoa (New Zealand)                                            | 2000, Bachelor of Midwifery; 4-year undergraduate.           | To enable students to access education from their own communities, to address midwifery workforce shortages in rural and provincial areas of the upper Te Waipounamu.         | Distributed across the Upper Te Waipounamu, with satellite sites across Canterbury, as well as Nelson, Marlborough and the West Coast.                       | Students are recruited from across the upper half of Te Waipounamu (South Island).          | Blended learning/ distance education enabling students to complete most of the program in the areas in which they live. | Daellenbach 2022 (82)       |

(Continued)

TABLE 3 (Continued)

| Program name, location                                                                                                                          | Year of commencement, health profession; program description                                       | Purpose                                                                                                                               | Place definition                                                                                                         | Place-based selection methods                                                                                                                                                                      | Place-based rural training                                                                                                                         | Evidence sources/citations |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Pipeline, Profession and Practice (PPP): Community-based Dental Education Program, Ohio State University College of Dentistry (COD), Ohio, USA  | 2002, Dentistry; Graduate entry.                                                                   | To increase access to dental care for underserved populations.                                                                        | Rural areas of Ohio (state).                                                                                             | 75% of places are reserved for students from Ohio. Active recruitment to increase diversity of cohort.                                                                                             | Short rural rotations during fourth year.                                                                                                          | Thind 2009 (59)            |
| Charles Sturt University (CSU), New South Wales, Australia                                                                                      | 2003, Bachelor of Nursing; Undergraduate.                                                          | To enable enrolled nurses to upgrade to registered nurses without leaving their communities.                                          | New South Wales and Northern Victoria (region).                                                                          | Community outreach program to recruit potential applicants.                                                                                                                                        | Blended learning/ distance education delivered to students living in target communities.                                                           | Latham et al. 2009 (41)    |
| Web-based Bachelor of Science in Pharmacy program, Umea University, Sweden                                                                      | 2003, Pharmacy; 3-year undergraduate.                                                              | To address the shortage of prescriptionists in rural Northern Sweden.                                                                 | Focus on 3 rural counties in Northern Sweden.                                                                            | 5 local study sites located in strategic rural areas to attract local students.                                                                                                                    | Blended learning/ distance education. Local study groups facilitate the recruitment of students living in target areas and have them remain there. | Mattsson et al. 2018 (47)  |
| The Pathway Program (PP), California social work education network, California State University, California, USA                                | 2006, Social work; undergraduate.                                                                  | To develop a distance education program for employees of county and tribal health and human services departments in rural California. | Aims to serve 'struggling California' – isolated regions of Northern California and Inland southern California (region). | Initially aimed to recruit employees of child welfare agencies, extended over time to other under-represented students.                                                                            | Blended learning/ distance education delivered to students living in target communities.                                                           | Morris et al. 2016 (38)    |
| Missouri Health Professions Consortium Occupational Therapy Assistant Program (MHPC-OTA), a consortium of 5 community colleges in Missouri, USA | 2008, Occupational Therapy Assistants; undergraduate.                                              | To provide educational opportunities to rural, place-bound students.                                                                  | Rural areas of Missouri (state).                                                                                         | Recruitment targets students currently embedded in rural communities.                                                                                                                              | Blended learning/ distance education through one of 5 community colleges covering most areas of the state.                                         | Brandt 2014 (54)           |
| Rural Pharmacy Education (RPHARM) program, The University of Illinois at Chicago College of Pharmacy, Rockford, Illinois, USA                   | 2010, Pharmacy; an interprofessional rural health professions program (linked with Illinois RMED). | To graduate pharmacy and medical students who will return to live and work in rural Illinois.                                         | Rural areas of Illinois (state). Rockford campus 90 miles from Chicago.                                                  | Targeted recruitment in rural communities classified as Rural Urban Commuting Area (RUCA) 4 or higher, multi-faceted admission seeking rural background, rural interest, community recommendation. | Short clinical placements in rural communities (3 × 6 weeks).                                                                                      | Soliman et al. 2012 (97)   |

(Continued)

TABLE 3 (Continued)

| Program name, location                                                                                                                                                                                                                                 | Year of commencement, health profession; program description | Purpose                                                                                                                             | Place definition                                                                                                                                                | Place-based selection methods                                                                                                                     | Place-based rural training                                                                                         | Evidence sources/ citations |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Plan of Dentistry (PoD) North Carolina. School of Dentistry at East Carolina University and University of North Carolina Chapel Hill, North Carolina, USA                                                                                              | 2011, Dentistry; 4-year.                                     | Educating primary care dentists for rural and underserved areas of North Carolina.                                                  | Rural areas of North Carolina (State). Non-metropolitan counties considered rural areas.                                                                        | Students recruited based on mission of the school and community service. Collaboration plans with community colleges.                             | Fourth year program in 8–10 service-learning centers in underserved rural communities.                             | Chadwick et al. 2008 (67)   |
| The College of Nursing, University of Saskatchewan, Northern Saskatchewan, Canada                                                                                                                                                                      | Commencement date not available, nursing; undergraduate.     | Widening access for students in Northern Indigenous communities to study nursing.                                                   | Northern Saskatchewan province. Population of 38,000 people across 45 communities.                                                                              | Focus on recruiting Indigenous residents from Northern Saskatchewan province.                                                                     | Fully rural program at three distributed rural sites.                                                              | Butler et al. 2018 (37)     |
| Eastern Shore of Virginia (ESVA) RN-to-BSN, Virginia, USA                                                                                                                                                                                              | Commencement date not available, nursing; undergraduate.     | To increase the number and diversity of baccalaureate educated nurses from a rural resource-limited community in the United States. | Rural Eastern Shore of Virginia.                                                                                                                                | Recruitment of students from the economically disadvantaged rural area.                                                                           | Blended learning/ distance education delivered to students living in target community.                             | Hawkins et al. 2018 (89)    |
| Registered Nurse/ Bachelor of Science in Nursing Public Health Leadership in Nursing Program, the University of Wyoming and Health Resources and Services Administration's (HRSA) Nurse Education, Practice, and Retention Grant Program, Wyoming, USA | Commencement date not available, nursing; undergraduate.     | RN to BSN completion program designed to develop strong public health leaders for underserved rural communities.                    | Rural communities of Wyoming (state). State population density of 5.1 people per square mile and 73.9% of the population living in frontier areas of the state. | Targeted recruitment of students in community colleges and the community, with a focus on underrepresented groups.                                | Blended learning/ distance education delivered to target populations of students in rural underserved communities. | Ouzts et al. 2006 (52)      |
| Rural Clinics Program, University of Texas Arlington, Texas, USA                                                                                                                                                                                       | Commencement date not available, nursing; undergraduate.     | Preparing nurses for rural Texas.                                                                                                   | Rural Texas (state).                                                                                                                                            | Program delivered to existing residents of rural communities.                                                                                     | Education delivered by visiting faculty to students who remain living in their rural communities.                  | Sandlin 1994 (115)          |
| Delta Health Education Partnership (DHEP), partnership of six schools spanning four states – Arkansas, Louisiana, Mississippi and Tennessee, USA                                                                                                       | Commencement date not available, nursing & midwifery.        | Recruit, educate and retain interdisciplinary groups of primary healthcare practitioners to increase access to healthcare.          | Areas of the lower Mississippi Delta that are medically underserved and experience health professional shortages.                                               | Active recruitment of students from non-traditional backgrounds and minority groups and with a commitment to practice in the region as graduates. | Blended learning/ distance education delivered to students living in target communities.                           | Skorga 2002 (53)            |

TABLE 4 Typology of rural training models by health profession.

|             | Type 1: short rural placements                                                                                                                                                                                                                                                                     | Type 2: extended rural placements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Type 3: rural campuses                                                                                                                              | Type 4: distributed blended learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not able to be classified                                                     |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Description | <i>Urban primary campus location with recurrent short rural clinical placements (&lt;12 weeks)</i>                                                                                                                                                                                                 | <i>Blend of urban campus training with extended rural placements (&gt;12 weeks), including Longitudinal Integrated Clerkships</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <i>Fully rural program, including pre-clinical campuses</i>                                                                                         | <i>Fully distributed rural program, entire program delivered to students in rural locations through blended learning/distance education.</i>                                                                                                                                                                                                                                                                                                                                                                                                                  | <i>Rural training model not specified</i>                                     |
| Medicine    | Regional quota scheme Jichi Medical University and Asahikawa Medical University, Jefferson Medical College Physician Shortage Area Program, West Virginia University School of Medicine, University of New Mexico School of Medicine, University of California Davis Programs in Medical Education | Thailand Ministry of Health (MOH) Collaborative Project to Increase Production of Rural Doctors, Thailand MOH One District One Doctor, Thailand MOH Inclusive Track, University of Missouri School of Medicine Rural Track Pipeline Program, Michigan State University Upper Peninsula Program, University of Louisville School of Medicine Rural Pathways Program, University of Minnesota Medical School Rural Physician Associate Program, University of Illinois College of Medicine Rural Medical Education track, University of Alabama Rural Medical Scholars Program, University of Washington School of Medicine Washington, Alaska, Montana, Idaho TRUST program, The University of Wisconsin School of Medicine and Public Health Wisconsin Academy for Rural Medicine, University of Kansas School of Medicine Scholars in Primary Care Program, Oklahoma State University Center for Health Sciences College of Osteopathic Medicine, Ateneo de Zamboanga University School of Medicine, University of Philippines School of Health Sciences, Chulalongkorn University Medical Education for Students from Rural Areas Project, University of Namibia School of Medicine, Walter Sisulu Medical School, Northern Ontario School of Medicine, University of British Columbia Northern Medical Program, Memorial University of Newfoundland and Labrador | James Cook University, Northern Territory Medical Program, University of Kentucky College of Medicine, West Virginia School of Osteopathic Medicine |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | University of Gezira Faculty of Medicine, University of Tromsø Medical School |
| Nursing     |                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     | The College of Nursing, University of Saskatchewan, Charles Sturt University, Ara Institute of Canterbury, The Arctic University of Norway-Hammerfest, Tromsø University College Distance Nursing Education, Eastern Shore of Virginia Registered Nurse-to-Bachelor of Science in Nursing program, University of Wisconsin-Eau Claire program, University of Wyoming and Health Resources and Services Administration's Nurse Education, Practice, and Retention Grant Program, University of Texas Rural Clinics Program, Delta Health Education Partnership |                                                                               |

(Continued)

TABLE 4 (Continued)

|                      | Type 1: short rural placements                                                             | Type 2: extended rural placements                                                                  | Type 3: rural campuses | Type 4: distributed blended learning                                          | Not able to be classified           |
|----------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------|-------------------------------------|
| Dentistry            | Ohio State University College of Dentistry Pipeline, Profession and Practice program       | School of Dentistry at East Carolina University and University of North Carolina Plan of Dentistry |                        |                                                                               |                                     |
| Allied Health        |                                                                                            | The University of Alabama Linkages program                                                         |                        |                                                                               | Area Health Education Center, Texas |
| Pharmacy             | The University of Illinois at Chicago College of Pharmacy Rural Pharmacy Education program |                                                                                                    |                        | Umea University Web-based Bachelor of Science in Pharmacy program             |                                     |
| Social work          |                                                                                            |                                                                                                    |                        | California State University social work education network Pathway Program     |                                     |
| Occupational Therapy |                                                                                            |                                                                                                    |                        | Missouri Health Professions Consortium Occupational Therapy Assistant Program |                                     |

year, and clinical rotations in rural areas in later years (66). Although programs in this category offer training within the program’s defined rural region of varying durations, it was often not clear whether mechanisms were in place to allow students to experience continuity with a single rural community, or their home community, when they undertake more than one rural placement during their course. Jichi Medical University (Japan) reported that students spent ‘some weeks’ in their home prefectures in 5th year (94). In contrast, UC Davis rural-PRIME (USA) rotates students between five different rural communities for their third-year clerkships to experience different systems of care.

In *Type 2 programs: extended rural placements* (medicine:  $n = 21$ , dentistry:  $n = 1$ , allied health:  $n = 1$ ), rural stream students complete pre-clinical training at an urban campus but undertake at least one extended period of rural placement ( $\geq 12$  weeks). This model describes most included medical programs, although there is considerable variation in the structure and timing of rural placements. Several programs are structured around a number of years of initial urban campus-based pre-clinical training followed by relocation for subsequent years of rural clinical training. An example is the Collaborative Project to Increase Production of Rural Doctors program (Thailand) where rural track students complete their first three years jointly at universities with ‘normal track’ students, then relocate to regional and provincial hospitals in their home communities for their three clinical years (92, 107). In other programs, such as NOSM (Canada), students participate in several eight-week rural immersion experiences in the early years, followed by an eight-month community-based rural longitudinal integrated clerkship in third year (111, 112).

There were few examples of programs of this type that deliberately connect students with a single rural community or their home region for rural placements (68, 99, 102). An exemplar is the Targeted Rural Underserved Track (TRUST, USA), which provides students with a longitudinal curriculum connected to a single rural continuity site, throughout the course duration. By contrast, NOSM deliberately provides students with a diverse range of rural community placements in Northern Ontario (113). Most other programs of this type did not provide information on whether students’ rural placements provided continuity with their home or another rural community over time.

In *Type 3 programs: rural campuses* (medicine:  $n = 4$ ), the entire training duration occurs in a rural location. These programs were confined to medical schools established in rural states or areas. Australian examples are the Northern Territory Medical program and James Cook University, with all four years of delivery based at rural campuses and training sites. Preferential student recruitment to these programs occurs at the level of the state or region of the medical school, suggesting that students may be required to relocate from their home communities to attend these rural campuses. The included articles did not provide details on the process by which students were matched to a rural training campus to determine whether their home rural community was a key consideration. An expectation of these programs was that the establishment of a new rural campus would attract students from that location into the course, who would then choose to train there (69, 114).

In *Type 4 programs: distributed blended learning* (nursing & midwifery:  $n = 9$ , occupational therapy:  $n = 1$ , pharmacy:  $n = 1$ ), confined to nursing & midwifery and allied health programs, students

TABLE 5 Outcomes evaluated by programs.

|                                                                 | Outcome measure                                                                                                    | Programs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Workforce outcomes</b>                                       |                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Graduates'</i><br><i>Geographic</i><br><i>Work Locations</i> | Working rurally: non-Standard Metropolitan Statistical Area (SMSA) counties (USA)                                  | Medicine: University of Minnesota Medical School Rural Physician Associate Program (RPAP) (157), University of Missouri School of Medicine Rural Track Pipeline Program (MU-RTPP) (56), Jefferson Medical College Physician Shortage Area Program (PSAP) (39, 74, 110, 157), West Virginia University School of Medicine (WVU) (104), University of Washington School of Medicine Washington, Alaska, Montana, Idaho TRUST program (WWAMI) (77, 110, 157) Allied Health: The University of Alabama Linkages program (UAL) (68, 115)                                     |
|                                                                 | Working rurally: RUCA codes 4-10 (USA)                                                                             | Medicine: RPAP (135), University of Illinois College of Medicine Rural Medical Education track (RMED) (20)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                 | Working rurally: Statistics Canada census subdivisions < 10,000 (Canada)                                           | Medicine: Northern Ontario Medical School (NOSM) (79, 129), University of British Columbia Northern Medical Program (UBC) (58, 133, 134), Memorial University of Newfoundland and Labrador (MUN) (58, 134)                                                                                                                                                                                                                                                                                                                                                              |
|                                                                 | Working in rural community <10,000, rural town <30,000                                                             | Medicine: MUN (106)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                 | Working rurally: Australian Standard Geographical Classification System Remoteness Areas (ASGS-RA) 2-5 (Australia) | Medicine: James Cook University (JCU) (124, 132, 167)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                 | Working rurally: Modified Monash Model (MM) 2-7 (Australia)                                                        | Medicine: JCU (131)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                 | Working in rural towns <25000, <30000 or <50000                                                                    | Medicine: RPAP (19, 157), Michigan State University Upper Peninsula Program (UPP) (56, 101, 157), PSAP (157), Regional quota scheme Jichi Medical University (JMU) (166), UBC (106), JCU (116)                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                 | Working rurally: remote village, small town, large town                                                            | School of Health Sciences, University of Philippines (UPM-SHS) (103)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                 | Working rurally: not defined                                                                                       | Medicine: UPP (155), PSAP (5, 77, 161), West Virginia University School of Medicine (WVSOM) (104), University of Alabama Rural Medical Scholars Program (RMSP) (44), RMED (19), NOSM (152), UBC (22, 64), JCU (143, 144), Ateneo de Zamboanga University School of Medicine (ADZU-SOM) (93, 144), Chulalongkorn University Medical Education for Students from Rural Areas Project (MESRAP) (146), Walter Sisulu Medical School (WSU) (58, 159)<br>Occupational therapy: Missouri Health Professions Consortium Occupational Therapy Assistant Program (MHPC-OTA) (54), |
|                                                                 | Working in state, territory, province or prefecture or other described region of medical school                    | Medicine: RPAP (5), MU-RTPP (56), RMSP (44) RMED (19) WWAMI (77, 110), Northern Territory Medical Program (NTMP) (28, 42), UPP (155), University of Tromso Medical School (Tromso) (48), NOSM (49, 64, 79, 129, 152), JCU (49, 128, 131, 143), ADZU-SOM (93, 113)<br>Occupational Therapy: MHPC-OTA (54)<br>Pharmacy: Umea University Web-based Bachelor of Science in Pharmacy program (Umea) (47)                                                                                                                                                                     |
|                                                                 | Working in region of clinical training                                                                             | Medicine: JCU (81, 84), WSU (159)<br>Allied Health: UAL (68)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                 | Working in home state, territory, province or prefecture of origin                                                 | Medicine: WWAMI (77, 156), JMU (94, 166), Tromso (48), UBC (64, 106, 134)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                 | Working in hometown or home area of origin                                                                         | Medicine: JCU (81)<br>Nursing: Ara Institute of Canterbury (Ara) (82), AUNH (86)<br>Allied Health: UAL (68, 115), AHEC (43),                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                 | Working in underserved areas/intention to do so                                                                    | Medicine: PSAP (5, 110) PSAP (74, 77, 110)/JCU (141), WSU (141), Gezira (141), ADZU-SOM (93, 100, 119, 141), UPM-SHS (103)                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                 | Motivation or intention to relocate or emigrate                                                                    | Medicine: WVU (91), JMU (165), Tromso (48), NOSM (75), JCU (75), WSU(75), Gezira (75), ADZU-SOM (75), UPM-SHS (75).                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

