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Dengue management using an Ecohealth approach: implementation analysis in Cali, Colombia (2020–2023)

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Dengue is a public health event that impacts communities and can result in death. Countries have joined forces to address this public health issue using various approaches, strategies, and methodologies to mitigate its socioeconomic and health impacts. In the city of Cali, Colombia, the Health Secretariat of the Special District of Santiago de Cali has implemented, for several years, a community intervention strategy with an Ecohealth approach to prevent vector-borne diseases. The objective of this study is to analyze the implementation of this strategy between 2020 and 2023 through a community case study. Primary sources, including focus groups with community and institutional stakeholders, and secondary sources, such as annual implementation reports, were utilized. The findings indicated that implementing the strategy has empowered communities in their territories to prevent the disease. Similarly, the results highlight the importance of interdisciplinary work in designing and implementing the strategy's activities, the feasibility of adopting a comprehensive approach to address public health problems, and the need to collaborate in intersectoral research and interventions, where academia plays a leading technical and analytical role. In conclusion, collaboration among the community, institutions, and academia is a crucial pillar for the sustainability of interventions and for progress toward integrated territorial management of vector-borne disease risk.

KEYWORDS

community participation, dengue, disease prevention, public health, public health surveillance

1 Introduction

Vector-borne diseases (VBDs) are recognized worldwide as major public health issues (1). Dengue, a VBD, is a zoonotic viral infection transmitted to humans by an infected mosquito (*Aedes aegypti*) and is common in tropical and subtropical regions (2). Its clinical signs range from asymptomatic to severe cases that can be fatal (3, 4).

In 2024, according to the World Health Organization (WHO), between 100 and 400 million cases of Dengue were recorded annually (3). That year, nearly half of the world's population was at risk of contracting the disease, with a record high of 14.6 million cases and more than 12,000 deaths. In the Americas, over 13 million cases were reported, compared to 4.1 million new cases and 7,700 deaths in 2023 (5). Dengue has been re-emerging in Colombia since the 1970s and persists due to its wide geographic distribution (6). In 2020, there were 77,281 cases (7), and in 2024, it was present in 73.3% of the national territory with 320,982 cases. By 2025, in epidemiological week 38, 104,188 cases were reported (8). Meanwhile, in Cali during 2023, the dengue incidence rate was 557.9 per 100,000 inhabitants (9). By epidemiological week 32 of 2025, an estimated incidence of 117.4 per 100,000 inhabitants had been reported, corresponding to 2,620 cumulative cases (10).

The presence and distribution of the vector, as well as the increase in dengue cases, are linked to climate change, endemicity, socioeconomic factors, demographic distribution (such as population density, migration, and overcrowding) (3), environmental factors (including water management and housing conditions), and human behavior related to the population's knowledge, attitudes, and practices regarding the disease (11–13). These factors are crucial for tackling VBDs, which is why the Pan American Health Organization (PAHO) (14, 15) advocates for their prevention, participation, and control through an intersectoral approach involving families and communities.

To control Dengue, strategies have been developed based on traditional approaches, such as implementing physical and chemical barriers, eliminating mosquito breeding sites and larvae (16), and community empowerment through interventions at personal, household, and community levels (17). Other comprehensive approaches, such as the Eco-Bio-Social (EBS) strategy, enable more effective disease control. This holistic, community-centered framework integrates ecological, biological, and social determinants to develop sustainable, multisectoral interventions for dengue prevention, which mobilize government, professional, societal, and academic actors to promote healthy environments (18).

Colombia implemented multiple strategies to control Dengue (19, 20). In Cali, the health authorities, in collaboration with Universidad del Valle, developed the guide “Module for Recognition, Participation, and Community Organization around the Prevention of VBDs (RPOC-ECOHEALTH)” (21) between 2007 and 2009. This guide was subsequently a public health strategy with an Ecosystem Approach to Human Health (Ecohealth). Ecohealth addresses issues holistically, recognizing the interrelationships among human, animal, and ecosystem health (22). It also aims to empower the community to take a

leading role in disease prevention in priority areas. This Community Case Study examines how the community-based dengue management strategy was implemented in Cali between 2020 and 2023, aiming to analyze the processes and outcomes of its implementation.

2 Context, environment, and population

Cali, located 1,070 meters above sea level has an average temperature of 24.7 °C, has 2,283,846 residents distributed across 560.3 km², of which 120.9 km² corresponds to the urban area, geographically divided into 22 communes (In Colombia, a commune is an official sub-municipal administrative unit defined by socioeconomic, demographic, infrastructural, and functional criteria) (23). Socioeconomic inequalities exist, with 4.11% of the population experiencing unmet basic needs and multidimensional poverty, mainly in communes 13, 14, 15, and 21. These communes have also been identified as persistent dengue hotspots in previous spatial analyses using Kernel density estimation in Cali, reinforcing the overlap between socioeconomic vulnerability and vector-borne disease risk driven by physical, environmental, and socioeconomic conditions (16, 24, 25). The strategy focused on neighborhoods with the highest dengue incidence, particularly in the east, northeast, center, and hillside areas of the city (9, 26).