(Continued)

TABLE 5 (Continued)

|                                                    | Outcome measure                                                                                                                           | Programs                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Graduate career time points</i>                 | Intentions at entry and exit from medical school                                                                                          | Medicine: NOSM (75), JCU (75, 116, 124–126, 128, 141), WSU (75, 141), Gezira (75, 141), ADZU-SOM (75, 141), UPM-SHS (75), JCU (143)<br>Dentistry: PPP (59)                                                                                                                                          |
|                                                    | Internship or first practice                                                                                                              | Medicine: RPAP (135), MU-RTTP (56), JCU (58, 81, 84, 124, 126, 128, 143, 144), UPM-SHS (103)<br>Nursing: The Arctic University of Norway-Hammerfest (AUNH) (86), Tromso University College Distance Nursing Education (DNE) (85)<br>Allied Health: AHEC (43)<br>Occupational Therapy: MHPC-OTA (54) |
|                                                    | Early career (1–5 years after graduation)                                                                                                 | Medicine: RMED (19, 61), RMSP (44), UPP (101), NOSM (79, 152), UBC (106, 133), JCU (95, 122, 144, 167), ADZU-SOM (93), WSU (58),<br>Pharmacy: Umea (47)<br>Allied Health: AHEC (43),                                                                                                                |
|                                                    | End of mandatory training or return of service                                                                                            | Medicine: JMU (5, 45, 71, 72, 166), NTMP (28)                                                                                                                                                                                                                                                       |
|                                                    | Mid-career (5–10 years after graduation)                                                                                                  | Medicine: PSAP (74, 137, 157), WVSOM (104), Tromso (48), NOSM (79, 129), UBC (134), JCU (49, 95, 117, 131, 132, 167), ADZU-SOM (93, 118, 119), UPM-SHS (103, 119)<br>Nursing: AUNH (86), DNE (85)<br>Pharmacy: Umea (47)                                                                            |
|                                                    | Late career (>10 years after graduation)                                                                                                  | Medicine: PSAP (5, 19, 161), WWAMI (77), UBC (134), UPM-SHS (103), RPAP (19)<br>WVSOM (77, 104), UBC (134), JCU (131), UPM-SHS (103, 119), RMED (20)                                                                                                                                                |
|                                                    | Long term retention in rural practice                                                                                                     | Medicine: PSAP (5, 19, 138, 161), WWAMI (77)                                                                                                                                                                                                                                                        |
|                                                    |                                                                                                                                           |                                                                                                                                                                                                                                                                                                     |
| <i>Specialty/setting</i>                           | Completion of Family Medicine/General Practice training/residency                                                                         | Medicine: PSAP (74, 138), RMSP (44, 142), NOSM (79, 152), UBC (106), JCU (49, 95, 144), UPM-SHS (103)                                                                                                                                                                                               |
|                                                    | Current fully qualified practice in Family medicine/General practice                                                                      | Medicine: RPAP (135, 157, 158), UPP (87, 155, 157), MU-RTTP (56) PSAP (5, 74, 77, 161), RMED (20, 21), WWAMI (102), JCU (131)                                                                                                                                                                       |
|                                                    | Family medicine, long-term retention                                                                                                      | Medicine: RPAP (138, 161)                                                                                                                                                                                                                                                                           |
|                                                    | Primary care (family physician, paediatrics or general internal medicine)                                                                 | Medicine: RPAP (158), UPP (155), PSAP (77, 110, 157), RMSP (44), RMED (20, 21), WWAMI (77, 102, 110, 157), JMU (94), Tromso (48)                                                                                                                                                                    |
|                                                    | Scope of practice, generalist practice                                                                                                    | Medicine: Trover (110), NOSM (79), JCU (78, 116, 123), ADZU-SOM (118)                                                                                                                                                                                                                               |
|                                                    | Working in public/government/community health care                                                                                        | Medicine: JCU (117)ADZU-SOM (118), UPM-SHS (103)<br>Nursing: DNE (85)<br>Pharmacy: Umea (47)                                                                                                                                                                                                        |
|                                                    | Working with underserved population groups/intention to                                                                                   | Medicine: NOSM (79, 160), JCU (100, 117, 122), ADZU-SOM (100, 119), UPM-SHS (76), WSU (100), UG (100)<br>Dentistry: PPP (59)                                                                                                                                                                        |
| <i>Workforce contribution</i>                      | Graduates as proportion of rural physicians in state/province                                                                             | Medicine: PSAP (5, 74, 138), UBC (133)                                                                                                                                                                                                                                                              |
|                                                    | Availability of physicians in small communities or municipalities, reduction in recruitment expenditure and reliance on locum physicians. | Medicine: ADZU-SOM (76, 93), NOSM (65)                                                                                                                                                                                                                                                              |
|                                                    | Number of junior resident medical staff in the region                                                                                     | Medicine: JCU (144)                                                                                                                                                                                                                                                                                 |
|                                                    | Student roles in physicians' offices                                                                                                      | Medicine: RMED (21)                                                                                                                                                                                                                                                                                 |
| <i>Widening access through student recruitment</i> | Proportion of rural students: rural hometown or primary school                                                                            | Medicine: RPAP (105, 135), RMED (21), NOSM (75, 79) UBC (22, 99, 106), JCU (75, 141, 144), WSU (75, 141), Gezira (75, 141), ADZU-SOM (75, 141), UPM-SHS (75).<br>Pharmacy: RPHARM (97)                                                                                                              |
|                                                    | Proportion of rural students: rural not defined                                                                                           | Medicine: UPP (39), Trover (39), JCU (114, 149)                                                                                                                                                                                                                                                     |
|                                                    | Proportion of students from state, province, prefecture, territory, county or other described region of school/program                    | Medicine: RMED (21), JCU (114, 149) NTMP (28), UPP (87), Trover (39), WVU (91), Tromso (48), NOSM (64, 88, 108, 152)<br>Nursing: AUNH (86), DNE (85), Eastern Shore of Virginia Registered Nurse-to-Bachelor of Science in Nursing program (ESVA) (89)<br>Pharmacy: Umea (47)                       |
|                                                    | Proportion of students with low socio-economic status                                                                                     | Medicine: JCU (75, 141), WSU (75, 141), Gezira (75, 141), ADZU-SOM (75, 118, 141), UPM-SHS (75), NOSM (75)                                                                                                                                                                                          |

(Continued)

TABLE 5 (Continued)

|                                        | Outcome measure                                                                                                                                                        | Programs                                                                                                                                                                                                                                                        |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | Proportion of Aboriginal students                                                                                                                                      | Medicine: NOSM (79, 88, 152), UBC (99), NTMP (28), JCU (144)<br>Nursing: UoS (37)                                                                                                                                                                               |
|                                        | Proportion of Francophone students                                                                                                                                     | Medicine: NOSM (79, 88, 152)                                                                                                                                                                                                                                    |
|                                        | Proportion of students who identify with underserved group                                                                                                             | Medicine: JCU (75, 100, 141), WSU (75, 141), University of Gezira Faculty of Medicine (UG) (75, 141), ADZU-SOM (75, 141), NOSM (75), UPM-SHS (75)<br>Dentistry: Ohio State University College of Dentistry Pipeline, Profession and Practice program (PPP) (59) |
|                                        | Parental income, educational level                                                                                                                                     | Medicine: JMU (94), JCU (141), WSU (141), UG (141), ADZU-SOM (141), UPM-SHS (75, 103)                                                                                                                                                                           |
| Academic and competency-based outcomes | Comparison of rural and mainstream cohort grades                                                                                                                       | Medicine: PSAP (77), RMSP (44), RMED (21), NOSM (152), UBC (69), NTMP (28)                                                                                                                                                                                      |
|                                        | Student attrition/retention                                                                                                                                            | Medicine: MU-RTPP (56), WWAMI (140), University of California Davis Programs in Medical Education (PRIME) (70)<br>Nursing: The College of Nursing, University of Saskatchewan (UoS) (37, 86), ESVA (89)                                                         |
|                                        | Graduation from program                                                                                                                                                | Medicine: NTMP (28)                                                                                                                                                                                                                                             |
|                                        | Achievement of clinical competence: procedural skills, biomedical and clinical knowledge, achievement of learning outcomes, patient/problem encounters, work readiness | Medicine: RPAP (158), RMED (21), NOSM (152), JCU (122), UPM-SHS (103), MESRAP (146)                                                                                                                                                                             |
|                                        | Social accountability competencies: communication skills, teamwork, professionalism, commitment to health equity and working with underserved populations              | Medicine: JCU (76, 116, 122), ADZU-SOM (118), UPM-SHS (103), RMED (21)<br>Occupational Therapy: MHPC-OTA (54)                                                                                                                                                   |
|                                        | Progression to post-graduate degree and residency programs                                                                                                             | Medicine: PSAP (161), RMED (21)<br>Occupational Therapy: MHPC-OTA (54)                                                                                                                                                                                          |
|                                        | Medical licencing or certification exam results                                                                                                                        | Medicine: RMSP (44), RMED (20), JMU (45), NOSM (152), ADZU-SOM (93, 113, 144), UPM-SHS (103)<br>Occupational Therapy: MHPC-OTA (54)                                                                                                                             |
| Community outcomes                     | Correlation of community projects with community needs, impact of community projects                                                                                   | Medicine: RMED (21), ADZU-SOM (93)                                                                                                                                                                                                                              |
|                                        | Community empowerment and economic impacts                                                                                                                             | Medicine: NOSM (152)                                                                                                                                                                                                                                            |
|                                        | Decrease in infant mortality rates                                                                                                                                     | Medicine: ADZU-SOM (93, 144)                                                                                                                                                                                                                                    |
| Economic outcomes                      | Contribution of physician tutors (economic and teaching)                                                                                                               | Medicine: RPAP (158)                                                                                                                                                                                                                                            |
|                                        | Increase in graduates' household income                                                                                                                                | Medicine: ADZU-SOM (118)<br>Occupational Therapy: MHPC-OTA (54)                                                                                                                                                                                                 |
| University outcomes                    | Graduates serving as faculty                                                                                                                                           | Medicine: MU-RTPP (56)                                                                                                                                                                                                                                          |
|                                        | Reasons for applying to rural programs                                                                                                                                 | Medicine: JMU (71), JCU (128), UPM-SHS (103)<br>Nursing: DNE (85)<br>Pharmacy: Umea (47)                                                                                                                                                                        |
|                                        | Barriers and facilitators to program entry                                                                                                                             | Medicine: WVU (91)<br>Nursing: Charles Sturt University (CSU) (41)<br>Allied health: Umea (47)<br>Occupational Therapy: MHPC-OTA (54)                                                                                                                           |
|                                        | Number of placement weeks spent in rural communities                                                                                                                   | Medicine: UBC (99)                                                                                                                                                                                                                                              |

complete their studies without leaving the rural communities in which they live (37, 38, 41, 47, 53, 54, 67, 88, 89). Learners are often more widely dispersed across a rural region and in smaller groups, with education delivered through blended learning, combining online curriculum delivery with local, site-based teaching and supervision. Decentralized training sites were often strategically established in

areas of workforce shortages, with small groups of students working with local clinical preceptors (52, 89, 115). An example of this model is the Eastern Shore of Virginia Registered Nurse to Bachelor of Science in Nursing program delivered via online asynchronous distance learning, in partnership with local hospital preceptors and study facilities.

## What program outcomes are being investigated?

The scope of outcomes evaluated was broad, with three main areas studied: (i) graduate workforce outcomes, (ii) success in widening access to HPE programs, and (iii) academic outcomes. In addition, a range of other impacts of programs were evaluated, with a full list available in Table 5.

Most program outcomes were evaluated through cross-sectional and retrospective single or multi-cohort studies using surveys (39, 43, 49, 78, 79, 81, 85, 97, 101–103, 107, 116–129), data linkage of school-held administrative data with publicly available practice location data (42, 43, 47, 56, 58, 74, 79, 84, 92, 95, 106, 130–138) or admissions data analysis (139, 140). Other types of studies included prospective cohort studies (54, 75, 100, 108, 141–143), case studies (44, 60, 62, 65, 91, 93, 99, 144, 145), program descriptions/project reports (20, 21, 28, 37, 38, 46, 50, 52, 53, 55, 57, 61, 68–70, 73, 83, 86, 88–90, 96, 98, 109, 112–115, 146–155), reviews (5, 19, 76, 77, 87, 156, 157), commentaries/policy analysis (22, 41, 113, 144, 158–160), editorials (64, 105, 161, 162), an economic review (80), a conceptual framework (163), and a typology (66).

Early program evaluations demonstrated an interest in the academic equivalence of rural stream students to their urban counterparts, through measures including assessment results (21, 28, 44, 69, 77, 151), clinical competency assessments (21, 103, 122, 146, 151, 157), development of social accountability competencies (54, 76, 103, 116, 118, 122), attrition and retention rates (37, 56, 70, 86, 89, 140), medical licensing exam results (44, 45, 93, 103, 113, 135, 144, 151) and progression to post-graduate degrees and residency programs (21, 54, 160). One program reported distributed learning as the most important factor in increasing the success of Indigenous students in nursing education (37).

Early graduate workforce outcomes (1–5 years) evaluated included graduates' career intentions when entering and exiting medical school (75, 116, 124–126, 128, 143), first practice locations (43, 54, 56, 58, 81, 84–86, 103, 124, 126, 128, 135, 143, 144), and intention to emigrate (48, 75, 91, 164). Programs evaluating mid-career (5–10 year) graduate outcomes investigated the impact of specialty training vocation on rural practice (74, 79, 103, 118, 128, 129, 131, 134, 137), and retention in rural practice (74, 85, 156), including after the completion of mandatory training or return of service periods (5, 28, 45, 71, 72, 165). Longer-established programs evaluated outcomes of multiple cohorts, including rural practice locations in late career (>10 years) (5, 19, 20, 77, 103, 104, 119, 131, 134, 160), and long-term graduate retention in rural practice (5, 19, 77, 138, 160).

Locally relevant rurality classification systems were used to determine the number of graduates in rural practice (Table 5). In the USA, these included non-Metropolitan Statistical Area counties (39, 56, 68, 74, 77, 104, 110, 115, 156) and Rural–Urban Commuting Area (RUCA) codes (20, 135). Canadian programs used Statistics Canada census subdivision of <10,000 population as the definition of a rural community (58, 79, 106, 129, 133). Australian programs utilized the Australian Statistical Geography Standard Remoteness Areas (ASGS-RA) (124, 132, 166) and Modified Monash Model (MM) (131) to classify the rurality of practice locations. Internationally, programs also reported rural outcomes with reference to an upper limit of the town's population, commonly <25,000, <30,000 or <50,000 (19, 56, 101, 106, 116, 156, 165). Frequently, a precise description of the way that graduate rural practice location was determined by programs was

not provided (5, 19, 22, 44, 54, 58, 64, 77, 93, 104, 143, 144, 146, 151, 154, 158, 160).

Interest in graduates' work locations went beyond binary outcomes of rural or metropolitan practice to evaluate the program's place-based outcomes. These measures included the proportion of graduates practicing in the program's state/province/prefecture or region (5, 19, 28, 42, 44, 47–49, 56, 64, 77, 79, 93, 110, 113, 128, 129, 131, 143, 151, 154) or in their home state/territory/province/prefecture or other region of origin (48, 64, 77, 94, 106, 133, 134, 155, 165). A small number of programs reported on the contribution of a particular program's graduates to the region of interest's workforce (5, 74, 134, 138, 144), including improvements in the availability of junior doctors or physicians in areas of need (65, 76, 93). Involvement in working with under-represented population groups (59, 76, 79, 100, 117, 119, 122, 159) or in underserved areas (5, 43, 77, 93, 100, 103, 110, 119, 141, 156) was also reported (Table 5).

The specialty and context of medical graduates' practice were commonly evaluated, with a particular focus on family medicine (5, 20, 21, 44, 49, 56, 74, 77, 79, 87, 102, 103, 106, 122, 131, 135, 138, 142, 144, 151, 154, 156, 157, 160), primary care (20, 21, 44, 48, 77, 94, 102, 110, 154, 156, 157) or generalist practice (78, 79, 110, 116, 118, 123), often linked with the greatest workforce needs of the communities being served.

Programs evaluated the impact of widening access to HPE initiatives by investigating the presence of under-represented population groups in their student cohort (Table 5). Programs reported on the presence of rural background students in their cohort (21, 22, 39, 75, 79, 97, 99, 105, 106, 109, 114, 135, 141, 144), and on the presence of students from the program's defined region (21, 28, 39, 47, 48, 64, 85–89, 91, 108, 109, 114, 151). Other cohort demographics reported included socio-economic status (75, 118, 141), educational background (75, 94, 141), Aboriginal and Francophone student representation (28, 37, 79, 88, 99, 144, 151), and self-identification with an underserved population group (59, 75, 100, 141).

There was limited investigation of the outcomes for the communities in which programs were being delivered. Outcomes evaluated included the correlation of student projects with community needs (21, 93), economic impacts (151, 157) and physician availability (65, 76, 93). There was also a notable absence of published findings regarding the experiences of students and graduates participating in these programs.

## Discussion

Place-based programs identified in this review varied significantly in their geographical scale and design, in part due to the inclusion criteria that allowed for programs up to large state or provincial level in size and the inclusion of a broad range of rural training models. The predominance of medicine in the included programs likely reflects the greater volume of published literature on medical graduate workforce outcomes, which in some countries such as Australia, is a program funding requirement (11).

Despite this heterogeneity and the contextualisation within their global settings, programs were found to be characterized by three common features. Firstly, a comprehensive program design linking targeted student recruitment, rural training and evaluation of relevant outcomes, secondly, a focus on widening access to HPE opportunities,

and thirdly, a community-engaged approach. These features align closely with key principles of social accountability, suggesting synergies between social accountability and place-based approaches (29).

## Comprehensive place-based program design

Comprehensive program design refers to the use of multiple interventions or bundled strategies to achieve a program's goals (1, 6, 20, 21). Programs demonstrated a comprehensive approach to achieving their place-based workforce goals, through targeted recruitment strategies and pre-entry programs, purposeful admission processes and requirements, recurrent or extended training experiences in rural communities and evaluation of outcomes designed to assess the effectiveness of these strategies.

Approaches to student recruitment were heterogeneous, illustrating both the lack of a 'gold standard' approach and the need for this to be contextualized for each program's setting. Common characteristics of place-based recruitment were the presence of pre-entry programs that facilitated early connection with local students, strategies to preferentially admit rural students from the region through adjusted admission requirements, and the involvement of the local community in the recruitment process. For medical programs, attributes commonly assessed through a suite of admission requirements included academic capability, rural commitment and often primary care career intentions. These strategies demonstrated that programs were interested not only in rural outcomes, but also in the development of a generalist workforce that would meet the primary healthcare needs of rural communities.

The variation in the geographical scale at which place-based recruitment and training occurred calls for reflection on ideal or preferred approaches. Large state or provincial programs often recruited broadly from their rural region and required students to relocate on more than one occasion for rural training experiences (Table 4, Types 1 and 2), some explicitly valuing the variety of exposure this provided. Other programs had clear mechanisms for students to foster a longitudinal relationship with a single rural community, through entirely rural campus-based programs, or distance education (Table 4, Types 3 and 4). Distance education models (Type 4), prominent in nursing and midwifery, prioritized local student recruitment and keeping learners in their home communities throughout training.

These variations in approach may be due to both practical and pedagogical influences. The absence of Type 4 distance education models in medicine may reflect traditional Flexnerian educational approaches with a period of on-campus pre-clinical learning, allowing for exposure to scientific laboratories and anatomical specimens (167). Extended rural placements have become increasingly common for clinical learning in medicine, illustrated by the predominance of this program design in Table 4. Following the impact of the COVID-19 pandemic during 2019–2021, it will be interesting to observe whether there is an increased uptake of blended learning delivery inclusive of distance education for medical programs. Many programs were forced to 'pivot' rapidly to online delivery of learning during the

pandemic, a disruptive event that may have an ongoing impact on how programs are delivered that is not yet apparent in the literature (168, 169).

The provision of continuity with a rural community throughout training aligns with evidence that extended rural placements are associated with enhanced rural workforce development (6, 18). Extended rural placements allow students to develop and strengthen their rural identity and self-efficacy, participate more fully as members of the clinical team, and develop meaningful relationships within the community (6, 170–172). Studies that have examined the effect of extended rural training within a student's own rural region of origin have demonstrated even greater workforce benefits (26). Repeated exposure that provides continuity with the same rural community throughout training, including extended periods of placement time in a students' home rural community, has the potential to be an important defining feature of authentic place-based program design.

An important consideration is that purposeful selection of students, and location of training sites is not always under the control of individual programs but may be subject to the national policy context. For example, in Australia, rural students are equally eligible for government-mandated rural admission quotas at any rural medical program in the country, meaning students often apply broadly and may relocate long distances for their studies. In contrast in Japan and Thailand, admission quotas operate at a provincial or district level, encouraging a more localised place-based approach. Thus, programs may have been constrained by the policy environment in the extent to which they were able to adopt a place-based approach to student selection and training.

The diversity of outcomes evaluated by programs was perhaps unsurprising given the heterogeneity of included programs. The proposal in this review of a typology distinguishing four models of rural training potentially allows for future identification and comparison of outcomes for narrower clusters of programs with more similar place-based approaches. The utilization of program logic models is recommended to clarify and visually represent the goals and components of programs and how outcomes being evaluated relate to these goals (173, 174). In this way, evaluation can be more clearly linked to the core purposes of these programs to provide a fit-for-purpose rural workforce for their region. The adoption of a program logic model may also draw attention to the importance of evaluating the experience of students participating in these programs, an area identified as a current gap in the literature. Program logic models prompt the development of outcome goals across short, medium and long-term timeframes which would help to shift attention from early outcomes (such as academic equivalence) to evaluate longer term impacts on rural communities, for example improving access to healthcare and health outcomes for underserved populations. Furthermore, the use of program logic models would provide a consistent framework for place-based program description, whilst allowing for customization and clear identification of local contextual factors and assumptions impacting on program design.

Reporting on workforce outcomes for the region of interest, an important feature of place-based programs, is recommended. Ideally, this should include not only the proportion of program

graduates working in the region and in primary care but also the contribution of the program's graduates to the workforce in the region, including other priority specialties based on community needs. A closer examination of workforce outcomes for a more limited range of programs sharing similar design features is warranted to identify factors that positively contribute to graduates working 'in place'. Programs are encouraged to utilize and clearly define rurality classification systems to describe their place-based geography and apply these measures consistently to student recruitment, training site locations and the measurement of workforce outcomes. This would assist with transparency of how rurality is defined and applied in all elements of program design and enable comparisons to be made between similar programs (175, 176).

## Widening access

Programs expressed clear goals to train fit-for-purpose healthcare professionals for rural and underserved communities, to improve health outcomes for these communities. This 'back-end' purpose, to meet societal needs was, in most programs, also associated with a 'front-end' purpose, to widen access to their educational programs for students from these same communities (177). While this secondary purpose to widen access was clearly articulated for some programs, for others it could be inferred through the outcomes of interest that were evaluated, for example, the diversity of the student cohort. This duality of purpose to widen access for underserved population groups *from* the region and train *in and for* the region could be considered an identifying hallmark of PBE programs. It is noteworthy that the scale on which these strategies were applied varied significantly, from small rural provinces to entire states, prompting consideration of possible upper limits of scale at which a program could be described as truly place-based.

Place-based program design was found to address both spatial (geographic) and aspatial (economic, socio-cultural, political) barriers to program participation (178). Spatial barriers were addressed by the location of rural learning sites, either through the establishment of new campuses or through de-centralized, distributed learning models. Aspatial barriers, such as financial disadvantage, were also addressed by programs that allowed students to complete their course without the expense involved in relocation, or through the provision of financial assistance. Socio-cultural barriers were addressed by many programs through widening access initiatives in student recruitment, relevant to each program's context.

## Community engagement

Community engagement is a feature of social accountability that involves authentic interdependent partnerships between health services and academic institutions, respects the knowledge and experience of rural communities and gives them a voice in the selection and training of students (179, 180). This was evident through rural communities being given agency in student selection, with their level of involvement varying from responsibility for nominating

students for consideration for program entry (62, 103), to more collaborative involvement as stakeholder representatives on admissions committees (20, 44). Rural communities were also engaged in student training through distributed educational models, often through the provision of clinical supervision. Community engagement was further evident through pre-entry recruitment programs, for example, partnerships with local rural high schools (92, 94, 96).

In terms of program outcomes for communities, measures such as economic impact and healthcare access were reported by a small number of programs. However, there was limited investigation of the broader experiences of communities in which programs were based. This is an important area for future evaluation, given the central role of the community in PBE. Sustainable rural pre-registration HPE programs require collaborative, symbiotic partnerships with health services and communities that enable mutual benefit (181, 182). Evaluation of program outcomes with this focus would recognize the investment of rural communities and provide examples of best practice in this field.

## Limitations

As data for this review were extracted from the peer-reviewed literature only, there may be other place-based pre-registration HPE programs that have not been included. Database search terms were designed to capture a range of terminology and concepts that may be used to describe place-based approaches, however the primary usage of PBE terminology in Western countries may mean that alternative terms used to describe programs adopting similar approaches may not have been captured. A further limitation of this study, with its focus on program design, was the absence of data extraction on rural/place focussed curriculum content and how this may contribute to building and reinforcing place connection. Overall, there was insufficient curricular detail to assess this important aspect of a place-based approach adequately. This knowledge gap could be addressed through a literature review on a narrower subset of place-based pre-registration HPE programs, to explore current practice in this area and how place-based curriculum is being incorporated.

The absence or heterogeneity of rural definitions and classification systems hindered comparisons and contextualisation of programs. This issue has been noted in previous systematic reviews on rural workforce outcomes (4, 5, 19, 77, 175). To assist with this, programs should consider providing a clear and specific description of their defined area of focus, as well as information on how rurality is classified in their region. Population density (persons/square km) was one strategy identified to compare international programs that may be helpful to consider as a unifying program statistic (75, 141).

## Conclusion

Through the identification of common design features of place-based pre-registration HPE programs, this review provides a foundation and framework to guide the establishment and evaluation of similar programs. Key considerations for comprehensive place-based program design include: accurately defining the geographical

scale of the program, developing a strategy for student recruitment from the target region focused on widening access, provision of continuity with rural communities through longitudinal training experiences, engaging communities in the design and delivery of the program, and the alignment of evaluation plans with the goals of the program and the communities served. There are rich opportunities for further research into each of these areas, to compare and contrast how place-based HPE programs are delivering on these outcomes through their program design.

## Author contributions

LF: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing, Project administration, Visualization. JB: Investigation, Writing – review & editing. MM: Supervision, Writing – review & editing. VV: Supervision, Writing – review & editing. GR: Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1546701/full#supplementary-material>

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# Intervention to strengthen caregiving capacities among rural caregivers: a replicable model

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**Introduction:** Decades of armed conflict in Colombia have deeply undermined public trust in the health system, particularly within rural regions. The legacy of violence has restricted healthcare delivery in these areas, concentrating services in urban centers and exacerbating geographic and social inequities. Informal caregivers in rural communities, essential yet often overlooked actors in healthcare, face significant challenges due to structural limitations and lack of institutional support.

**Objective:** This study evaluates a community-based intervention aimed at strengthening the competencies of informal caregivers in rural, post-conflict settings. It further positions caregivers as pivotal contributors to distributed health education models, where care practices must adapt to contextual barriers and local realities.

**Methods:** Developed using a Participatory Action Research (PAR) approach, the intervention engaged caregivers as co-creators. Drawing from popular education principles, it combined in-person sessions with experiential, culturally relevant materials tailored to rural environments. Ongoing remote support was provided via calls, text messages, and voice notes. The program was evaluated qualitatively through a focus group and 15 semi-structured interviews, analyzed thematically.

**Results:** Findings revealed four key domains of change: (1) transformation of the caregiving role, (2) personal and technical impact on caregivers, (3) shifts in family dynamics, and (4) recognition of the course as an empowering, community-building experience. Despite barriers such as digital illiteracy, poverty, and low educational attainment, participants demonstrated increased self-efficacy and engagement.

**Conclusion:** The intervention illustrates the potential of distributed education to reduce rural health inequities. It highlights the power of academic-community partnerships in developing scalable, context-sensitive strategies that strengthen care, foster empowerment, and promote equity in underserved areas.

## KEYWORDS

caregiver empowerment, rural healthcare, participatory educational intervention, community engagement, popular health education, distributive education

## Introduction

Colombia's internal armed conflict, one of the most prolonged in modern history, began in 1944 with bipartisan violence and evolved into a complex confrontation involving insurgent groups (FARC-EP, ELN), paramilitaries, and criminal cartels. Over seven decades of cyclical violence have disproportionately impacted rural areas. Despite the 2016 Peace Agreement with the FARC-EP, structural drivers of conflict—including poverty, inequality, and state absence—remain unresolved. Violence persists, especially in rural regions prioritized for post-conflict recovery (1).

This study was conducted in Icononzo and Chaparral, two municipalities in Tolima Department historically affected by armed groups. Icononzo is home to a Territorial Space for Training and Reincorporation (ETCR), a reintegration initiative for ex-combatants, while Chaparral has been prioritized for the Development Programs with a Territorial Approach (PDET). Both areas continue to experience deep socioeconomic inequities, institutional weakness, and limited access to health and education.

In Colombia, 6.8 million people engage in unpaid caregiving, 85.7% of whom are women. In rural areas, 1.4 million women and 166,000 men assume caregiving responsibilities, with women dedicating an average of 8 h daily versus three for men (2). These caregivers face multiple constraints: geographic isolation, poor transportation infrastructure, and limited institutional support. Just 30% of rural areas have reliable internet and adequate connectivity, limiting access to telehealth services, educational content, and support networks (3–7).

Access to health services in these regions is often inconsistent with rural socio-cultural realities. Caregivers report long wait times, a lack of specialized care, and services that fail to address their needs (4, 8, 9). Financial burdens are also significant, as many caregivers must reduce or abandon paid work, incur in high out-of-pocket expenses for healthcare and transport, and experience economic dependency, all of which contribute to emotional and mental strain (3, 6, 8). Social isolation, lack of institutional support, and multiple caregiving roles—especially among women—lead to chronic stress, burnout, and a sense of institutional marginalization (4, 6, 10).

Enhancing the skills and knowledge of informal caregivers is essential to promote autonomy, improve health outcomes, and build social capital in underserved rural contexts (11, 12). Capacity-building initiatives have demonstrated positive results internationally. In Malawi, a WhatsApp-based program improved psychosocial outcomes among caregivers of people with HIV/AIDS (13). In the United States, cognitive behavioral therapy (CBT) programs for rural caregivers led to improved optimism and reduced anxiety (14). Other multicomponent interventions have shown increased self-efficacy, emotional well-being, and support perception (14, 15). However, some limitations persist, particularly regarding objective caregiving burdens and interpersonal dynamics, underscoring the need for culturally adapted and context-responsive approaches (16, 17).

Multidimensional strategies that integrate psychoeducation with empowerment frameworks appear most effective for enhancing caregiver well-being (18). In Colombia's post-conflict rural zones, the need for such interventions is urgent and underexplored.

This study aimed to address that gap by implementing a participatory educational intervention with informal caregivers of individuals with chronic illnesses in rural areas affected by armed

conflict. The initiative was co-designed with caregivers and led by health sciences faculty, drawing from distributed education principles. By relocating learning to rural territories and emphasizing local relevance, the intervention sought to strengthen caregiving competencies, build academic-community alliances, and contribute to more equitable, sustainable health education models (19).

## Methods

A Participatory Action Research (PAR) approach was used to co-design and implement an educational intervention aimed at strengthening the competencies of informal caregivers in rural, post-conflict regions. Grounded in the principles of popular health education (20), the intervention prioritized caregivers' lived experiences and was adapted to local rural contexts. Its development involved collaborative input from caregivers, community leaders, and health sciences faculty, ensuring cultural and contextual relevance.

The training, conducted between 2023 and 2024, integrated dialogic pedagogies, experiential learning activities, and territorially adapted materials, combining face-to-face group sessions with remote support via calls, messages, and audio content. To explore caregivers' perceptions and the meaning they attributed to the experience, a phenomenological qualitative methodology was employed through semi-structured interviews and a focus group.

The study was carried out in two rural municipalities—Icononzo and Chaparral, located in Colombia's Department of Tolima—both designated as post-conflict areas. Participants were recruited via an open call and snowball sampling, reaching caregivers through local networks. Eligibility criteria included: being an unpaid family caregiver of a person with a chronic non-communicable disease, living in a rural area, having access to a mobile phone, and willingness to participate. Caregivers receiving financial compensation were excluded.

In total, 30 participants enrolled in Icononzo (Territory 1) and 40 in Chaparral (Territory 2). After implementation, 23 participants completed the program in Territory 1 and 25 in Territory 2, with respective dropout rates of 23.3 and 37.5%, largely due to economic pressures, time constraints, and health-related issues.

## Co-creation of the intervention with a popular health education approach

**Phase One:** As part of the initial phase, home visits were conducted to explore caregivers' experiences, needs, and expectations regarding the intervention. During these visits, researchers performed semi-structured interviews to assess the knowledge and skills required to care for individuals with chronic illnesses. The interviews were guided by Maslow's hierarchy of human needs (21), providing a multidimensional framework to identify unmet physiological, emotional, and social needs. Responses were analyzed thematically, revealing recurring concerns and priorities (see Table 1). These findings were later shared with the broader participant group, who collectively validated and refined the topics, shaping the final content of the educational intervention.

Table 1 presents the caregivers' perceived formative needs, organized into three dimensions—physical, social, and

**TABLE 1** Caregivers' perceived training needs according to Maslow's hierarchy of needs.

| Dimension | Quotation                                                                                        |
|-----------|--------------------------------------------------------------------------------------------------|
| Physical  | "I want to learn how to give my mom her medicine better." (2-C-IC-2023)                          |
|           | "What do I feed her if everything has been taken away?" (1-C-IC-2023)                            |
|           | "What do I do if my relative falls? Getting them out of the village is very hard!" (3-C-CH-2023) |
|           | "How do I know if a wound is getting worse and when to take my relative to town?" (14-C-CH-2024) |
| Social    | "No one can help me take care of him, I'm scared to leave and something happens." (2-C-CH-2024)  |
|           | "Learning more helps me support my family and others in need." (4-C-CH-2023)                     |
| Emotional | "I'd like to talk about it, because he's always angry." (5-C-IC-2023)                            |

emotional—based on Maslow's hierarchy. These reflect practical concerns related to caregiving tasks, family support, and emotional strain. Notably, caregivers did not initially identify self-care as a priority, prompting the teaching team to underscore its importance in enhancing caregiving capacities.

**Phase two:** The second phase focused on co-constructing the intervention content based on thematic priorities identified during the initial needs assessment. Dialogs with caregivers informed the development of each session, fostering an environment where participants could share questions, experiences, and prior knowledge related to caregiving. This participatory design ensured the educational content remained aligned with caregivers' lived realities and learning interests.

The methodology drew on Paulo Freire's theory of dialogic education and critical consciousness (22), complemented by the pedagogical expertise of the Health Research Group at the University of Tolima (23–26). Table 2 outlines the thematic areas and strategies employed across sessions.

Each session began with a real-life rural caregiving scenario, followed by experiential learning activities and the use of culturally adapted educational materials. Caregivers were given self-directed exercises and received remote assistance (via calls and messages) to reinforce learning and facilitate real-world application.

Sessions were conducted in public venues within the urban centers of each municipality. To ensure accessibility, transportation stipends were provided. Each session lasted 4 h and included reflective, dialogic, and context-sensitive activities, along with homework tasks designed to stimulate personal reflection and practical implementation.

A range of competency-based strategies were employed to strengthen caregiver capacities. Peer learning was integral to each session, encouraging the exchange of experiences, collective knowledge building, and the formation of a support network. Educational materials were tailored to the realities of rural environments, incorporating both in-person and home-based formats.

Participatory tools were used to explore caregiving challenges and promote collaborative problem-solving. For instance, the "Caregivers' Network" activity invited participants to reflect on the emotional demands of care and to propose improvements in caregiving and

self-care. The "Care Cake" dynamic visually mapped the distribution of care responsibilities within households.

Specific sessions addressed technical skills, such as medication management, where caregivers were trained to develop personalized medication charts with key drug and patient information, enhancing safety and accuracy.