3 Details to understand the key programmatic elements

The background and methodology are presented within the framework of implementing the Ecohealth-RPOC-ECOHEALTH approach strategy in Cali.

3.1 Background

Between 2007 and 2009, a project was developed in Cali, Colombia, involving academia -represented by Universidad del Valle- and the health authority, titled “A Dengue Intervention Strategy with an Ecohealth Approach,” using the Mobilizing for Action through Planning and Partnerships model. In that project and in this community case study, academia played a technical role, providing conceptual, methodological, and analytical support for the design and follow-up of the strategy. To establish effective dengue control actions, community work was essential, focusing on individual, collective, and inter-institutional perceptions, knowledge, and practices related to dengue transmission. It also identified environmental and urban growth factors that could influence transmission. One of the project's main achievements was the development of the Ecohealth-focused strategy—the RPOC-ECOHEALTH Module.

The Ecohealth approach positions human beings and their health as the result of multiple connections between health status and the

social, cultural, and economic conditions where individuals develop (27), an aspect previously recognized and closely related to the conceptual framework of social determinants (28). Understanding how changes in ecosystems affect health is essential because they influence a socio-ecosystem through exchanges of matter, energy, and information across social, environmental, economic, political, cultural, and historical dimensions (29).

Intervention experiences under this approach are based on the principles of transdisciplinarity, the participation of multiple stakeholders, including social participation, gender, and social equity, as well as systemic thinking, sustainability, and knowledge-to-action (25).

In 2010, the Health Secretariat of the Special District of Santiago de Cali (SSDESC), through its Environment and Health Team (EHT), began implementing the guide, which is understood as an RPOC-Ecohealth intervention strategy. The methodological challenge was to formalize and consolidate the actions developed year after year in the city. Therefore, in 2019, a logbook was established as a tool to systematize the management of the

strategy’s development, and the need arose for a city-wide vision for its implementation during 2020-2023.

The implementation of the strategy involves five phases, each consisting of specific activities. These phases are sequential, starting with the recognition and appropriation of the territory and concluding with the deepening and strengthening of the multipliers, as illustrated in Table 1.

During the analyzed period (2020–2023), the Health Secretariat prioritized, based on epidemiological criteria related to high dengue incidence, 11 neighborhoods in 2020, 15 in 2021, 16 in 2022, and 17 in 2023, distributed across 18 communes. Communes 6 and 13 received interventions every year; the remaining communes and neighborhoods were incorporated variably based on annual epidemiological risk, without uniform coverage.

3.2 Methodology

This qualitative study employed a case study design (30), specifically a community case study, to examine the

TABLE 1 Intervention strategy for the control of dengue RPOC-ECOHEALTH.

Phase	Activities and practices	Objective
1. Recognition and appropriation	Activity 1. Familiarization Tours	Approach the different resident communities in the neighborhoods.
	Activity 2. Previous Experiences	Identify health intervention experiences implemented by various institutions.
	Activity 3. Overview of Vector-Borne Diseases (VBDs)	Develop training on VBDs prevention, including general prevention aspects, signs and symptoms of the disease, and breeding site control.
	Activity 4. Neighborhood Survey	Collaboratively develop, with the communities, a map or summary chart that represents and identifies the social practices related to the problem and the possible causes of VBDs in their environment.
	Activity 5. Spaces, Resources, and Mediators	Collaboratively identify with the community potential non-mediated resources (such as community public address systems and neighborhood bulletin boards), mediators (leaders and promoters), and alternative communication spaces (parks and community centers) that exist in the area.
2. Collective construction and empowerment	Brainstorming, messages, and materials on the prevention of VBDs.	Collaborate with the community to develop a table of ideas for creating educational materials to prevent VBDs and conduct a community exercise to analyze existing informational resources.
3. Field practices	Multiplication of knowledge and socialization of the Module’s experience, at meeting points by community leaders.	Create practical exercises to prevent VBDs, including sharing knowledge and developing support materials in collaboration with SSDESC officials and the community, to manage spaces for promoting and spreading environmental health in the intervened territories.
	Participation of multiplier leaders in comprehensive public health days focused on preventing and controlling VBDs in housing and the environment.	Develop practical exercises to prevent VBDs by sharing knowledge and creating support materials in collaboration with SSDESC officials and the community, as part of comprehensive public health days.
4. Institutional and community evaluation of the experience	Evaluation, recognition awards, and directory distribution. Commitment to follow-up.	Evaluate the scaling-up exercise with the various actors involved in the process to comprehensively strengthen the strategy.
5. Deepening and consolidation of multipliers	Follow-up practices: Conduct practices with the module group in meeting spaces and with organized groups recommended by the same community.	Sharing knowledge and experiences, reinforcing the themes of environmental health and socializing the community dynamics of leaders, from institutional and community knowledge, in the meeting places.

implementation of the RPOC-Ecohealth intervention strategy for dengue control in Santiago de Cali, Colombia.

The study adopted an interdisciplinary approach, with researchers actively participating in the design, data collection, and analysis phases. Primary and secondary sources were integrated to understand, from a participatory perspective, the achievements, challenges, and lessons learned from the strategy's implementation between 2020 and 2023.

The primary sources were obtained from three focus groups conducted between December 2024 and January 2025 at the University of Valle. Each participant signed an informed consent form prior to their participation, following intentional sampling (31).

- The first group consisted of 12 institutional stakeholders responsible for operationalizing the RPOC–Ecohealth strategy in the communes and preparing the annual implementation reports. None of them participated in the design of the strategy or in this research. The leader of the Environment and Health Team (EHT) did not participate as an informant in the focus group, ensuring independence between the research team and the participant group.
- The other two groups, one 9 and the other 11, consisted of community leaders from the prioritized territories, selected based on the following criteria: active participation in the strategy's implementation, time availability, and ease of travel to the meeting location.

Each focus group consisted of 9 to 12 participants, all of whom signed informed consent forms before their participation.

The researchers designed a semi-structured inquiry guide, addressing four preliminary categories:

1. Territorial context,
2. Intervention experience,
3. Lessons learned, and
4. Challenges.

The research team reviewed and adjusted the instrument to ensure its consistency with the study objectives.

The researchers recorded and transcribed the sessions verbatim with the participants' permission. The information was systematized in analysis matrices in Microsoft Excel[®] and subsequently subjected to thematic content analysis (32). The analysis employed a deductive and iterative process, involving open coding, categorization, and triangulation of sources and perspectives. The final emerging categories corresponded to *achievements, challenges, and opportunities for improving the strategy*.

Secondary sources consisted of four annual implementation reports (2020–2023), referred to as logbooks, provided by the SSDESC. Prepared by the EHT, these documents describe activities of the RPOC–Ecohealth strategy, organized by implementation phase, and summarize annual citywide

implementation aggregated and spatially referenced at the commune and neighborhood levels. These logbooks were analyzed through a structured document review, using the operational phases of the strategy and analytical categories of community management, surveillance, and vector control.

Finally, the criteria of credibility, confirmability, and transferability proposed by Guba and Lincoln (33, 34) were applied. Credibility was strengthened through the triangulation of actors, documents, and community records. Confirmability was ensured by the traceability of the analysis, supported by logbooks, coding matrices, and textual quotations; and transferability was achieved through the description of the territory, its dynamics, and implementation conditions, allowing for the assessment of the applicability of the results in similar contexts.

4 Results

Two sections presented the results. The first analysis examines the 2020–2023 logbooks in accordance with the five sequential phases of the RPOC-ECOHEALTH strategy, assessing activities and practices and consolidating findings at the city level. The second section analyzes focus group interviews, describing the achievements, challenges, and opportunities for improvement perceived by SSDESC staff and community leaders.

4.1 Logbook analysis

4.1.1 Phase 1. Recognition and appropriation

4.1.1.1 Activity 1. Tour and recognition

The community comprises organized community groups (senior citizen groups, community leaders, community mothers' associations, members of Community Action Boards, youth police, among others). The research team reached agreements on the availability of spaces, schedules, and support from leaders in areas with increased security risk. It was the strategy used to build neighborhood databases and foster collaborative community engagement.

4.1.1.2 Activity 2. Previous experiences

The researchers identified 207 prior experiences relevant to the community, including (1) *Control and prevention of VBDs*: fumigation (vehicle/perimeter; variable schedules/routes), cleaning, elimination of breeding sites, larvicide in drains, talks on Wolbachia, and preventive maintenance (2); *Environmental/waste management*: planting in abandoned tires and collection in parks and neighborhoods (3); *Community education*: prevention of dengue and Zika; and (4) *Institutional participation*: coordination with the Health Department and inspection/surveillance/control of public spaces. They also recognized experiences promoting physical activity and recreation, providing basic health services, including

actions for domestic animals, and offering psychosocial and community support.

4.1.1.3 Activity 3. General information about VBDs

Between 2020 and 2023, 87 workshops were conducted, involving a total of 1,593 participants. In 2020, 7 communes and 33 workshops, attracting 581 participants. In 2021, 8 communes and 20 workshops drew a total of 234 people. In 2022, 7 communes and 17 workshops, with 361 attendees. In 2023, 14 communes and 17 workshops, with 417 participants. Overall, the period demonstrates territorial expansion, doubling the initial coverage from 7 to 14 communes, and shows stabilization in the number of workshops over the last two years, with a slight increase in participation in 2023 compared to 2022.

4.1.1.4 Activities 4 and 5. Neighborhood recognition and spaces, media, and mediators

In the logbooks, the researchers found that these two activities help the SSDESC understand community dynamics and build trust relationships for deploying the strategy. The workshops were held in various locations, including community dining halls, sports centers, courts, parks, community centers, and the homes of community leaders.