Recognizing literacy barriers, one session used audio messages and photos to teach wound care, allowing participants to narrate their experiences and demonstrate understanding without relying solely on written language.

To monitor engagement and adherence, a systematic attendance and participation log was maintained across the seven in-person sessions. This included tracking session attendance, use of remote support resources, completion of home assignments, and observed application of caregiving practices. Participants were considered to have completed the program if they attended at least 80% of the sessions and demonstrated integration of key caregiving competencies into their daily routines.

**Phase Three:** In the third phase, a focus group with 16 participants and 15 individual semi-structured interviews were conducted to explore caregivers' perceptions of the intervention's impact, relevance, and applicability. This evaluation phase allowed participants to reflect on how the training influenced their caregiving practices and addressed the specific challenges of rural life.

**Phase Four:** Thematic analysis followed Braun and Clarke's framework, ensuring methodological rigor throughout the process (27). Data familiarization began with transcription and close reading, followed by inductive coding led by one researcher to identify meaningful units, which were then organized into preliminary themes using analytical matrices and conceptual mapping. A second researcher independently reviewed the coding structure to ensure consistency and clarity. Final themes and subthemes were collaboratively refined, incorporating verbatim participant quotations and contextual interpretations.

The analysis was grounded in a constructivist epistemology, emphasizing the co-construction of meaning through caregivers' narratives and reflexive researcher interpretation. MAXQDA 2024 software was used to organize and visualize codes and thematic relationships. Additionally, ChatGPT-4.0 (OpenAI) was used to explore the emergence of new categories, though no novel codes were identified. All themes were thoroughly reviewed by the research team to ensure internal coherence and conceptual precision, with any disagreements resolved through discussion and consensus.

## Bioethical considerations

This study adhered to ethical standards for qualitative research and was approved by the Research Ethics Committee of the University of La Sabana (Approval ID: MED-359-2023). It was conducted as part of the broader project, Health Inequities in Rural Colombia: "Characterization of Rural Health Inequalities in Two Municipalities of Tolima as a Basis for a Demonstrative Model Aligned with Community Needs," funded by Colombia's Ministry of Science, Technology, and Innovation (Minciencias) and jointly implemented by the University of La Sabana and the University of Tolima.

All participants provided informed consent, were fully briefed on the purpose and scope of the study, and their data were anonymized

TABLE 2 Educational content based on popular health education for rural caregivers: shared knowledge, dialogue, and transformative action.

| Session                                       | Dialogical construction*                                                                                                 | Experiential and reflective learning                                                                                       |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1. Recognizing the role of the caregiver      | Sharing caregiving experiences                                                                                           | Joint analysis of a case study reflecting rural caregiving reality                                                         |
| 2. Understanding illness and complications    | Exploring symptoms, myths, and concerns about chronic illnesses                                                          | Discussion of clinical cases, identification of warning signs, reflection on personal experiences, and empowerment actions |
| 3. Safe medication administration             | Discussing the responsibility of medication use and common difficulties                                                  | Reflection and learning about medication administration, empowering other family members                                   |
| 4. Wound care in rural areas                  | Storytelling of common wound cases; analysis of local practices                                                          | Wound care simulations, integrating technical knowledge and traditional rural practices                                    |
| 5. First aid                                  | Sharing rural accident experiences, recognizing emergencies, and the need for an organized response                      | Emergency simulations using locally available materials                                                                    |
| 6. The importance of self-care for caregivers | Dialogs on what is appreciated and disliked in the caregiving role; dynamics to identify stress and self-care strategies | Reflection and practice of active breaks and relaxation techniques; recognizing the importance of self-care moments        |
| 7. Healthy eating                             | Discussion of food practices, difficulties, and challenges; explanation of food types and nutritional value              | Meal planning with local products; preparation of healthy dishes                                                           |

\*Dialogical construction as defined by Freire, is a horizontal educational process where teacher and learner co-create knowledge through critical dialog, acknowledging themselves as transformative subjects (36).

to ensure confidentiality and uphold their rights throughout the research process.

Results

Participants who completed the intervention ranged in age from 20 to 70 years, with the majority falling within the 35–64 age group. The cohort was predominantly female (93%). In terms of geographic distribution, 48% of caregivers resided in remote rural areas, while 52% lived in central township zones. Educational backgrounds varied widely, spanning from individuals with no formal education to those with professional training. The care recipients ranged in age from 15 to 94 years.

The qualitative analysis of data from the focus group and post-intervention interviews led to the development of a structured analytical framework comprising categories and subcategories (see Table 3). The main categories represent the overarching thematic axes derived from participants’ narratives, while the subcategories offer a nuanced understanding of caregivers’ lived experiences, the perceived effects of the intervention, and the personal and family-level transformations that resulted from their participation.

The full set of themes emerging from the analysis of caregiver narratives is summarized in Table 3, which outlines the interpretive framework constructed through thematic analysis.

The following section details the emergent categories and subcategories, offering a comprehensive view of the complex, multidimensional nature of caregiving for individuals with chronic illnesses in rural contexts.

Transformation of the caregiver’s role

This category captures the evolving process through which caregivers redefined their identities and caregiving functions as a result of their participation in the educational intervention. The

TABLE 3 Emergent categories and subcategories from post-intervention analysis.

| Categories                                           | Subcategories                        |
|------------------------------------------------------|--------------------------------------|
| Transformation of the caregiver’s role               | Learning to care and to self-care    |
|                                                      | Empowerment and autonomy             |
| Impact of the course on the caregiver and caregiving | Application of technical knowledge   |
|                                                      | Development of skills                |
|                                                      | Change in caregiver habits           |
| Change in family and social dynamics                 | Redistribution of caregiving         |
|                                                      | Family unity and communication       |
|                                                      | Encouraging care recipient autonomy  |
|                                                      | Observable patient improvements      |
| Course value as a training and community space       | Relevance of the learning experience |
|                                                      | Peer learning                        |

program empowered participants to see themselves as active subjects with rights, emotional needs, and decision-making agency. Through dialogical learning and collective reflection, caregiving was reimagined not merely as a task-oriented obligation, but as a relational and reciprocal practice—one that demands emotional regulation, shared family responsibility, and a foundational sense of self-respect.

Learning to care and self-care

This subcategory reflects a key turning point in participants’ conceptualization of their roles. Caregivers began to recognize themselves not only as providers of care, but as individuals equally deserving of attention and support. This shift in self-awareness contributed to the strengthening of caregiving practices by reinforcing the caregiver’s sense of dignity and personal worth. As expressed in participants’ reflections, acknowledging the importance of self-care generated a positive feedback loop of well-being within the patient–caregiver dyad, where the health of one directly influenced the other.

Participant narratives underscored the significance of self-care as a foundational component of effective caregiving. This emergent understanding reflects a transformative shift in the caregiver identity—from one characterized by self-sacrifice to one rooted in mutual care, self-worth, and boundary-setting.

As one participant expressed, *“I’ve learned to value myself, to take care of myself, and understand it’s not just about caring for the patient”* (FOCUS GROUP: 77). Another reinforced the importance of personal limits, stating, *“I’ve learned that I need to care for and value myself, not take on too many duties, and set limits”* (FOCUS GROUP: 87).

This evolving self-perception was further captured in a caregiver’s comment: *“I also learned to value my time. I learned to value myself as a caregiver... I have to be well first in order to provide better care”* (13-C-CH: 4–4). Collectively, these insights emphasize the emergence of a reciprocal care dynamic, wherein the caregiver’s own health and self-recognition are understood as essential to sustaining the health and dignity of the care recipient. The formation of this patient–caregiver dyad, grounded in mutual well-being, marks a significant advance in the conceptualization of caregiving within rural contexts.

## Empowerment and autonomy

The emergence of personal agency was identified as a key subcategory within the broader theme of transformation. Through the intervention, caregivers began to recognize their right to express needs, request support, and share caregiving responsibilities—actions that marked a significant shift from silent endurance to active participation in their care networks. This process of empowerment extended beyond functional relief; it also held profound emotional significance, fostering a sense of liberation from the isolation, invisibility, and disproportionate burden that often characterize caregiving in rural settings.

One participant reflected, *“I learned I do not have to do it all myself; others can and should help”* (FOCUS GROUP: 44), highlighting a pivotal shift from solitary responsibility to shared care. Another stated, *“I never knew I had the right to speak to my siblings... now I do”* (FOCUS GROUP: 71), emphasizing how the intervention helped reframe family dynamics and open pathways for communication and collaboration. This shift toward autonomy was also reflected in self-perceived well-being: *“I’ve gained weight and feel more at ease... thanks to this course, I let go of the burden I was carrying”* (04-C-CH: 4).

These narratives illustrate the caregiver’s evolving recognition of themselves as subjects of both rights and responsibilities. Learning to express their needs, ask for help, and activate existing support networks was interpreted not as a sign of weakness but as an act of personal reconciliation—with oneself, one’s family, and the person receiving care. This redefinition of autonomy reaffirms the caregiving role as one rooted in dignity, self-knowledge, and shared responsibility—key pillars for sustainable caregiving practices in underserved rural settings.

## Impact of the course on the caregiver and caregiving

This category captures the multifaceted effects of the educational intervention on both caregiving practices and caregivers’ personal development. The impact extended beyond technical knowledge acquisition to include the reconfiguration of daily routines, emotional responses, caregiving attitudes, and self-care behaviors within the rural caregiving context.

## Application of technical knowledge

Caregivers reported successfully integrating new technical competencies into their caregiving routines. These competencies were perceived as relevant and applicable to the realities of rural life. As one participant noted, *“I’ve learned how to give medication properly—dosage, route, timing”* (13-C-CH: 4). Another shared, *“I have put into practice the care of a venous ulcer—how to clean it, manage it properly, and ensure appropriate nutrition”* (14-C-CH: 4). A third participant reflected, *“I’ve learned how to safely transfer my father and identify bathroom hazards”* (FOCUS GROUP: 30). These examples demonstrate the practical implementation of health knowledge, particularly in settings where professional care is limited. They also reveal how applied knowledge can function as a protective factor for individuals with chronic conditions and help reduce health disparities in rural areas.

## Development of caregiving skills

Participants described acquiring interpersonal and emotional skills that enhanced their ability to respond to the complex demands of caregiving. For example, one caregiver shared, *“I’ve developed patience and empathy... and learned how to help my relative cope with the illness”* (13-C-CH: 4). Another remarked, *“I discovered hidden skills that are now helping me on this journey”* (15-C-CH: 6). These accounts highlight the adaptive capacity that emerged through experiential learning, emphasizing the relational and emotional dimensions of caregiving.

## Changes in caregiver habits

The intervention also prompted caregivers to adopt healthier personal habits, recognizing the interdependence between their own well-being and their caregiving effectiveness. As one participant explained, *“I used to forget my own medication; now I’m disciplined... it’s changed my life”* (FOCUS GROUP: 16). Another noted, *“I quit drinking so much coffee and feeling nervous... I have more control now”* (FOCUS GROUP: 129). These behavioral shifts reflect an internalization of the training content and a broader commitment to self-care as an essential caregiving strategy.

Together, these reflections illustrate a process of caregiver empowerment in which newly acquired knowledge is actively applied to enhance both the quality of care provided and the caregivers’ own health and autonomy.

## Change in family and social dynamics

This category captures the relational and collective transformations that occurred within families as a result of caregivers’ participation in the educational intervention. By recognizing the significance of caregiving and developing communication skills, caregivers fostered the redistribution of responsibilities and initiated processes of shared care. These changes reduced the sense of isolation and burden often associated with caregiving in rural settings, while simultaneously strengthening emotional bonds and intrafamilial communication.

## Redistribution of caregiving responsibilities

This subcategory reflects the caregiver’s increased ability to voice their needs and negotiate caregiving tasks with family members—an outcome closely tied to the empowerment developed through the

intervention. As one participant noted, *“Now everyone helps. Before, I was the only one looking after my mom”* (FOCUS GROUP: 71). Another added, *“My sister took over when I had to leave... I learned to delegate”* (FOCUS GROUP: 44). These statements illustrate how the intervention promoted more equitable distribution of labor and encouraged caregivers to seek and accept support, reshaping caregiving as a shared family practice.

## Family cohesion and communication

While caregiving responsibilities can often lead to tension and emotional strain within families, participants reported improvements in mutual understanding and relational closeness. This shift was facilitated by greater dialog, emotional expression, and appreciation of caregiving as an act of love and solidarity. One caregiver reflected, *“What I love most is caring for my husband... we talk more now, we are closer. I take care of him with very much love and affection”* (06-C-CH: 4). Another observed, *“Now we have lunch together, we share more, and we appreciate each other”* (FOCUS GROUP: 142). These accounts suggest that caregiving, when supported and valued, can catalyze family cohesion and interpersonal growth.

## Observable patient improvements

Participants also reported notable improvements in the autonomy and emotional well-being of those receiving care, which they attributed to changes in caregiving practices. One caregiver shared, *“She now bathes herself—she did not before”* (FOCUS GROUP: 106–108), while another noted, *“Don Luis now makes his bed, bathes himself, and is happier”* (FOCUS GROUP: 77). These reflections indicate that caregiver empowerment and family engagement had positive ripple effects on the care recipients themselves, fostering greater independence and well-being within the household.

## Value of the course as a training and community space

Participants described the educational intervention not only as a source of practical knowledge but also as a transformative community experience. The course served as a collective learning space where education was closely tied to mutual recognition, shared experiences, and the development of solidarity among caregivers.

## Relevance of the learning experience

The perceived relevance of the course stemmed from its alignment with real-world caregiving needs. Participants emphasized that the content addressed everyday challenges and provided them with concrete tools to manage chronic conditions, boosting their confidence and reframing their identity as caregivers. As one participant noted, *“This course has helped me... now I know how to respond to hypertension or diabetes”* (05-C-CH: 4). Another reflected, *“In 22 years of caring for my son, we have never had training like this”* (FOCUS GROUP: 135). These statements underscore the course's value as a long-overdue educational intervention that responded directly to a critical knowledge gap in rural caregiving.

## Peer learning

Moreover, peer learning emerged as a powerful element of the experience. The opportunity to learn from others in similar situations

not only enhanced knowledge acquisition but also fostered emotional support, strengthened community ties, and helped create a safe, trusting environment. One caregiver shared, *“I’m learning a lot from others’ experiences around me”* (02-C-CH: 5), while another highlighted the ripple effect of community solidarity: *“We’ve been supporting each other in various ways, and for those who have not taken the course but are in similar situations, we have also found ways to help and assist them”* (FOCUS GROUP: 63). These accounts reflect how the course functioned as a space for democratizing knowledge and promoting inclusive, network-based caregiving practices.

## Discussion

Rural caregivers in Colombia face interconnected challenges—including geographic isolation, economic hardship, limited digital literacy, and weak health infrastructure—which compound their caregiving burdens and restrict access to formal support systems (7). These barriers are particularly acute in post-conflict territories, where structural disadvantages accumulate over time. In this context, distributed education emerges as a promising strategy to enhance community care capacity and resilience.

Also known as decentralized or community-based education, this approach grounds clinical and public health training in the lived realities of rural and underserved populations. By embedding learning within local contexts, universities are positioned to address systemic inequities, engage with social and cultural dynamics, and foster a shared sense of responsibility through partnerships with the community.

As emphasized by Gomes and Merhy (20) and Muller et al. (19), academic institutions play a pivotal role in promoting participatory, context-sensitive education within marginalized settings. This study further affirms the university's role as a driver of territorial equity and social justice. In this framework, distributed education becomes a platform for building synergies among academia, communities, and health systems, particularly in rural areas.

The following discussion is organized around five thematic axes derived from caregivers' qualitative narratives, which illustrate the intervention's impact and inform the development of contextually grounded educational strategies in rural health.

## On caregiver role development

The enhanced perception of the caregiver role observed in this study aligns with prior evidence demonstrating the benefits of community-based interventions. One study reported improvements in self-care and coping strategies among rural caregivers, underscoring the importance of addressing the emotional and psychological dimensions of caregiving (28). Similarly, in New Zealand, a lifestyle-focused program effectively promoted healthier habits, illustrating the value of locally grounded approaches to caregiver well-being (29).

In rural Pakistan, a technology-assisted parenting intervention targeting caregivers of children with developmental disorders led to increased confidence and empowerment, significantly enhancing caregivers' ability to support developmental progress. Comparable to the current intervention, this model demonstrated strong scalability

and adaptability in resource-constrained rural settings, reinforcing the potential of distributed education models to strengthen caregiver agency and broaden access to relevant training (30).

## On technical skill development and behavioral change

The observed improvements in technical caregiving skills and health-related behaviors are consistent with findings from previous studies. For instance, a training program for rural African American caregivers of individuals requiring palliative care reported that participants felt better prepared post-intervention, supporting the use of targeted training to mitigate the shortage of specialized healthcare professionals in underserved areas (31).

Given the sociodemographic complexities of rural contexts, community-based educational interventions that enhance practical knowledge and caregiving competencies can be effective strategies for reducing caregiver burden and improving overall quality of life. A study involving 32 rural caregiver-care recipient dyads demonstrated that a culturally tailored, phone-based intervention significantly reduced caregiver burden, showcasing the potential of remote and context-sensitive approaches in regions with limited in-person access (32).

Similarly, an intervention aimed at reducing sugar-sweetened beverage consumption in rural areas was met with high acceptance by caregivers, emphasizing the value of adaptable and behavior-focused strategies (33). Collectively, these studies highlight the effectiveness of flexible, context-aware interventions and reaffirm the critical role of academic institutions in their design, implementation, and sustainability.

## On transforming family dynamics

The intervention led to significant transformations within family systems, particularly through the redistribution of caregiving responsibilities, the strengthening of emotional bonds, and the promotion of autonomy among care recipients. These outcomes reflect the relational impact of empowering caregivers, not only on individual well-being but also on the broader family dynamic.

Comparable findings were reported in a study involving the co-creation of services with rural caregivers, which contributed to emotional support, enhanced self-confidence, and the reinforcement of community networks. That study also identified logistical and infrastructure barriers—such as limited access and connectivity—that mirror the contextual challenges encountered in the present intervention (34).

## On the role of educators and digital health literacy

The intervention, led by university faculty, was positively received by participants and offered valuable insights for the design of future community-based initiatives. The academic involvement and contextually relevant content were highly appreciated, reinforcing the role of universities in co-creating responsive educational strategies.