4.1.2 Phase 2. Collective construction and empowerment

The researchers disseminated the messages by combining educational content with creative activities, such as posters, songs, plays, poems, stories, and other methods, facilitating learning and knowledge acquisition. To comprehend the process of collective construction and empowerment, an analysis was conducted on the distribution of messages developed by the community. From the examination of 151 messages, four main categories were derived:

4.1.2.1 Prevention

The messages reflected a collaborative approach and concrete actions, with phrases such as “prevention depends on everyone” and “clean your yard, cover your cisterns”. This category forms a fundamental basis in community strategies to mitigate the spread of disease vectors.

4.1.2.2 Vector recognition

The focus was on information about *Aedes aegypti*, including its physical characteristics and life cycle, with the goal of “learn about the white-legged mosquito and eliminating its breeding grounds”. This emphasis on the vector suggests a community that has made progress in understanding the mosquito’s life cycle and its direct relationship to eliminating breeding sites.

4.1.2.3 Recognition of institutions and their strategies

The messages highlight the role of public institutions in implementing innovative methods, such as the use of guppy fish for biological vector control, stating, “With guppy fish, we can control breeding grounds”. The messages also emphasized the importance of institutional campaigns and health fairs as an integral part of the fight against dengue, promoting trust in institutions and their initiatives.

4.1.2.4 Identifying disease symptoms

The importance of educating people about the early signs of dengue fever, such as fever, muscle aches, eye pain, and skin rashes, was emphasized. Messages in this section emphasize the importance of seeking medical care early when symptoms appear: “We recognize the symptoms and must see a doctor”. This information is essential for raising community awareness and encouraging quick action to prevent serious complications.

Analysis of community messages on dengue prevention and control over the years shows an emphasis on preventive actions, especially the elimination of breeding sites and the adoption of preventive practices. However, messages addressing vector identification, institutional support, and symptom recognition remain limited, revealing both progress and gaps in the communication strategy (Table 2). It underscores the need to diversify messages and strengthen comprehensive approaches that include all categories in a balanced way.

Figure 1 illustrates the spatial distribution by communes of messages generated and disseminated between 2020 and 2023.

The findings showed that communes 13 and 6 had the highest numbers of messages (20–23 and 15–20, respectively), partly because they were the only communes that were intervened every year and are highly vulnerable to vector-borne diseases. Communes such as 4, 14, 15, 21, and 18 showed an intermediate participation,

TABLE 2 Percentage of community messages on dengue prevention and control by year.

Type of action	2020		2021		2022		2023		Total	
	n	%	n	%	n	%	n	%	n	%
Prevention	20	80%	36	71%	22	63%	24	60%	102	68%
Vector Recognition	3	12%	11	22%	7	20%	13	33%	34	23%
Institutional Recognition	2	8%	3	6%	4	11%	–	–	9	6%
Symptom Identification	–	–	1	2%	2	6%	3	8%	6	4%
Total	25	-	51	-	5	-	40	-	151	100%

The bold values means the total of messages.

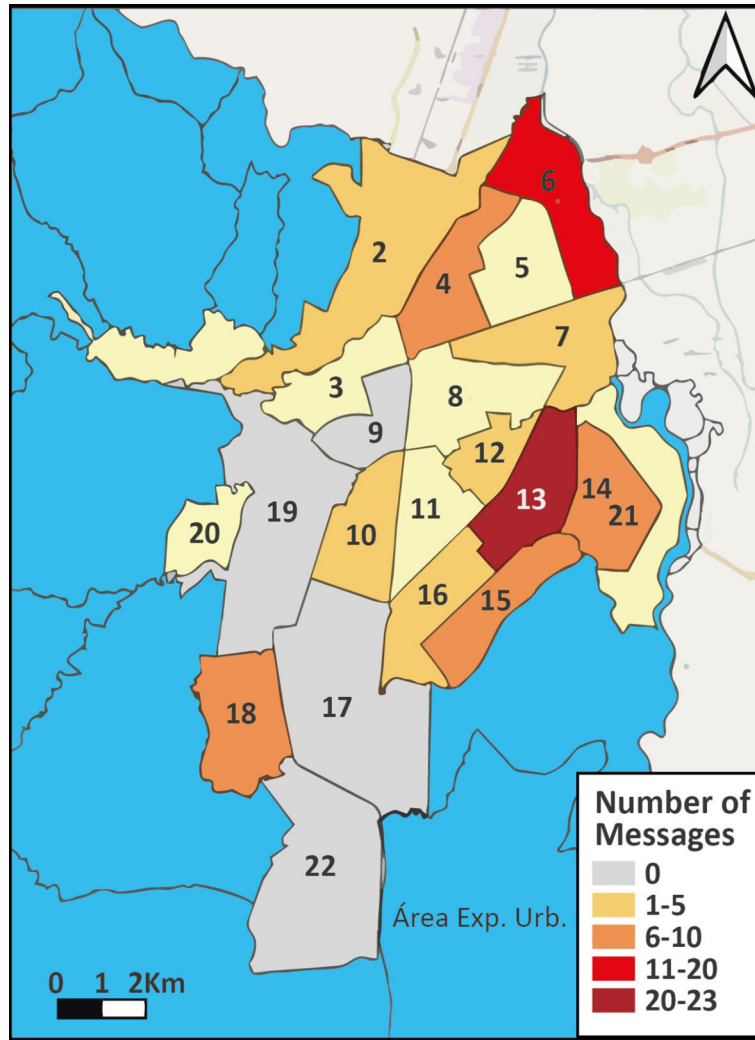


FIGURE 1 Spatial distribution of community messages by communes in Cali, 2020–2023.

while the remaining areas, such as 2, 5, 7, and 20, registered low intensity. Likewise, communes 9, 17, 19 and 22 (represented in gray) do not display visible coverage, indicating a limited presence of institutional and community leaders in these areas.

4.1.3 Phase 3. Field practices: communication for action

Management by community leaders, as multipliers of knowledge and disseminators of the strategy, as well as their participation in comprehensive public health campaigns, enabled the development of practices for preventing and controlling VBDs. The logbooks identified two types of practices: preventive practices, which are proactive interventions aimed at reducing the likelihood of vector emergence and proliferation; and corrective practices, which are reactive measures taken in response to vector presence or active outbreaks.

Between 2020 and 2023, 187 practices were recorded: 128 preventive (68%) and 59 corrective (32%). Preventive practices predominated in all years, although their relative weight

decreased year after year, in parallel with an increase in corrective practices. The annual number of interventions grew from 23 (2020) to 62 (2023), with the highest number of actions occurring in 2023 (Table 3).

In terms of the distribution of the number of practices in Cali, some communes had 30 practices (commune 13), while others had only between 1 and 4 (communes 3, 8, 10, and 20) (Figure 2).

Preventive practices centered on inspection, education, and recommendations aimed at communities to eliminate potential breeding sites before they become a serious risk. These practices included:

- Cleaning tanks, flower vases, pet water bowls, and drains.
- Applying larvicides to water containers that are currently larvae-free.
- Community education on best practices.

In the corrective measures, the research team intervened in positive breeding sites with larvae present in different developmental stages:

TABLE 3 Preventive and corrective actions per year.

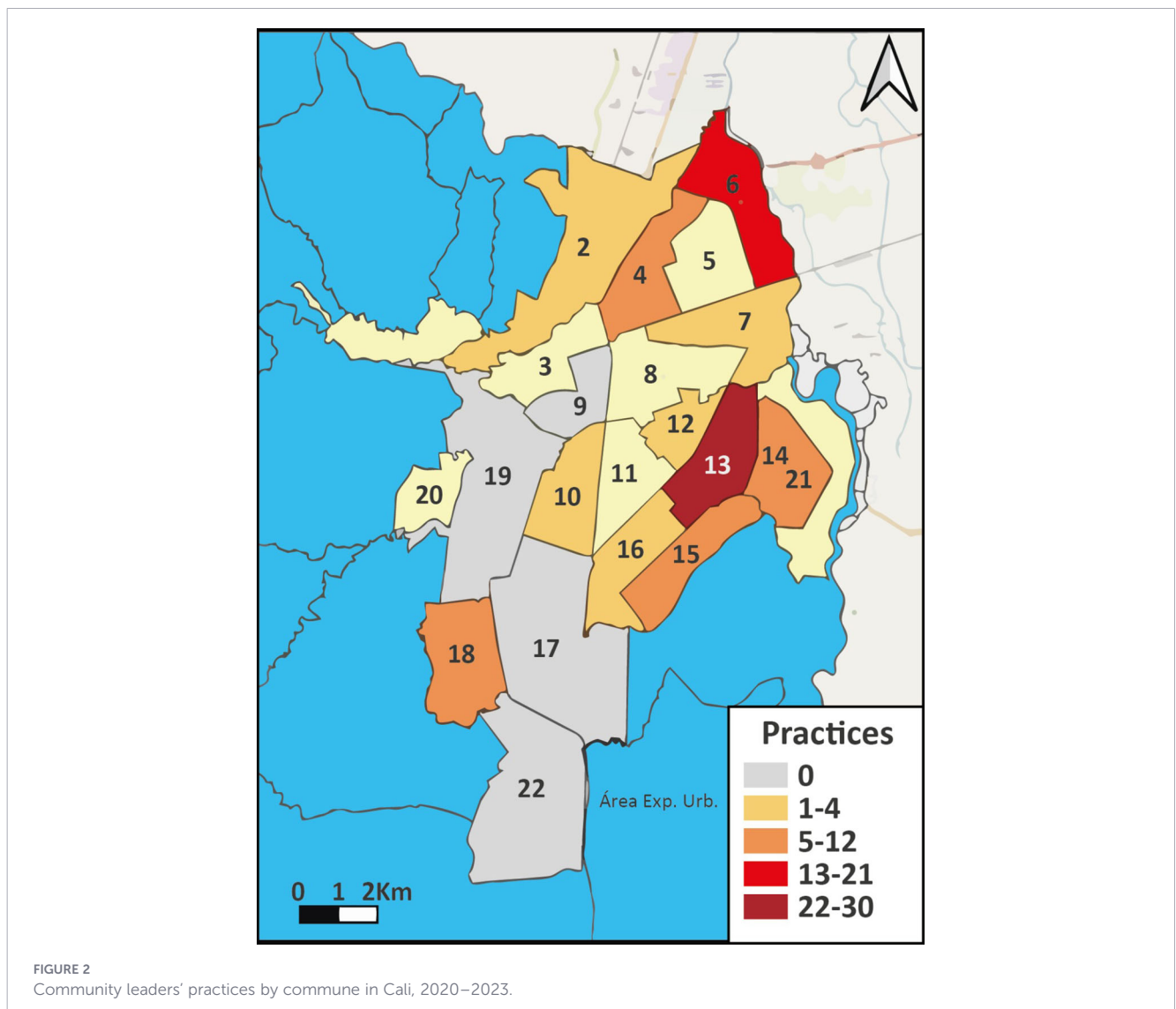
Type of action	2020		2021		2022		2023		Total	
	n	%	n	%	n	%	n	%	n	%
Preventive	20	87%	48	86%	26	57%	34	55%	128	68%
Corrective	3	13%	8	14%	20	43%	28	45%	59	32%
Total	23	-	56	-	46	-	62	-	187	100%