However, digital literacy emerged as a critical determinant of caregiver engagement and participation. As highlighted in prior research (33, 34), limited proficiency with digital tools can restrict the effectiveness of technology-based interventions in rural areas. These findings underscore the importance of integrating digital literacy training into future virtual or hybrid educational models, ensuring more inclusive and equitable access to learning opportunities.

## Distributed education: a model of impact and sustainability

This experience exemplifies the effective application of distributed education in post-conflict rural settings, demonstrating how academic-community collaboration can enhance both caregiving competencies and the broader social context in which care occurs. It underscores the value of scalable, context-sensitive education models rooted in territorial equity and service-learning principles, fostering knowledge co-construction and sustained engagement between universities and communities (35).

In Colombia, this initiative marks a pioneering effort to bridge academic training with rural realities, advancing human resource development in health grounded in equity, social accountability, and territorial justice.

## Limitations

Several limitations should be acknowledged. Methodologically, the lack of ethnographic observation limited the triangulation of participants' narratives with actual caregiving practices. Additionally, the absence of member-checking to validate interpretations may have affected the confirmability of the findings.

At the participant level, factors such as low educational attainment, limited digital literacy, and time constraints reduced engagement. Structural barriers—including geographic isolation, transportation difficulties, and poor internet connectivity—further hindered participation in both on-site and remote components.

Finally, institutional limitations within participating universities constrained mobility and logistical support for rural engagement, revealing the need for more adaptable academic structures to effectively implement distributed education models in rural contexts.

## Conclusion

This study demonstrates the effectiveness of community-based educational interventions in enhancing caregiving capacities within rural settings. The caregivers who participated not only developed practical technical competencies but also experienced meaningful personal, familial, and social transformations. These shifts contributed to improved well-being for both caregivers and care recipients, reaffirming the value of integrating education with empowerment in underserved communities.

The findings further underscore the strategic importance of embedding distributed education approaches within the training of the healthcare workforce. By recognizing caregivers as essential actors in rural health ecosystems, such models promote sustainability,

strengthen community engagement, and contribute to the advancement of equity in health service delivery. The success of this intervention suggests that similar educational strategies—tailored to local contexts—can serve as effective public policy tools to reduce health disparities in rural and vulnerable populations.

Replicating and adapting this model across other rural and post-conflict territories holds significant potential for informing health system reforms and fostering more inclusive, community-oriented approaches to health education and care.

## Data availability statement

The datasets presented in this article are not readily available because the interviews were approved with informed consent, provided that participants' identities remained anonymized. The same condition applied to participation in the focus group. Requests to access the datasets should be directed to [jlomboc@ut.edu.co](mailto:jlomboc@ut.edu.co).

## Ethics statement

The studies involving humans were approved by Research Ethics Committee of the Universidad de La Sabana under the research project titled: Health Inequities in Rural Colombia. Approval ID: Project Characterization of rural health inequalities in two municipalities of Tolima: Bases for a demonstration model consistent with the needs of the Communities (MED-359-2023). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## Author contributions

JL-C: Supervision, Conceptualization, Methodology, Investigation, Writing – review & editing, Formal analysis, Writing – original draft. RD-S: Conceptualization, Project administration, Data curation, Writing – review & editing, Methodology, Writing – original draft, Investigation, Formal analysis. JP-A: Writing – original draft,

Investigation, Writing – review & editing, Validation, Supervision. FL-L: Validation, Writing – review & editing, Methodology, Supervision, Conceptualization, Writing – original draft.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that Gen AI was used in the creation of this manuscript. The authors declare that generative artificial intelligence tools were used in supporting a phase of the thematic analysis process as presented in the methodology, and in assisting the translation of the article from Spanish to English and the final edition in English.

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# Research in place: the critical role of rural health research in Canada

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People in rural communities often experience different access to healthcare and services, which can lead to poorer health outcomes compared to their urban counterparts. This holds true across the international context, though our focus here is on Canada. Health research plays a crucial role in identifying challenges and solutions, and we argue that research conducted in rural communities by rural researchers is essential to addressing the unique needs of a rural population. However, several barriers hinder rural research in Canada, including inadequate infrastructure, uneven resource distribution, and the absence of a national rural research network. Prioritizing rural research is vital, as it can improve workforce recruitment and retention while guiding informed healthcare decisions and policies.

## KEYWORDS

research capacity building, rural health research, primary care research, rural medical education, distributed medical education

## Introduction

All Canadians have the right to universal and accessible health care as outlined in the Canada Health Act. Despite this, people living in rural and remote communities often face challenges accessing care in their home community (1, 2), and have worse health outcomes than patients in urban areas (3). Urban-based health research does not often translate to improved rural outcomes (4). The development of distributed medical education programs in Canada reflects a shift from urban academic centers to education in communities (5). While this distribution provides medical education in rural contexts, equivalent academic structures for rural-specific research are lacking. Rural health research is crucial to providing direction for health policy, and interventions for optimal patient outcomes (5–7).

Our objective for this paper is to support the vital role of rural health research, explore challenges in generating authentic rural evidence in Canada, and discuss barriers and assets toward building a robust national field of rural health research. We aim to address this by (1) examining successful rural health research strategies; (2) identifying barriers to growth in three key areas: infrastructure, workforce capacity, and connectivity, while illustrating approaches to overcome them; (3) describing a role for distributed health professions education to grow rural health research; and (4) proposing

a shift in perspective to raise the profile of rural health research in Canada.

## Health research in the rural context

Rural communities are not uniform, and there are many ways to define rurality, each with pitfalls (8–11). Here, we will use the term “rural” to encompass rural, regional, remote, and northern settings (12). Each can be under-represented in the evidence base, due to historic under investment in research outside of urban academic settings (4, 13). Solutions facilitating community-based research in the smallest, most remote, most northern places can serve all rural populations and non-traditional research settings. Research conducted in rural Indigenous communities should meaningfully include community members throughout the process (14).

Leaders in rural research capacity building efforts in Canada point out that innovation is central to rural medicine (15). Rural physicians are driven to discover solutions to problems facing their communities (15). Conducting research in rural communities can be quite different from the approach of the urban academic setting. Rural health researchers in Australia work with many methodologies and topics, in small multidisciplinary teams, and trusting local partnerships. They build a generalist skillset to best serve community needs, and find their work highly rewarding because of its impact on their communities and health systems (16). This approach centers on social accountability. Research in rural settings must be done by rural people to generate meaningful evidence (17–19). Differences in rural demographics, geography, and service availability make urban evidence difficult to generalize (20–22).

Canadian rural physicians are scholars, interested and well positioned to carry out local research (13, 15). Their impact can be amplified by involvement of all health professions and local academically trained researchers (23–25). It can be difficult to conduct research in the rural context due to many competing priorities, in addition to geographic and professional isolation, which can lead to delays or abandonment of research work (26). System-wide supports are needed to facilitate research in this context: infrastructure, skill building, connection and integration.

## Rural research infrastructure

The infrastructure that regularly supports research in academic institutions is lacking in rural areas. A system-wide evaluation of rural research needs in one Australian jurisdiction describes an over-reliance on individual activities, resulting in fragmentation, and identifies a need for support at the systems level (27). Early career rural researchers from several communities describe having limited support or staff, and being responsible for all aspects of research processes, including finding opportunities to build capacity toward meeting high community demand (16). This is compounded by challenges typical of rural contexts (geography, demographics, service availability) and rural research (wide breadth of topics and methodologies) (16, 22). Fixed-term funding models for rural academics present a barrier to continuity of high-quality rural

research and urban–rural partnership (28). In Canada, rural academia is not as well defined or established, though it faces similar obstacles (13, 15).

Rural health professionals infrequently have access to academic appointments, protected academic time, grant administrative support, research assistants, methodological support, or highly qualified research personnel. Instead, some universities have formed dedicated units for rural health research. In Canada, the Center for Rural Health Research at the University of British Columbia emerged due to demand for evidence to inform policy on health services delivery to serve rural communities (29). The Center for Rural Health Studies at Memorial University of Newfoundland performs similar work, with a particular focus on rural/urban disparities (30). These centers benefit from the research infrastructure of central universities, and generate important rural evidence.

Still, place-based research is a unique, under-explored concept. One success story is Colac, a rural town in Australia. There, local research activities generate evidence that influences practice, and this promotes growth in research interest, capacity, and funding. This successful research program began with one team project, leveraging temporary availability of PhD expertise to gain funding for research support and protected research time for clinicians. Program expansion has secured sustainable funding for support staff, and sees newly engaged clinician researchers bring in project grants (23). They advocate for expanding opportunities for research at similar sites, and exploring small rural hospitals as drivers of rural research (23, 24). Similarly, teams led from Sweden and America describe the central roles of “local-actors and local-action” and “local relevance” in rural health innovation (18, 19).

Rural physicians in Canada are also well positioned to lead research in their communities (15). In Canada, the distributed medical education networks of all medical schools present excellent scaffolding for rural health research that remains largely unexplored (13). Health professions education programs in Australia can access funding for dedicated rural research professionals at distributed sites. This has contributed substantially to building rural research capacity and establishing rural research networks, leading to improved service delivery, patient care, educational innovations, and workforce retention (28).

Yet, investment in rural health research does not reflect the demand for rural evidence. In Canada, 17% of the population lives rurally, while the Canadian Institutes for Health Research (CIHR) awarded less than 1% of funds to rural projects from 2000 to 2019 (4, 31). Rural-specific funding avenues have long been advocated for at the national level (4, 32). In 2007, the Canadian Rural Health Research Society named the dismantling of the Health Canada Rural Health Office and removal of rural funding priorities by the Canadian Institute of Health Research as key barriers (33). Rural organizations now provide funding for rural work, such as Rural360 for research trainees in rural Newfoundland, and the Rural Physician Research Grant Program in British Columbia (34, 35). These efforts cannot meet the demand for rural evidence alone. Yet the profile of a successful rural researcher includes key differences from their urban counterparts that at present have no mechanism to be recognized or awarded in major grant competitions, and may even put them at a disadvantage (16).

Rural health research in Canada has been driven by the enthusiasm of dedicated individuals, often working outside of their payment structure, or on contractual funding. It is time for the administrative and methodological supports to be based in rural communities, with protected academic time at distributed sites to facilitate and support collaborative multidisciplinary research teams, with access to funding that reflects the demand for rural evidence.

## Skill building to grow rural health research capacity

At present, the rural workforce does not have enough health professionals to meet clinical needs, and even fewer with the knowledge, expertise and skills to meet the demand for research (23). Workforce turnover is another barrier, and affects all health professions in rural communities. However, academic opportunities can support rural health workforce retention (6, 28, 36). Rural skill building programs in research are needed (37). To be truly meaningful, training must be done by rural people for rural people (12, 26). In Australia, despite having a more established role for rural academia, needs assessments call for training programs to build rural health research capacity, and develop more pathways to rural academia (12, 16, 27). Working rural academics also seek out skill building opportunities to develop a more generalist skill set to better meet the needs of their communities (16).

Memorial University of Newfoundland Canada has created a faculty development program to specifically build rural research capacity in medicine (26, 38). The program was designed to equip rural physicians to carry out research in their communities (37). Alumni are supported to continue their work with ongoing mentorship, research assistant support, and incorporation into a growing network of rural health researchers. The program's impacts in capacity building extend beyond the new research skills and outputs of trainees, to also raising the profile of research in rural medicine across the participating region, and highlighting resources available to all faculty (26). Still, the output of this program is small in numbers in comparison to the need, and not enough similar initiatives are in place nationally in Canada. The program development team identifies Faculty of Medicine support and funds as a key facilitator for program initiation, along with a professional culture valuing homegrown rural evidence, leading to quick uptake (26).

University rural health research centers present opportunities for a variety of trainees, clinical and non-clinical, to conduct research with a rural focus. However, this will not necessarily equip trainees for place-based research. In-community research lags behind academic centers in learning opportunities. As demonstrated in Colac Australia, clinicians can be engaged in research through local projects, and thereby gain the skills to lead future work (23). Undergraduate and postgraduate medical trainees participate in scholarly work, and their learning opportunities in place-based research would also be enhanced by increased availability of local research expertise at rural teaching sites. Engaging with students on scholarly activities is another way for rural faculty to conduct and support research, and to foster the creation of scholars within the rural community (39).

Becoming a rural health researcher, in Australia, usually involves either a rural move for a specific role, or pursuing a PhD to get one,

though a few move rurally for personal reasons and later find work in rural academia (16). They describe a need for additional pathways to rural academia to meet the high demand for rural health research (16). Canada remains without formal pathways to rural academia, and often depends on individual drive to bring research skills to communities. A systematic approach encouraging more health researchers in rural spaces is essential, involving specific rural health research training opportunities (16, 37), rural research trainee scholarships (16), and visibility of rural research projects (16, 26).

## National strategies to support growth in rural health research

In 2017, a joint task force of the College of Family Physicians of Canada and the Society of Rural Physicians of Canada created The Rural Roadmap for Action, aimed at improving the health of rural Canadians. Direction 4 calls for a national rural research agenda, rural health services research network, and strengthening rural medical education by incorporating research (40). While the Society of Rural Physicians of Canada is engaged in development efforts, success will require support from outside the rural space, and more can be done to include other health professions in rural research (1, 25, 41).

## Rural health research agenda

A national rural research strategy is needed that includes priority research topics and funding to support a national rural health research network and research activities. This can ensure a collective focus on relevant research and ensure it is shared with others, learning together from both the process and the results, and integrating rural evidence into an overall picture. Developing a national rural health research strategy will need to incorporate perspectives and priorities of rural health professionals, rural medical and health professions education programs, rural-based academics, and rural populations, as well as meaningful engagement and collaboration with Indigenous groups. Recently, the National Summit on Equitable Access to Medical Transport in Rural Canada identified interested parties and brought them together to understand priorities (42). Led by the Society of Rural Physicians of Canada, this approach outlines a strategy that could also be applied to shaping a health research agenda and strategy for rural Canada. Involvement from government and major funders would allow more sustainable solutions (4, 33). The United States provides a small-scale example, with federally funded short-term Rural Health Research Centers studying priority rural healthcare policy issues, though small in number and geographic coverage (43).

## Rural health research network

Canada is without a true rural research network, nationally. Rural health researchers are often working in relative isolation from their colleagues in research, and disconnected from other findings in their field (37). A national rural health research

network can create connections, collaborations, visibility, and legitimacy. The Hauora Taiwhenua Rural Health Network has done this for New Zealand, by creating a research and education chapter, with a dedicated national gathering, and intentions to define national rural health research and education priorities (44). Several Canadian jurisdictions have mechanisms for sharing rural health research resources and information (45–47). These initiatives have risen to address local or regional needs but are unconnected to each other. A national network would strengthen existing rural health research organizations and better serve more geographically isolated communities.

## Rural research in distributed health professions education

Robust distributed medical education provides an ideal ground to grow rural research, as is already being done in Australia. Canadian medical schools have strong distributed networks, well positioned to grow rural research (5, 13). Strong medical education enhances research, and research enhances medical education (15). The NorFam residency program, based in Happy Valley-Goose Bay Labrador, is one of the earliest examples of rural and remote residency program delivery (48). This community is also home to the School of Arctic and Subarctic Studies, an important player in bringing socially accountable research to Canada's North (49). Together, these parallel entities could open more opportunities for the population than either would alone, in establishing better access to care and creating an avenue for representative evidence and policy advocacy. Health professions' education could intentionally create more such opportunities for the many communities involved in distributed education networks, most established with medical schools (13). Intentional distribution of academic research resources throughout all medical education networks would align with World Health Organization (WHO) guidance, rather than retaining expertise in a centralized hub (50). The social accountability framework for medical schools defined by the WHO in 1995 is "the obligation to direct education, *research* and service activities toward *addressing the priority health concerns of the community, region and/or nation they have a mandate to serve*" (51).

## Discussion

Research in place, led from rural locations, by rural researchers engaged with their communities, is critically important. Evidence-based medicine historically excluded women and children, and now we are facing a deficit in evidence on rural populations (1). Distributed health professions education can play a role in closing this gap, toward making evidence-based decisions that are relevant to our full geographic population. Still, solutions must not overlook populations with no trainees, or no university in their jurisdiction. Rurally engaged research is only truly valuable when informed by and conducted by and with communities (17–19). Community engagement to address local priorities may produce more applicable and relevant forms of evidence for health professionals and policy makers (7, 12, 52). Community needs and characteristics will vary, as will the approach to research in each setting and there are no one-size-fits-all solutions.

Yet there are overlying principles to support research across rural settings:

- 1 *Rural questions are legitimate questions and findings are valuable to all.* Due to the interconnected nature of health systems, part of the payoff of improved rural care and outcomes is better coordination with urban providers. There are examples where rural communities are better positioned to innovate and can bring evidence forward to all settings. Frostbite treatment guidelines developed in Whitehorse, and self-collection cervical cancer screening methods validated by First Nations and Metis communities in British Columbia (BC), are just two recent Canadian examples (53–55). The Pentagon Partnership Plus model, developed in BC to address rural and Indigenous health inequities, presents a practical application of social accountability principles with broad applicability (17).
- 2 *Rural researchers are legitimate researchers and their positionality is of unique value to all research.* They look different from central university-based researchers and the differences are critically important. Until this is acknowledged by scholarly structures and processes, including funding agencies, success will depend too much on individual enthusiasm to grow and to meet the demand for rural evidence. Developing a rural researcher professional identity for rural health professionals in Canada will add to the imperative that rural health research needs rural researchers to do it.
- 3 *Research infrastructure and processes must reflect the value of rural evidence.* Protected time and support are needed, and the work is rarely done by individuals alone. Distributing the research support team of administrative assistants, research assistants, and methodologists along with education programs, is necessary. Health professions education programs hold many of the needed resources to support the growth of research in these communities and can opt to intentionally distribute more of the resources to rural communities, as has been started in Australia. Robust connectedness of this field will rely on a truly national rural research agenda and network.

From these principles, key priorities emerge: (1) embed rural research into existing systems for long-term sustainability, (2) create avenues for research skills to be taught to rural health professionals and learners by skilled, experienced professionals from similar settings, (3) ensure visibility of rural researchers, (4) support with on-site expertise and navigational knowledge of overall systems, and (5) develop rural research priorities, with funding reflecting the importance of the evidence this work will generate. These actions can shift the positioning of the rural and distributed context to a legitimate academic space where all aspects of academic healthcare occur, and thereby open a rural academic identity to a wide range of rural professionals and increase capacity for their important work.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

# Author contributions

SW: Conceptualization, Writing – original draft, Writing – review & editing. MW: Writing – review & editing. BZ: Writing – review & editing. DP: Writing – review & editing. GP: Writing – review & editing. NO: Writing – review & editing. AJ: Writing – review & editing. JK: Writing – review & editing.