The bold values means the total of actions.

- Elimination of detected breeding sites.
- Use of larvicides in positive containers (main product VectoBac® - produced in Libertyville, Illinois, USA).
- Targeted interventions in chronic locations such as landfills or sources with high accumulation of water and larvae.

After reviewing the data by commune and the focus of the activities, communes 6, 7, and 15 predominantly employ preventive

practices, recognizing community empowerment through efforts to eliminate potential breeding sites. On the other hand, communes such as 13, 16, and 20 primarily exhibit corrective practices, indicating a significant prevalence of active breeding sites and the need for interventions to mitigate these risks. The research team identified chronic areas in communes 14 and 18, especially recurring dumpsites, which require constant attention due to their persistent nature and potential as breeding grounds for the vector.



4.1.4 Phase 4. Institutional and community evaluation of the experience

Once the workshops were completed, during phase 4, the EHT conducted: (i) an assessment of acquired knowledge, (ii) a workshop satisfaction survey administered to community participants attending the workshops, and (iii) the distribution of participation certificates. The logbooks recorded, by neighborhood, the number of knowledge assessments completed by community participants. However, the results were not consolidated globally by year, nor were the areas that needed reinforcement in future workshops identified.

Between 2020 and 2023, the EHT administered 3,755 satisfaction surveys with nine Likert-type questions to community participants to evaluate workshops led by the SSDESC. The surveys inquired about the achievement of objectives, timelines, resolution of concerns, materials used, and other factors. Most responses were in the “Very Satisfied” and “Satisfied” categories, with no responses in the lower satisfaction categories.

During this phase, the community received certification for its efforts after completing 40 hours of training. From 2020 to 2023, a total of 1,365 certificates were awarded (2020: 142, 2021: 299, 2022: 538, 2023: 386), demonstrating a sustained increase in participant retention within the program. These certificates enable the recognition of a significant number of Cali citizens who possess knowledge of VBDs.

4.1.5 Phase 5. Deepening and consolidation of multipliers

For the analysis of phase five, the research team was unable to produce a city-wide consolidated report due to differences in the level of detail and the lack of standardization in the annual logbooks, revealing heterogeneity in how implementation was recorded. Some logbooks recorded the number of activities per neighborhood and organization, while others described the thematic approaches, and still others included only photographic evidence, making comparison impossible.

4.2 Achievements, challenges, and opportunities for improvement, a city experience

The researchers present the main findings of the focus groups conducted with community leaders (CL) and staff from the Environment and Health Team (EHT) of the SSDESC, organizing the results through a thematic analysis of achievements, barriers, and opportunities for strategy improvement.

Among the achievements, the guide demonstrated a high level of appropriation. The intervention is supported by a situated pedagogical adaptation that promotes understanding of content, consolidates the Environment and Health Team’s sustained trajectory (averaging 7 years of work), and showcases the team’s ability to adapt to diverse contexts. It also highlights effective coordination between community and institutional actors that enhances local governance, along with the community’s autonomous mobilization in deploying the learned practices.

“Of all the investments made in dengue, this is the only thing that has been sustained over time, and that is very important. This is thanks to the work done by the coordination team and the team [Environment and Health]” (EHT).

“The sustainability of this process lies in its human talent. The creativity that they have is undeniable; they are professionals, technicians, and technologists with extensive knowledge of community work and managing VBDs” (EHT).

“The guide provides step-by-step instructions for the group to implement it effectively in their communities, regardless of which part of Cali they are working in. It also provides the community with a space to express how they perceive their territory and their practices within their homes” (EHT).

The Environment and Health Team’s initial approach to the communities was perceived as a collaborative and respectful process, prioritizing assertive and effective communication with local leaders.

“Well, there are many organizations that go to the neighborhoods and do not care [about what is going on there]. It is just, as they say, a photo for Face [Facebook] (...), but here we are, a group of workers who love and care about our community (...) The Secretariat does not do this; that is why we have liked it”. (CL).

Furthermore, the community positively values the information provided on Dengue and its practical application, exceeding their expectations by receiving in-depth and detailed information.

“We didn’t expect to learn how to prevent it from our homes (...). They taught us things we didn’t really know, like how to identify larvae in clear water” (CL).

“I really enjoyed the first workshop because you learn from the beginning, and it encourages you to keep coming back and to invite more friends to learn too” (CL).

Furthermore, the teaching methods used in the workshops were highly valued, as participants were the protagonists in various activities, fostering a dialogue of knowledge.

“They took us to the health center, set everything up [teaching materials], and explained how to use them in the workshop. It was a really nice experience.” (CL).

On the other hand, the challenges perceived by the Environment and Health Team and community actors correspond to difficulties in accessing certain territories, which affect the safety and integrity of the team; long working hours, including nights and weekends; and the timely hiring of the team for the deployment of activities.

“(…) the intervention was difficult; even entering the territory [El Vergel neighborhood] was complicated! (…) even for the team’s movement (…) There, you never know; you’re walking and suddenly bullets start flying. So, we were accompanied by the leaders throughout the entire process; we made the journey with them (…). Even as leaders, they couldn’t get through (…), but we persisted, we persisted, and we developed the module.” (EHT).

“Here, we work morning, noon, and night, Saturday and Sunday. Because we host educational workshops, we attend all events where people gather.” (EHT).

Among the opportunities for improvement to strengthen the strategy, the approach with populations considered by the participants as resistant to change (men and young people) stands out:

“The most resistant population is the male population; men tend not to pay much attention to these things.”(CL).

To this end, proposals exist to include activities that directly involve men, such as those related to community roles or interests, including maintaining public spaces or workshops for fathers. Likewise, integrating dengue prevention into schools was seen as an opportunity to change attitudes from an early age.

“I would like to work in schools with ninth-grade groups so that they can become multipliers with other students in different grades, and we [EAS] can follow up with them. (…) Then, if we start with this population, we will realize that, within a few years, [Dengue] will decrease somewhat.” (EHT).

Another recommendation from community leaders was to ensure ongoing and regular activities; they suggested maintaining a consistent presence of the Team and continuing to motivate and train participants.

“Let the program continue (…), hold more frequent workshops. That way, we could inform more people.” (LC).

Intersectoral work in the field is also crucial, involving relevant and timely actions such as fumigation in areas with high concentrations of the vector, garbage collection, and the cleaning of rainwater channels.

“In Valle Grande [Commune 21], we have the reservoir right next to us (…). That is an immense tank, more than 15 meters deep (…). They drained it; there is a hole, but there is standing water [rainwater], so it has been a maximum concentration of mosquitoes.” (CL).

Participants recommend issuing identification cards to certified individuals; this would enable them to be visible in their communities and maintain ongoing leadership in their territories, while focusing on preventing the spread of contagion.

“The strategy results in trained and certified leaders (…), which can be kept as a card, because they give us a certificate, but they [community] don’t believe us, so with a card (…), we can continue implementing the strategy in the territories” (CL).

Finally, the results demonstrate the comprehensive and complex commitment of the RPOC-ECOHEALTH implementation by the Health Authority, which aims to create a city vision with an Eco-healthy focus, encompassing prevention and intervention in vector management and reducing the burden of disease.

5 Discussion

Implementing a community-based dengue control strategy in a complex city like Cali is a necessary response to the epidemiological and social challenges affecting urban public health. The study results demonstrate that the Ecohealth approach, applied to the RPOC strategy, facilitated the integration of technical vector management with education, participation, and community empowerment processes elements that align with PAHO’s regional guide for effective interventions (15).

The focus groups revealed that strengthening local capacities, promoting the adoption of educational messages, and fostering social organization within communities led to sustainable changes in vector control practices. This experience reaffirms that social mobilization and health education are cornerstones for the sustainability of community-based strategies, contributing to the modification of risky behaviors and the consolidation of local health leadership (29, 30).

5.1 Integration with the Ecohealth conceptual framework

The Cali case study constitutes an empirical application of the Ecohealth principles, which are expressed as follows:

- **Transdisciplinarity:** the participation of geographers, public health specialists, epidemiologists, social workers, and public health technicians demonstrated an integration of technical and social knowledge, consistent with the arguments of Charron (35) and Lebel (27) regarding the need for heterogeneous teams to address complex socio-ecological systems.
- **Participation of multiple stakeholders:** the co-creation of the intervention guide with the health authority and academia reflects shared governance and collaborative learning, elements that strengthen the legitimacy and sustainability of local policies.
- **Equity:** the focus of actions on communes with the highest disease burden and most vulnerable conditions demonstrates a deliberate effort to reduce health and environmental disparities.