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# Correction note

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# Connecting with the community—experiences of medical students doing homestays in rural South Africa

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**Introduction:** This study explores the educational and personal experiences of final-year medical students at the University of KwaZulu-Natal who participated in a homestay program during a seven-week rural clinical attachment. The initiative aimed to deepen students' understanding of the social determinants of health by immersing them in the communities they served, moving beyond traditional hospital-based training.

**Methods:** Students were invited to participate in the homestay project, prior to their rural clinical attachment. The study draws on qualitative data from focus group discussions and interviews with participating students, exploring their experiences during the homestays. The transcripts were thematically analysed using a framework analysis approach.

**Results:** The research highlights how living with host families in deep rural areas fostered cultural humility, empathy, and a holistic view of care. Students reported that the homestay experience humanized their clinical practice, allowing them to perceive patients as individuals embedded within complex social and cultural contexts. Many described transformative learning moments, such as navigating cultural differences and traditional healing practices, and understanding the challenges of health care in rural communities. Despite challenges—including transport issues, food adaptation, and navigating gender norms—students overwhelmingly found the experience enriching and stress-reducing, with strong relational bonds formed between them and their host families.

**Discussion:** The study situates these findings within broader discourses on decentralized health professions education (HPE), arguing that authentic, relational learning in community settings can challenge hierarchical and urban-centric models of medical training. The homestay model facilitated a shift in educational space—from controlled clinical environments to complex, lived community contexts—enhancing students' professional identity formation and responsiveness to rural health needs. The process of place-making seems to be key in shaping meaning making and transformational change. The homestay project demonstrated the potential of community immersion to transform medical education by fostering empathy, cultural understanding, and a deeper, authentic connection to the lived realities of patients in shaping socially accountable health professionals.

## KEYWORDS

homestays, decentralized, rural, health professions education, humanizing, community engaged education

## Background

The idea of training health professionals to be responsive to the needs of their patients and communities has emerged as a central concept in health professions education (HPE) (1, 19). This has often been conceptualized to include a strong public health perspective and understanding of social determinants of health as part of many of the curricula of HPE programs. However, the theoretical positioning or didactic teaching on the ecological links between a person's illness and the individual, contextual and cultural dimensions may be inadequate to train health professionals to be able to deeply appreciate the context of the people that they treat – and therefore to be adequately responsive to the needs of the individuals, families and communities that seek care.

In order to increase the engagement in communities, a homestay project was initiated (see below for details) that offered final year students to live in the community during a 7 week rural attachment.

## Literature

While homestays are becoming common in tourism, their application is less commonly explored in the literature in educational settings Hughes et al. (3) Where homestays for medical students has been used, the objectives for the approach has varied, such as finding a local solution to accommodation, particularly for elective students in global health or creating a setting for teaching cultural competence. Research by Crampton et al. (2) demonstrates that homestays facilitate cultural immersion and community integration during rural clinical rotations, improving students' understanding of social determinants of health. The literature on homestays also highlights the role in enhancing clinical training experiences, particularly in rural and international settings (3).

Several studies emphasize the educational benefits of homestays (3). It was found that living with local families deepened students' appreciation of community context in healthcare delivery. Similarly, living in the community improved cultural competency and communication skills among participants in international homestay programs (4). The depth of the engagement by the students in the community seemed to play a critical role in the positive experiences students had (3).

Cost-effectiveness represents another theme in the literature, and the significant financial advantages of homestays in tourism compared to traditional accommodation options (5), particularly relevant given rising medical education costs. Similarly, Worley et al. (6) identified homestays as a sustainable solution for housing students during distributed clinical training.

However, challenges exist. Concerns regarding professional boundaries and privacy have been identified, and noted difficulties in homestay program standardization and quality control (7).

Overall, the literature suggests that homestays potentially offer valuable educational, cultural, and financial benefits for medical students while presenting logistical and professional challenges requiring thoughtful program design and implementation.

## Context

At the University of KwaZulu-Natal (UKZN), the final year class in the medical program spends 7 weeks based in a rural hospital in the

province of KwaZulu-Natal. The hospitals where students are placed are situated between 80 km and 450 km from the central medical school and are either in small rural towns or in deep-rural communities. The module is designed to cover a range of competencies beyond the clinical training, with a strong focus on generalist skills, on how to function within the health care system, and on how to engage with traditional healers and communities.

A project was initiated to offer students an opportunity to live in the community, rather than at the provided accommodation at the rural hospitals. The sites for the project were all located in deep rural areas that were part of the previous 'homeland' system in apartheid South Africa, i.e., part of tribal land, which generally still has much lower socio-economic status (8). The sites were distributed across the province, St Andrews Hospital in the South, Church of Scotland Hospital in Msinga, in central KZN, Mseleni Hospital and later Bethesda Hospital, in the North of the province. The sites were selected to reflect a range of contexts of the local arrangements – in Mseleni and COSH, previous international students had already stayed in the community, and so there was a context that we could learn from. At Bethesda, there was a strong linkage between the hospital and the community, but no homestays had been attempted previously. In St Andrews, the linkage between the community and the hospital was not very strong, and there was no previous experience of students living in the community. The extensive process of engagement with the communities preceded the placement of students in the selected homes that participated in this project.

Over the period of approximately 3 years, the number of participating students increased from 1 in 2016 to 21 students per block of approximately 40 students in 2017 and 2018. The allocation of students to the available space for the project was done on a first-come, first-served basis. In fact, during 2017, more than 50% of the class requested to live in the community, rather than in the hospital accommodation, but the project was not able to accommodate all of them. The main driver of the requests seemed to be the word-of-mouth spreading of information about how positive the experience was, and some students applied to do the homestay project a number of rotations in advance, long before the application process for them opened. In total, 229 students participated in the Homestay Project between 2016 and 2018.

Part of the exploration of the project included the students' experience of living in the community, and how this influenced their learning processes in the rural block.

## Methodology

A qualitative approach was employed for the study, using focus group discussions as the main data collection tool.

## Selection of participants

The study was introduced to the students prior to the block, so that they had a chance to select to participate and ensure placement in the hospitals where the homestay project took place. All students were invited to apply, and it was shared at every meeting that the research team wanted to understand the process and experience of the students and the community in the project. As mentioned above, the students who volunteered were selected on a first-come, first-served basis, and those students who were not able to be accommodated once the spaces for the

homestays were filled were not included as participants. The students were also requested to participate in the research project, but those who did not want to do so did not disqualify them from the project.

The student population at UKZN is very diverse. The selection process of students at UKZN has a strong social justice perspective and supports the selection of students from disadvantaged backgrounds by selecting 28% from schools in economically disadvantaged areas, and a large proportion of students come from rural areas. The selection of students for this project did not apply any further criteria besides what is outlined above, but the participating students reflected the student population in terms of diverse backgrounds, such as economic backgrounds, ethnic groups, or rural–urban backgrounds.

## Data collection

While the PI of the project was on the faculty of the rural block, two independent researchers, with no other relationship to the students, were involved in managing the project and conducting the interviews and focus group discussions. As part of a larger study, the homes and the students were interviewed and visited on a regular basis by one researcher. A focus group discussion with all the students participating in the homestay project was held prior to departure to the rural block and again on return, facilitated by the 2 researchers using a question guide – see [Box 1](#). The focus group discussions and interviews with the students were conducted in English, audio-recorded and transcribed.

## Analysis

The focus group discussions and interviews were quality checked for errors in transcription. A framework analysis approach was used in managing and analyzing the data (9). This included the steps of transcription of the data, familiarization with the transcripts of the interviews and focus group discussions, and the initial coding of the

transcripts according to emerging relevant ideas (inductive process). The inductive coding was compared with the deductive codes that emerged from the literature, which had informed the focus group guides. From these steps, an analytical framework was developed that charted and indexed the data as it was analyzed against the codes. The framework was iteratively reviewed to ensure it remained comprehensive throughout the analytical process and which aided in the interpretation of the data. The matrix structure of the process offers a useful and comprehensive overview of the data and assists in the recognition of patterns, with an inductive/deductive iteration of the data. A hierarchy of themes and nodes was developed using a framework analysis in structuring the relationships and NVivo<sup>®</sup> software was used in the analysis process.

## Ethics

The proposal for the study was approved by the Humanities Social Sciences Research Ethics Committee of UKZN (ref: HSS/0133/016), and gate-keeper permission to conduct the research was obtained from the Registrar of the University. Students were asked to give voluntary consent to participate in the study after information was given to them. Declining to participate in the research study did not influence their participation in the homestay project. The information regarding the project was initially shared via email that was sent to the whole class of students, and students were invited to an information-sharing meeting. At the meeting, questions could be asked, and additional questions would also be discussed individually, if required, and follow-up enquiries could be made.

## Results

Rich experiences were shared from the focus groups and reflections. Many of the experiences were told with humor and enthusiasm of re-telling an exciting adventure. However, a number of difficult experiences were also shared.

## Engaging in a new context

Most students felt that the homestay project was a positive experience that allowed them to understand the people they were seeing at the hospital and the community in which they worked in a more holistic manner. They came to understand the role culture and tradition played in health and medicine, and felt that the host families reduced their stress and were most welcoming. Such an environment allowed them to feel safe, and most students indicated that it shifted their preconceived ideas and that they learnt valuable life skills, which prepared them better for their role as medical doctors.

Many students expressed that the homestay experience helped them to better understand their patients that they were treating in the hospitals. This is noted in the following student's remarks:

‘... it made me understand the patients that we have coming to the hospital I was based at, and it broadened my perspective in a way. I got to see the patient as, uh, more than just a patient with the disease that they are presenting.’ (INT 1)

### BOX 1 Guide for focus group discussions

Can you describe your experience of being involved in the homestays project?

- Why did you decide to participate in the home stays project?
- What have you liked most about the homestays project?
- What have you liked least about the homestays project?

What did you learn from the homestays project?

Do you think your participation in the homestays project has impacted on your clinical experience?

What do you think the difference is between staying in a parkhome within the hospital and staying in homes during the rural block rotation?

- Would you recommend home stays to your fellow students?
- Did you build any relationships during the homestays project? Please explain
- Did the homestays project create an opportunity for you to build relationships in the community? Please explain:
- Do you think that home stays should be extended to other sites?

What do you suggest could have been done differently in the homestays project?

The dehumanization of patients (reducing the person into a disease entity) is a strong feature of the narratives. This is juxtaposed to the humanizing experience of understanding people in their context. The medical students were often from a different cultural background to that of the community, and the homestays gave them a platform for understanding the patients' culture:

'I got to understand Zulu people, I am not Zulu...their culture, what they do, and also to learn about the new ... so it was amazing.' (P6, FGD 2)

Homestays allowed medical students to transition past social barriers and feel integrated into the community. One student described this by saying,

'... we see ourselves in the community, not being alienated from our places, but being part of those places, but being able to learn medicine, being part of the community, being able to understand and help the community in advance.' (P8, FGD4)

Medical students were able to better understand and conceptualize the cultural significance of health. This is noted in the following comment:

'My stay in the homestay was more than hundred percent good in my perspective, in the sense that I got to integrate with the people, how they live, I also got to understand their beliefs and the way they view western medicine, not in the patient's perspective but in the community's perspective.' (P2, FGD4)

The significance of traditional medicine was further supported in another student's viewpoint:

'...understanding how my people live like and why they do the things they do, uh if you were in there you will understand that people in rural areas still use traditional medicine and you cannot tell them otherwise, you cannot tell them do not take these medicines, they will tell you "we are African." So, you just really do not have to shout at them when you see them at the hospital, because it's their culture... We just have to understand and try to explain things from our perspective, western medicine, but at the same time not to judge them. (P4, FGD4)

Living among the people allowed the medical students to feel 'more of an African with them' (P6, FGD 4). Living in the community not only allowed the students to observe or perceive how people live, but also supported conceptualizing their identity formation in the development of a professional persona, which arises out of the authentic engagement with the members of the household, their neighbors, and the surrounding community. The experiential and relational nature offers a much deeper appreciation of and engagement in the social ecology of the households they were staying at. The same student expressed that 'doing family medicine in the rural block you also got to learn the context, because most of the things they come with them...when you are dealing with their issues and be able to understand that when a person had an injury from playing soccer, they will start from Inyanga for 'ukugcaba' (form of healing by Zulu people) then come

to you. They will even delay some hours before coming to you, because they live so far.' (P6, FGD 4)

## Reality of living in the community

However, students did have some challenging experiences while living with the homestay families. Largely, they were transport issues, financial issues, and conflict in the family they were staying in, and these incidents reflected the realities of issues that are common in the community. The experiences made their living environment at times an awkward one, but also reminded them of the realities of the community and challenged the romanticized conceptualization of rural livelihoods. As an example, transport was a challenge for some students particularly when on call.

'Um the only issue that I had was the distance to the hospital. It was quite far.' (P9, FGD 4)

Students experienced social discomfort in the homestay homes when family members were arguing with each other. They felt like intruders and felt that this conflict impacted their relationships with the family.

In a house full of boys, some medical students, who were all female students, experienced a food shortage. However, this was resolved in discussion with the host family and made everyone aware of how to live together. At times, students noted they struggled with the food that they were given. It was cooked differently from what they were used to, and they had to adapt to that. Some students felt that it was disrespectful to complain about the host family's food, so they acknowledged that it was difficult to get used to. Similarly, one student expressed that he was raised not to challenge the cooks!

'One of the things that was instilled within me when I was growing up is that you do not ...need to fight whoever is cooking at home ... you do not question, especially if it is not the one you are married to. So there was that, so I never got to engage on the food but yah I did have struggles with food. I initially adapted but at the end of the block I was really struggling. (P4, FGD 5)

Some of the female medical students mentioned that their host families expected them to cook and clean for their host families and comply with traditionally gendered social expectations, and a few female students felt that members of the host family behaved inappropriately. The reality of living in a context where social norms were significantly different from their own created a tension and discomfort for students and required them to navigate this reality.

## Feeling nurtured and cared for

Yet, most students felt that their host families embraced them and cared for them.

'I have never had a grandmother before, so it was um the most beautiful thing to see and I actually enjoyed it, she ...fed us a lot... and she cared about us.' (P5, FGD 2)

Another student described this experience:

‘Then there was a time when I was sick and she really she took good care of me...it felt like I was really with my mum. It was nice and I am still in communication with her, she calls me, she checks up on me if I’m still ok yah.’ (P7, FGD 3)

Similarly, another student described the relationship she had with her host mom:

‘Um we had a really nice relationship and um even when I was on call I would tell her and she would um bring a meal for me at night.’ (P3, FGD 3)

## Reduced stress

Many students commented that living in the community was less stressful for them. It was like ‘...staying at home and I wasn’t worried about cooking and everything, I was just worried about my performance like waking up and go to school and come back.’ (P6, FGD 2). This allowed students to focus on their internships.

‘Your stress levels are a bit lower and you function better at the hospital... I think it affected my clinical experience positively. (P2, FGD5).

Some students felt that they did not have to worry about domestic chores (P1, FGD2), and it was described as a ‘luxury’ that came with the home stays, saying that they did.

‘...not have to worry about washing dishes and uh running out of bread. (P3, FGD5)

## Generous, social relationships with the host families

A strong sense of being welcomed and belonging was a recurring theme in the focus groups:

‘Also, you asked what our experience was, for me, it was...to realize that there is still some good in people (.) um just experiencing this family taking someone that they do not know... but they are still willing to take you in, yeah.’ (P6, FGD 2)

Likewise, another student said:

‘...I was just like their kid, so I like that a lot.’ (P7, FGD2)

The community homes was experienced like being at home away from home through the social connectedness they felt being in a family:

‘...and waking up every day with people smiling at you like you know. They made you feel like you are part of them and I had

a kid to play with... and the fact that that when you coming back you are not going back to an empty room and just look at your phone. You came back and be with people who are willing to listen to you and share fun stories with you and who want to know how the hospital was, people who are actually concerned. Those are the things I enjoyed about the stay.’ (P5, FGD 5)

Having the students live in the community also gave the community members a sense of hope. The experience of living in the community as an optional part of the medical curriculum decenters the medical school as the main place for learning. The idea that the presence of the university in the community is vital underscores the potential inversion of the current hierarchy of what is considered to be the center and what is peripheral. As one student said:

‘... I honestly feel like having UKZN sending students there is beneficial to both the students and the family, ... having a presence of UKZN students in the homes would bring children hope, in a sense that they would see that a person just like us has made it through all the adversities and issues that are there and they have made it into university and they are progressing...’ (INT 1)

## Discussion

The data presented above gives a detailed insight into the experiences of students becoming part of a community during the process of the homestays. The process of ‘moving out’ into the community and repeatedly making the journey between the hospital to go to the home (‘their home’) during the rural block offers an important lens through which to reflect on the idea of decentralization of HPE (10). The journey seemed to have taken place on a number of levels at the same time, and that appeared to synergistically produce a profoundly impactful experience. These shifts include.

- 1 a *geographic shift* (from urban to rural hospital to community), from home or residence to living in a rural village.
- 2 a *shift in location within the health care system* where the educational experience takes place: from central/ ‘academic’ hospitals to district hospitals and into the community.
- 3 and a *shift in the educational process* – from medical school and clinical training (high control, formal, experiential learning opportunities linked to clinical scenarios), to community (low level of control by educators, rich experiential learning beyond clinical context).

The experience of the students in the homestay was shaped not only by leaving the medical school campus, but also by how this challenged or resonated with their backgrounds in urban areas, privileged contexts, or for students who grew up in rural areas. For some, the homestay was a completely novel experience, while for others, it felt more like a homecoming. Shifting the educational context to the district hospital and into the community, and having an open-ended (educational) space for experiencing living in the community further shaped the process of learning (20). In all of these

levels, the notion of decentralization has a connotation of giving up power and not pre-determining the process and outcomes of the experiences. Therefore, the way the students experience their time in the rural community decenters the notion of meaning-making (11) from the urban medical school campus to the deeply meaningful relationships in the rural household. The giving up of power challenges our common approaches to assessment and, as Halata & Ellaway argue, linking assessment to authentic environments may become a threat to the authenticity of the experience of the environment (12).

Authentic and deep relationships seem to be a critical component of the homestay experience. The sense of being at home while being placed in an unfamiliar environment is seen in longitudinal relationships in longitudinal integrated clerkships (LIC's), which foreground relational learning (6). The idea of being recognized, being cared for, and being a member of the household is a profound leverage to making meaning of the local context and the wider environment of the medical placement. Even the challenging areas that students have experienced were part of the authentic environment (such as transport difficulties) that take on a deeper meaning when experienced rather than being 'taught' about it. Even though some of the experiences may have been challenging, in the context of the relationship, these took on a different character that allowed for engagement and resolution. In the literature on authentic learning (13) the difference between situational authenticity and cognitive authenticity is described – arguing that situations that are cognitively authentic, may lack the depth of learning if they are not also situationally authentic (14). However, as in our example, the critical role of relationships is for authentic engagements is increasingly recognized (15), the situational authenticity developed deep cognitive authenticity in how the relationships and the situation shaped the deep learning and shifting attitudes.

The active construction of a social space echoes Lefebvre's triad of conceived (or conceptualized) space, perceived (or experienced) space, and directly lived space in which one has agency and engagement (16). Having the students immersed and engaged in the households, their lived experience dialectically "co-reproduced perceived and conceived spaces" (Pierce & Martin, p 1284). The lived experience of the authentic engagements allows the students to conceive or conceptualize a sense of place, and perceive or be witnesses to an alternative way of being. This co-creation of space with the household of the homestay stands in contrast to the perceived privileged and centralized teaching of the medical school. It legitimizes and values the periphery (11) that challenges the biomedical dominance in the curriculum.

Such analysis offers a possible way of understanding the reflection that the students were able to see the patients in the hospital as people, as neighbors, as members of the community. It reveals how dehumanized patients are when generally presented to students in the hospitals, particularly in less decentralized settings (17). The way that the students' construct the context of the homestay seems to be an essential process in imagining the rural area and the people that live there as having great value.

The literature on transformative education (18) foregrounds the humanizing experience as part of the educational process. The account of the students' point to the possibilities is facilitated by a number of key factors that arise from the data. Disorienting dilemmas of struggling with food, coping with conflict in the home, are part of a deeper recognition of the 'other'. It reflects the need to experience and

engage in the local context, rather than to 'know' of it, as a critical component for humanizing the 'patient' into a human being.

As students volunteered for the placement in the community, it is noteworthy that more than half of the class sought the kind of experience that the homestay project offered, including the immersion, challenges, and the profound learning process that came from this.

## Conclusion

The educational value of deeply authentic and relational experiences in communities has been demonstrated in the reflections of the students we interviewed. The homestays showed a strong potential in humanizing the professional development of the students, which has been underpinned by active placemaking and the formation of authentic relationships by the students. It opens the exploration of how we can reposition HPE into novel environments and challenges the traditional power relations and sense of control inherent in HPE.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Humanities Social Sciences Research Ethics Committee of UKZN. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

BG: Investigation, Writing – review & editing, Supervision, Formal analysis, Visualization, Funding acquisition, Methodology, Conceptualization, Writing – original draft.

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The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author declares that no Gen AI was used in the creation of this manuscript.

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# Scaling distributed training in rural primary care: a Philippine model for LMIC health systems

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Low- and middle-income countries (LMICs) continue to face persistent shortages of trained primary care providers in rural areas. This challenge is compounded by the lack of locally accessible residency training programs, which limits opportunities for physicians to develop the skills needed to serve these underserved communities. Consequently, physicians working in underserved municipalities leave their posts to pursue specialization, exacerbating the workforce shortage. In Sorsogon, a province in the Philippines, this gap is further compounded by the mismatch between existing training models being offered in urban hospitals with a curative, episodic-care orientation and the province's need for a community-embedded program anchored on health promotion, disease prevention, and continuity of care. This community case study describes the design and implementation of the Sorsogon Province-wide Practice-Based Family and Community Residency Training Program (PBFCMRTP), a distributed, in-situ model co-developed by the Provincial Government of Sorsogon and the Philippine Academy of Family Physicians (PAFP). Grounded in the principles of the Universal Health Care (UHC) Law of the Philippines, the program enables rural physicians to undergo residency training while remaining in their practice sites—provincial and district hospitals, as well as rural health units—ensuring uninterrupted service delivery during training. Using a hybrid, spiral curriculum that combines digital learning classrooms, peer learning, integrated case discussions, periodic practice site visits, and workplace-based assessments, remote supervision with mentoring sessions by accredited family medicine trainers, the program emphasizes health systems integration, primary care leadership, and community-responsive care grounded on the Patient-Centered, Family-Focused, and Community-Oriented (PFC) approach. Over 4 years, the program has matured from a new program granted provisional accreditation status by the PAFP Residency Accreditation Board to full (Level 3) accreditation status. It has successfully prepared its trainees to lead primary care delivery in resource-constrained, community-based settings. This case highlights the feasibility of scaling practice-based residency training models in LMICs through strong local governance, policy support, and community-responsive curriculum design. Key enablers include the strategic use of digital platforms, trainees' commitment, dedicated trainers, and intersectoral collaboration. Lessons from the Sorsogon experience may inform efforts to decentralize medical education and strengthen rural health systems in similar contexts.

## KEYWORDS

family community medicine, distributed training, health systems strengthening, rural health, remote supervision

## Introduction

Health workforce shortages in rural and remote areas persist as a significant barrier to achieving equitable and cost-effective healthcare, particularly in low- and middle-income countries (LMICs). Globally, the mismatch between where physicians are trained and where they are most needed continues to challenge the achievement of Universal Health Care (UHC). The World Health Organization (WHO) projects a shortfall of 18 million health workers by 2030, with rural populations in LMICs most severely affected. Traditional residency training models are typically hospital-based, curative in focus, and located in urban centers. They require physicians to relocate for training, contributing to workforce migration and further weakening of rural health systems. Furthermore, Immersive exposure to specialized, hospital-centric environments also shapes trainees' long-term career preferences, making them more likely to remain in cities after graduation (1). In contrast, distributed training programs have shown promise; evidence from Canada suggests that residents trained in community-based sites are 15 to 36 times more likely to practice in rural areas than their urban-trained counterparts (2, 21).

The Philippines reflects many of these global trends. Despite national reforms under the UHC Law that mandate the assignment of a primary care provider for every Filipino, rural areas continue to face a chronic undersupply of trained and certified primary care physicians (20). Over 60% of Filipinos live in rural areas, yet the majority of physicians remain concentrated in urban centers due to a combination of professional, educational, lifestyle, and systemic factors. In these underserved areas, it is not uncommon for a single physician to be the sole healthcare provider in the community. Feelings of professional isolation, heavier workloads, and limited opportunities for career growth and professional development deter most physicians from pursuing long-term rural practice (19).

Sorsogon, a predominantly rural province in the southernmost part of Luzon, exemplifies this challenge. Despite aggressive local efforts—including active recruitment and expanding benefit packages—many young doctors leave after only 1 or 2 years of service to pursue residency training in urban centers due to the absence of accredited residency programs in the province. Those who remain often feel professionally stagnant, as the local health system cannot afford to release them for full-time training without compromising service delivery.

Compounding the geographic inaccessibility of residency training programs is the pedagogic misalignment of the traditional urban-based, hospital-centric model with the goals of UHC, which emphasize primary care, health promotion, and disease prevention. What Sorsogon needed was a training model that could capacitate rural physicians without requiring them to leave their posts, which was also aligned with the national goals for primary care oriented health systems.

This community case study documents a real-world, practice-driven innovation that emerged in response to the priorities of a local government unit. It examines the design, implementation, and early outcomes of the Sorsogon Province-wide Practice Based Family and Community Medicine Residency Training Program (PBFCMRTP)—a distributed, in-situ training model co-developed by the Provincial Government of Sorsogon and the Philippine Academy of Family Physicians. Anchored in principles of health systems integration and community-responsive care, the program aims to answer this question: *Can a locally designed and led, community-embedded residency program capacitate rural physicians to contribute meaningfully to health system strengthening, during and after training?*

## Context

The Philippine health care system is a decentralized structure composed of both public and private sectors. Public health services are delivered through various levels of government: national (3–5), provincial, city, and municipal units, each managing corresponding hospitals and health offices. While the Department of Health retains oversight of regional hospitals and central services, most frontline services have been devolved to local government units (LGUs), creating a complex network of shared responsibilities across regions, provinces, cities, and municipalities (Figure 1).

Sorsogon is a predominantly rural province located at the southeastern tip of the Luzon island mass in the Philippines. It has a population of approximately 828,000 people distributed across one city and 14 municipalities, including geographically isolated and disadvantaged areas such as islands and coastal barangays. The provincial health system is organized into four inter-local health zones and comprises one provincial hospital, four district hospitals, four infirmaries, 17 municipal health offices or rural health units (RHUs), and over 200 barangay health stations (BHSs). Despite the presence of these facilities, the province continues to face significant challenges in delivering accessible, high-quality healthcare services, particularly in remote and underserved communities.

The shortage of qualified physicians, particularly family and community medicine specialists, has long hindered the province's ability to fulfill its health service mandates and achieve its health objectives. Many rural health facilities operate with only one physician, often untrained or undertrained, who frequently serves as the sole provider for a wide catchment area, exceeding the ideal 1:10,000 doctor-to-population ratio. Turnover is high, with newly recruited doctors often leaving after a short period to pursue residency training in urban centers. Traditional hospital-based residency programs,

Abbreviations: PAFP, Philippine Academy of Family Physicians; WHO, World Health Organization; LMIC, Low Middle Income Country; UHC, Universal Health Care; PBFCMRTP, Practice Based Family Community Medicine Residency Training Program; PBRT, Practice Based Residency Training Program; PFC, Patient centered Family Focused Community Oriented; ICR, Integrated Case Report; CPCFP, Certified Primary Care Family Physician; BHS, Barangay Health Station; RHU, Rural Health Unit; KONSULTA, "Konsultasyon Sulit at Tama"; Philhealth, Philippine Health Insurance Corporation; HCPN, Health Care Provider Network; SDN, Service Delivery Network; LGU, Local Government Unit; MOA, Memorandum of Agreement; CIPP, Context Input Process Product; EBM, Evidence Based Medicine.

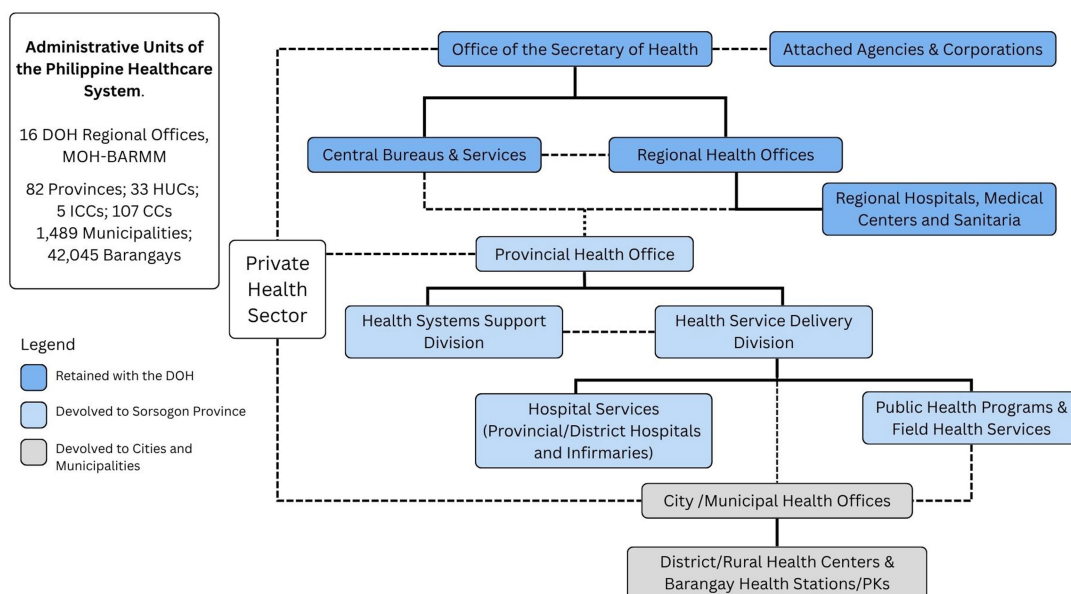


FIGURE 1  
Organizational structure of the Sorsogon Provincial Health care System.



FIGURE 2  
Geographic distribution of trainees throughout the province.

located far from the province and structured around curative, specialist care, are misaligned with Sorsogon's needs and the competencies required for rural primary care delivery (Figure 2).

Recognizing these systemic constraints, the Provincial Government of Sorsogon, in partnership with the Philippine Academy of Family Physicians (PAFP), launched the Province-wide PBFCMRTP in 2021. Practice-Based Family and Community Medicine Residency Training Program is a training program track that occurs while trainees are in their communities/areas of practice. This innovation was first introduced in 2000 by the PAFP

to enable physicians desirous to specialize in family medicine but cannot leave their posts/practice to pursue traditional hospital-based training. It is now being implemented all over the country in various iterations with enrollees coming from different types of medical practice settings.

The PAFP's Practice Based Program was specifically designed to allow the trainees' practice site to be their learning site as well. It was anchored in Kolb's Experiential Learning Theory, which postulates that knowledge is created through the processing and transformation of learners' actual experiences (6). The PAFP ensures that programs

are evaluated for quality improvement hence the CIPP model is used as the basis of evaluation for accreditation. The CIPP model takes into account context and process and is not only focused on outcomes like the traditional Kirkpatrick model (7).

For Sorsogon province, the initiative will provide a venue for rural physicians employed in their health facilities to enhance their competencies through processing of their experiences and anchoring their actual practice in theoretical frameworks supplanted by the latest clinical evidence from research, resulting in a more nuanced and contextualized patient care delivery. The training curriculum is grounded in the Patient-Centered, Family-Focused, and Community-Oriented (PFC) service delivery framework (8) and is delivered through a combination of blended learning strategies, remote supervision, and mentorship. The training is contextualized within the provincial health system but compliant with national specialty residency training program accreditation standards.

Sorsogon’s designation as a Universal Health Care Advanced Implementation Site, along with its high number of primary care facilities accredited by Philippine Health Insurance Corporation (PhilHealth) under the KONSULTA (*Konsultasyong Sulit at Tama*) program, made it an ideal setting for piloting a distributed training model. The program aims to address the dual challenge of rural health workforce shortages and misaligned training models, by offering a sustainable and scalable approach to capacitating primary care providers within their communities. It also aims to demonstrate how primary care strengthening through training and capacity building of frontline primary care physicians can improve gatekeeping within the provincial Health Care Provider Network (HCPN) and subsequently improve health outcomes and reduce the cost of healthcare services.

Key programmatic elements

The Sorsogon PBFCMRTP is a province-wide distributed training model designed to strengthen the rural primary care workforce and

improve service delivery. Its core objectives were to: (1) upskill rural physicians without disrupting service delivery, (2) align training with local health system needs, and (3) comply with national accreditation standards. The program followed the logic model shown in Figure 3 which illustrates how structured inputs and targeted activities in a distributed residency training program can generate educational outputs that will lead to system-wide outcomes and long-term health impacts. The approach aligns medical education with local service needs and national health reforms.

This design minimized service disruption and improved continuity of care, addressing both health workforce gaps and quality of care in underserved areas. These features align with global evidence on distributed medical education (9–11) which underscores the importance of training in the context of service.

Fit-for-purpose curriculum design

The program employs a context-specific, ladderized curriculum aligned with the health needs of Sorsogon’s population and the service delivery goals of the provincial health system. It integrates national standards set by the PAFP, ensuring that trainees are eligible for specialty certification upon program completion. The curriculum is structured around the six core physician roles—clinician, educator, leader, researcher, navigator, and coordinator—applied progressively across four training levels. Table 1 below summarizes the expected competencies at each training level reflecting the program’s spiral, competency based curriculum.

Patient-centered, family-focused, community-oriented (PFC) framework

All learning and service delivery activities are anchored in the PAFP’s PFC service delivery framework. This model emphasizes

Logic Model of the Sorsogon PBFCMRTP

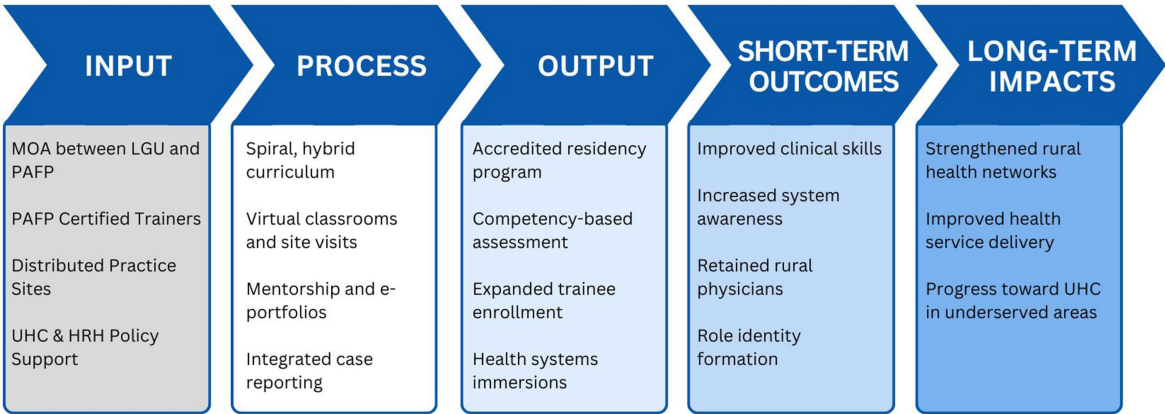


FIGURE 3  
Theory of change for the Sorsogon Province-wide PBFCMRTP.