- **Sustainability:** the continuity of the strategy across different administrative periods and its institutionalization in the Ministry of Public Health confirms its viability and organizational maturity.

These findings show that the Ecohealth strategy in Cali is moving towards an adaptive governance model as proposed by Robbiati et al. (36), where local actors adjust practices and policies based on community feedback and evidence, approaching the conceptual frameworks of Planetary Health and One Health, which recognize the interdependence between human, animal, and environmental health (37, 38).

5.2 Comparison with Latin American experiences

The Cali experience shares similarities with initiatives developed in several Latin American countries (39), supported by the International Development Research Centre (27), that have used the Ecohealth approach to integrate communities and local governments in the prevention of dengue and other vector-borne diseases. In Mexico, Magaña Valladares et al. (29) in 2017 demonstrated that competency-based Ecohealth training programs strengthen institutional capacity for the prevention of vector-borne diseases; while in Córdoba (Argentina), Estallo et al. (40) documented that citizen science empowers communities in vector control through participatory monitoring.

In the Colombian context, recent studies in the Orinoquía region, such as those by Jaramillo Ramírez et al. (41), highlight the importance of intersectoral cooperation and community communication in ensuring sustainability. In comparison, the Cali model stands out for its temporal continuity, its solid institutional base, and the articulation between applied research and territorial management, consolidating a replicable model of urban ecosystem health.

5.3 Implications for public policy

The study's results confirm that Ecohealth strategies should be considered as planning and governance tools in local public health. Systematizing the experience of the Environment and Health Team provides input for designing national vector-borne disease control programs with a territorial focus, thereby strengthening the Environmental Health Policy and guidelines for the integrated management of tropical diseases.

The work offers new conceptual insights, particularly the notion of co-knowledge management as an operational mechanism that transforms territorial experience into evidence for public policy. Additionally, the Ecohealth strategy is conceptualized as a multiactor governance structure that integrates academic knowledge, institutional action, and community practices, bridging the gap between theory and implementation in vector-borne disease control. Although the analysis draws on logbooks from 2020–2023, a period critically affected by the COVID-19 pandemic and its consequences for vector-borne disease control, this context was not explicitly reflected in the logbooks.

Consequently, it should be explored through complementary analyses or future research.

5.4 Limitations of the study

The researchers based the documentary review on institutional reports, which, although systematic, may reflect reporting biases. Additionally, the protocol for building the logbooks should be improved to strengthen the implementation of the analysis and the interpretation.

6 Conclusions

Integrating the Ecohealth perspective into local public policies, while promoting participatory and sustainable approaches, has proven to be a viable strategy for dengue control in Cali, particularly during the period from 2020 to 2023. Co-created governance between the health authority and academia strengthens the strategy's effectiveness and its contribution to the city's urban public health. In general, primary data from institutional stakeholders indicate that the community strategy implemented by the SSDESC and its interdisciplinary team has proven effective and sustainable, thanks to the commitment and creativity of its members and the communities involved. Despite logistical, financial, and contextual challenges, adapting to community needs and employing a didactic approach have been key to its success. However, it is essential to strengthen institutional support, take a leading role in the community, and seek additional resources to ensure the implementation, continuity, and expansion of these initiatives. Integrating the Ecohealth perspective into current and local public policies improves human health and the environment, positioning the city as a model of innovation in community environmental health. These results have global relevance, as the strategy can be replicated in territories with similar socioeconomic, environmental, and governance conditions, particularly in urban settings facing a persistent risk of vector-borne diseases. Its Ecohealth-based, multiactor approach provides transferable lessons for integrated dengue prevention beyond the local context.

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

This study was approved by the SSDESC Institutional Research Review Committee (Approval Code 202541450100105461). 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

OC: Supervision, Writing – review & editing, Methodology, Project administration, Writing – original draft, Resources, Data curation, Visualization, Validation, Conceptualization. LR: Writing – review & editing, Conceptualization, Writing – original draft, Supervision, Data curation, Visualization, Resources, Validation, Project administration, Methodology. CP: Validation, Visualization, Conceptualization, Resources, Supervision, Investigation, Writing – review & editing. GE: Conceptualization, Supervision, Visualization, Resources, Validation, Investigation, Writing – review & editing. BG: Resources, Writing – original draft, Visualization, Validation, Funding acquisition, Formal analysis, Methodology, Data curation, Investigation, Writing – review & editing, Conceptualization. YL: Resources, Writing – review & editing, Writing – original draft, Conceptualization, Formal analysis, Methodology, Visualization, Data curation, Investigation, Validation. DC: Investigation, Data curation, Methodology, Validation, Writing – review & editing, Conceptualization, Resources, Visualization, Formal analysis, Writing – original draft. DG: Formal analysis, Investigation, Resources, Data curation, Writing – review & editing, Writing – original draft, Visualization, Methodology, Validation, Conceptualization. FA: Resources, Writing – original draft, Funding acquisition, Project administration, Formal analysis, Validation, Visualization, Writing – review & editing, Supervision, Conceptualization.

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Conflict of interest

The author(s) declared that this work 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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