TABLE 1 Competency progression across the training levels of the Sorsogon Province-wide PBFCMRTP as adapted from the PAFP toolkit for trainers (18).

| Roles/Levels        | Level 1                                                                                      | Level 2                                                                                                                                                                                             | Level 3                                                                                                                                                                                                 | Level 4                                                                                                                                                          |
|---------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Healthcare provider | Manage patients in ambulatory and urgent care settings independently                         | Discuss comprehensive health plans, recognize needs of special populations, refer patients appropriately, utilize clinical pathways, perform lifesaving procedures and manage patient documentation | Manage health concerns of special populations, perform limited advanced surgical skills, deliver population-based services, implement and monitor community-oriented care, and analyze disease patterns | Serve as a generalist and family medicine expert, uphold ethical standards, and engage in research (clinical and public health) and quality assurance activities |
| Researcher          | Integrate case reports with evidence-based medicine appraisals                               | Apply evidence for clinical decision-making in acute, out and in-patient settings                                                                                                                   | Develop research protocols on health needs                                                                                                                                                              | Generate research to support quality care and inform policy                                                                                                      |
| Educator/Counselor  | Develop instructional designs for learning activities                                        | Apply principles of team approach and demonstrate interpersonal skills                                                                                                                              | Create instructional designs for capacity building, use technology in education and train other members of the healthcare team                                                                          | Contribute to shared knowledge and practice improving health outcomes                                                                                            |
| Care Coordinator    | Conduct multidisciplinary meetingsfor shared decision making                                 | Communicate effectively with families and health care teams and formulate proactive care plans                                                                                                      | Efficiently utilize service delivery networks                                                                                                                                                           | Ensure continuity and safety of care across levels and networks                                                                                                  |
| Patient Navigator   | Facilitate referral of cases to relevant health and social programs                          | Manage patient transitions and identify health system partners for resource access                                                                                                                  | Strategize navigation processes and engage in shared decision making with other stakeholders                                                                                                            | Facilitate access to health-related programs and resources using a whole of society approach                                                                     |
| Leader/Manager      | Participate in quality assurance activities and community-oriented primary care initiatives. | Design and implement communityoriented primary care action plans and activities                                                                                                                     | Evaluate and recommend improvement of community interventions                                                                                                                                           | Demonstrate leadership and engage with community and healthcare networks                                                                                         |

holistic care that considers not only individual biomedical conditions but also family dynamics and community health determinants. The framework equips residents to deliver integrated care that is culturally responsive and aligned with public health goals.

### Distributed training sites

Training takes place across a network of district hospitals, rural health units, and barangay health stations throughout the province (Figure 2). This decentralized approach allows residents to remain embedded in their communities while developing competencies in real-world, resource-constrained settings. The distribution of training sites also facilitates integration into the province’s HCPN and service delivery network SDN.

### Blended learning and mentorship

The program uses hybrid instructional methods, combining face-to-face learning, virtual lectures, and self-directed modules delivered through digital platforms. Remote supervision and regular mentoring sessions by PAFP-accredited trainers support each trainee’s progression. The Integrated Case Management (ICR) method (12) is employed to develop competencies through real patient encounters, using the PFC framework, the six roles of Family Physicians and the use of evidence-based medicine.

### Health system integration

The Sorsogon Province-wide PBFCMRTP is intentionally designed to align with the goals of the UHC Law and the province’s designation as a UHC Advanced Implementation Site. It builds the capacity of primary care providers to function effectively within integrated health systems, improving gatekeeping, care coordination, and referral efficiency across levels of care.

The short term outcomes of the Sorsogon province wide PBFCMRTP demonstrated that high-quality postgraduate medical education can be delivered effectively through a distributed, practice-based model embedded within rural health systems. The program allowed rural physicians to continue serving in their localities while undergoing training contributing to health systems strengthening during training.

### Discussion

Community-embedded training initiatives, such as Australia’s Remote Vocational Training Scheme (RVTS) and the Targeted Medical Education Program (TMEP) in rural China, demonstrate the effectiveness of localized medical education in addressing health challenges in underserved regions. These programs emphasize practice-based training, remote supervision, and flexible learning tailored to the specific needs of the community. By fostering a connection to local health systems, these training models not only

enhance the clinical competencies of healthcare providers but also contribute to the retention of physicians in rural areas, ultimately strengthening the overall health infrastructure (13–15).

The parallels between international models highlight the necessity for medical education that aligns with the realities of rural practice. Both the RVTS and the Sorsogon PBFCMRTP in the Philippines advocate for a curriculum that is responsive to local health needs, emphasizing continuity of care and public health challenges. A recent study in China underscores the gap between urban training and rural practice, reinforcing the demand for community-embedded, flexible education. These findings suggest that globally relevant residency programs, which integrate local health systems into their training frameworks, are essential for improving healthcare delivery in rural settings. The Sorsogon PBFCMRTP directly responds to these needs through a distributed, blended learning model with hybrid mentorship and a fit-for-purpose curriculum anchored in the PFC framework. These parallels affirm the global relevance and applicability of in-place rural residency programs tailored to local health systems.

The Sorsogon Province-wide PBFCMRTP has undergone a structured and progressive development since its inception. The journey began in March 2020 with the signing of a Memorandum of Agreement (MOA) between the PAFP and the Sorsogon Provincial Local Government Unit (PLGU), formalizing their partnership to co-develop a distributed residency training model anchored in primary care.

Following a year of preparatory work in the midst of the COVID-19 pandemic, the program officially launched in July 2021 with the enrollment of its first cohort of trainees. This marked the operationalization of the program's innovative, in-situ training model, which utilized existing local government health facilities as the primary learning sites and available educational resources in the local community.

In March 2022, the program gained formal recognition from the PAFP as a new residency training program. A year later, in March 2023, it achieved Level 2 Program Accreditation, a milestone that

affirmed the program's adherence to core training standards and quality assurance mechanisms.

By March 2024, the program celebrated the certification of 14 trainees as Certified Primary Care Family Physicians (CPCFP), reflecting the effectiveness of its training approach and the competency of its product. This is the Academic Rank awarded to PAFP Members after successfully complying with the Certification Process (Figure 4) set by PAFP Primary Care Certification Board. Applicants were evaluated based on the Common Standards, Criteria, Indicators, and Evidence of Compliance on the different domains including Healthcare Provider (Individual-based and Population-based Services), Educator, Coordinator, Research, Navigator, and Leader/Manager (16).

The program's commitment to continuous improvement culminated in March 2025, when it was awarded Level 3 (Full) Program Accreditation by the PAFP, signifying its full compliance with national standards and its readiness to sustain high-quality training in the years ahead.

A thematic analysis (Table 2) of the three accreditation reports from 2021 to 2024 provided a comprehensive view of the program's evolution from its inception to its current status. The program evaluation reports which utilized the CIPP (Context, Input, Process, Product) Model (17) documented how the program yielded substantial outputs and outcomes in all domains.

During this short period of implementation, the program contributed to improvements in service delivery through gatekeeping efficiency and care continuity. Residents developed competencies in system navigation, quality improvement, and interdisciplinary collaboration—skills that are critical to achieving Universal Health Coverage.

From the perspective of resident trainees, the program delivered more than technical skills—it fostered a deep transformation in clinical identity, systems engagement, and professional values. Residents reported that the curriculum's alignment with the PFC model enabled a shift from symptom-based treatment to holistic, systems-informed care. They developed greater confidence in

**Application Eligibility Criteria:** Applicants must be an active PAFP Associate member in good standing for at least 6 months, who does not hold an Academic Rank or Title in PAFP (e.g. CFP, Diplomate, Fellow). Specifically,

- Current FCM Residency Program Trainees who have completed Level 1 of their training
- DTTBs who have completed the one-year PAFP National Program
- Those in general practice for 5 years

**Steps in Certification process:**

**STEP 1:**  
Create Gmail account.  
Use <https://tinyurl.com/CP-C-FP2025> to access the forms and instructions

**STEP 2:**  
Accomplish the Self-Assessment Tool, create application e-portfolio and upload the prescribed evidence documents

**STEP 3:**  
Payment of processing fee. Submission of attestation and consent form.

**STEP 4:**  
Members of the Certification Board will review the submitted documents. Successful applicants will be presented to the PAFP Board, notified via email, formal awarding of the title will be done during the PAFP Annual Convention.

FIGURE 4  
Certification process for the certified primary care family physician academic rank.

**TABLE 2** Thematic analysis summary of the program evaluation reports of the PAFP residency accreditation board on the Sorsogon Province-wide PBFCMRTP.

| C-I-P-P Dimensions | Strengths                                                                                                                                                                                                                                                                                                            | Areas for Improvement                                                                                                                                                                                                                   |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Context            | <ul style="list-style-type: none"> <li>• Strategic alignment with UHC Law provisions</li> <li>• Integration with the Province HCPN and SDN</li> <li>• Strong LGU support and stakeholder partnership</li> <li>• Flexibility in training design to accommodate learners' needs and training locale context</li> </ul> | <ul style="list-style-type: none"> <li>• Need to develop more structured tools to evaluate trainees' activities in practice sites</li> <li>• Further define promotion criteria and process of assessment</li> </ul>                     |
| Input              | <ul style="list-style-type: none"> <li>• Contextualized curriculum</li> <li>• Distributed learning sites</li> <li>• Use of ICT (digital platforms)</li> <li>• Committee faculty</li> <li>• Use of mentoring</li> </ul>                                                                                               | <ul style="list-style-type: none"> <li>• Need to develop a recruitment and capacity building plan for local faculty to supplant the inadequate number of trainers</li> </ul>                                                            |
| Process            | <ul style="list-style-type: none"> <li>• Blended learning strategies</li> <li>• Structured mentoring sessions</li> <li>• Modular approach</li> <li>• Integrated case discussions</li> </ul>                                                                                                                          | <ul style="list-style-type: none"> <li>• Need to improve family focused care</li> <li>• Need to augment procedural skills training</li> <li>• Need to improve evaluation of learning outcomes vis health system improvements</li> </ul> |
| Product            | <ul style="list-style-type: none"> <li>• Increased clinical competence of trainees</li> <li>• Professional identity formation</li> <li>• PHC approach and systems thinking application</li> </ul>                                                                                                                    | <ul style="list-style-type: none"> <li>• Need to manage trainee attrition due to competing workload and responsibilities</li> </ul>                                                                                                     |

managing chronic conditions, applying clinical guidelines, and coordinating across service levels—core competencies aligned with UHC goals.

Trainees credited the hybrid, flexible learning format and mentorship culture as key growth enablers. The program's hybrid learning approach proved essential in bridging geographic barriers while promoting reflective practice. Mentorship emerged as a central enabler, offering both professional guidance and psychosocial support. Mentoring sessions not only guided clinical practice but also supported personal development and career resilience.

Notably, structured assessments such as integrated case discussions, census audits, and Evidence Based Medicine (EBM) appraisals reinforced reflective practice and quality improvement. These tools helped residents understand the interplay between evidence-based care and real-world challenges, particularly in resource-constrained rural settings. These findings are consistent with global evidence highlighting the value of distributed training in building socially accountable, community-responsive health professionals (10).

A particularly striking outcome was the transformation in professional mindset and identity. Trainees began to view themselves not only as care providers but also as educators, leaders, researchers,

and system navigators. The six roles of the Filipino family physician were internalized through practice, mentorship, and guided reflection. Longitudinal narrative accounts revealed how trainees evolved into confident, community-rooted physicians capable of advocacy, leadership, and systems-level change.

The program also promoted systems thinking and proactivity. Residents began initiating care coordination across service levels, identifying gaps, and proposing solutions. For example, trainees described how they improved hospital discharge protocols and strengthened referral loops—actions critical to the functioning of an integrated health provider network.

These outcomes affirm the strength of the distributed training model in cultivating not only technical competence but also values-driven leadership. The Sorsogon experience suggests that training in place, when structured through mentorship and aligned with health system goals, can produce a rural health workforce that is both clinically skilled and socially responsive. The program has also contributed to recruitment and rural physician retention in Sorsogon.

## Lessons learned

The implementation of the Sorsogon Province-wide PBFCMRTP offers valuable insights for enhancing distributed training in rural health systems, particularly in LMICs. The lessons learned can be categorized into facilitative strategies, challenges, and opportunities for growth, based on 4 years of program experience and qualitative feedback from stakeholders.

## Facilitative strategies and enabling factors

### Local ownership and good governance drive sustainability

One of the most critical enablers of success was the strong ownership of the program by the Provincial Government of Sorsogon. By embedding the training model within the province's service delivery and health workforce development strategies, the program gained political support, financial commitment, and integration with local health system priorities. This decentralized governance structure allowed for greater responsiveness to contextual realities, such as staffing shortages and local health needs.

*"The presence of training residents in rural health units brought renewed energy to service delivery,"* noted the Provincial Health Officer, reinforcing the value of embedding training in service.

### Mentorship is foundational for trainee retention and competency development

Structured, longitudinal mentorship emerged as a cornerstone of the program's success. Each trainee was paired with an accredited family medicine mentor who provided clinical guidance, psychosocial support, and reflective learning opportunities. This mentoring relationship proved particularly important in building confidence, sustaining motivation, and preventing professional isolation—common barriers in rural postings.

As one resident reflected, *"Mentorship helped me reflect, reset, and grow into the doctor I wanted to be."*

The program's mentorship model compensated for limited faculty availability by leveraging remote supervision and group mentoring, which were highly valued by trainees.

### Fit-for-purpose curriculum reflected local needs and system realities

A major strength of the PBFCMRTP was its curriculum design, which was context-specific, resource-sensitive, and aligned with both national accreditation standards and the provincial service delivery network. Trainees reported that the curriculum's emphasis on the PFC model improved their ability to manage real-world cases, navigate referral systems, and deliver holistic care.

The use of the ICR method helped assess not only clinical competence but also the application of systems thinking and health promotion in routine practice.

### Blended learning and digital tools can overcome geographic and lack of faculty

The hybrid learning approach—including virtual classrooms, asynchronous modules, and on-site mentoring—was instrumental in maintaining training continuity without pulling physicians away from their service sites. This flexibility enabled learners to manage real patient loads while progressing through structured competency development.

*"I could learn while staying in my municipality—this kept services going,"* shared one trainee.

The strategic use of digital platforms allowed limited faculty to support multiple learners across remote locations, improving training efficiency.

### Accreditation can be used as a tool for program strengthening

Rather than treating accreditation as a bureaucratic hurdle, the program used it as a developmental benchmark. Over 4 years, the program progressed from "New Program" to Level 3 full accreditation by the PAFP, with iterative revisions made in response to formal feedback.

This outcome affirms that distributed training models can meet national standards for residency education when supported by structured evaluation and ongoing quality improvement.

### Challenges encountered

Despite these successes, the province-wide residency training program faces significant implementation challenges. Foremost among them are the critical shortage of PAFP-certified faculty, inadequate diagnostic and training infrastructure in certain rural locations, and the lack of sustainable financing mechanisms for program expansion and faculty development. These constraints highlight the urgent need for sustained investment in rural teaching capacity and a more robust integration with national health workforce development strategies to ensure the program's effectiveness and sustainability.

### Opportunities for growth and innovation

The province-wide practice-based family and community residency training program presents several promising opportunities for growth, particularly through its ongoing curriculum revisions—four in total since its inception. These revisions have been instrumental in enhancing the training experience for resident trainees, allowing for a more comprehensive and relevant training framework. One notable opportunity is the incorporation of a rural surgery program, which

offers residents the chance to gain practical skills within a limited scope of surgical practice tailored to the unique needs of the province. This initiative not only equips trainees with essential surgical competencies but also addresses the healthcare gaps in underserved areas, thereby fostering a more robust healthcare workforce. By continuing to adapt and respond to the evolving healthcare in the province, the program can further strengthen its impact and better prepare residents for their roles in family and community health.

The Sorsogon Province-wide PBFCMRTP provides a compelling model for addressing health workforce inequities in LMICs through distributed, community-embedded training. By leveraging local ownership, structured mentorship, and a context-specific curriculum, the program successfully aligns training goals with service delivery needs, enhancing both trainee competency and rural health system foundations. Despite challenges such as faculty shortages and infrastructure limitations, the program's adaptive strategies and continuous improvements present significant opportunities for growth, particularly through curriculum enhancements and rural surgery initiatives. Overall, the program demonstrates that with strategic alignment and sustained investment, scalable solutions for rural health workforce development are achievable.

## Conclusion

The Sorsogon Province-wide PBFCMRTP demonstrates that distributed, community-embedded training models can effectively strengthen the rural primary care workforce in LMICs. By aligning medical education with local health system needs, the program addresses persistent gaps in access, equity, and workforce retention without compromising service delivery.

The program's fit-for-purpose curriculum, anchored in the PFC model, produced physicians capable of navigating complex care environments, coordinating across service levels, and leading health systems improvement initiatives in their communities. Through strategic use of mentorship, hybrid learning platforms, and provincial government ownership, the program successfully integrated residency training into the local healthcare ecosystem—resulting in improved clinical competencies, increased retention, and strengthened health systems performance.

The Sorsogon Province-wide PBFCMRTP confirms that residency training does not need to be centralized or hospital-bound to be rigorous and impactful. When designed for context, grounded in community realities, and supported by enabling policies and partnerships, distributed training models can serve as powerful instruments for rural health systems transformation. The lessons from Sorsogon provide a compelling case for replication in other provinces in the Philippines and similarly situated LMICs working toward UHC Coverage.

### Acknowledgement of any conceptual or methodological constraints or limitations

This community case study reflects the unique context of a provincial health system in the Philippines and is not intended to be generalized across all rural training environments. The findings

and lessons are drawn from a single implementation site at Sorsogon province, where enabling conditions such as strong local government support, a motivated pool of trainees, and an existing partnership with the PAFP contributed to the program's early success. As such, replication in other settings may require adaptation to differing governance capacities, workforce compositions, and infrastructure readiness.

Methodologically, the study relied on qualitative evaluation through document analysis, accreditation reports, and narrative reflections by trainees and mentors. While this approach allows for rich, context-sensitive insights, it may be limited by subjectivity and potential reporting bias. Quantitative measures such as patient outcomes, service utilization patterns, or long-term workforce retention were not systematically collected at this stage and will be important to include in future studies to strengthen impact attribution.

Additionally, the study only captures outcomes from the first 4 years of implementation. Longitudinal evaluation will be needed to assess sustained effects on health system performance, trainee career trajectories, and population health outcomes. Despite these limitations, the Sorsogon Province-wide PBFCMRTP offers a grounded example of how distributed training can be implemented effectively in resource-constrained settings, with meaningful implications for policy and practice.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

AR-E: Conceptualization, Writing – original draft, Writing – review & editing. AL: Conceptualization, Data curation, Methodology, Visualization, Writing – original draft, Writing – review & editing. RL: Conceptualization, Data curation, Methodology, Visualization, Writing – original draft, Writing – review & editing. RB: Writing – original draft, Writing – review & editing. DL: Funding acquisition, Writing – review & editing.

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