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# Growing complexity in the emergency department: evidence from the resuscitation room (2012–2024)

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**Objective:** To describe the temporal trend in the use of the resuscitation room (RR) in a tertiary emergency department between 2012 and 2024.

**Methods:** Retrospective study including all RR episodes; we calculated the annual percentage of RR visits over total emergencies and analyzed trends with linear regression.

**Results:** Among 1,210,551 visits, 29,175 required RR care. RR use increased from 1.37 to 3.14% (slope +0.165 percentage points/year;  $R^2 = 0.97$ ;  $p < 0.0001$ ).

**Conclusion:** The marked growth in RR activity reflects increasing clinical complexity and supports reinforcing staffing, critical care skills and specific quality indicators in emergency departments.

## KEYWORDS

case-mix, clinical complexity, emergency department, resuscitation room, time trends

## Introduction

In recent years we have observed an increase in demand in emergency departments (EDs), not only in our country but worldwide. Several reviews have examined the reasons for this sustained rise in visits to emergency care facilities (1).

This sustained pressure has been widely framed as ED crowding from high demand and crowding, a phenomenon driven by multiple interacting input, throughput, and output factors. Published evidence suggests that increases in ED presentations are not explained by population growth alone and that growing patient complexity and access block contribute meaningfully to delays. In parallel, studies (2) have described an “intensification” of ED care, with a disproportionate growth of high-intensity ED visits over time. These trends have renewed attention on the ED’s critical care function and on care models and spaces designed to deliver time-sensitive resuscitation and stabilization early in the patient journey (3).

In Spain, 25 million hospital emergency visits were recorded in 2023, a figure not seen before (4). Since the SARS-CoV-2 pandemic, the number of visits to hospital emergency services has continued to grow. Although it has been reported that nearly 50% of patients who attend the ED do so for low-acuity reasons (triage levels IV or V), in our hospital we have also observed an increase in the clinical and social complexity of the patients we treat. The appropriate use of emergency department services, considering the progressive increase observed after the pandemic, has prompted several studies examining appropriate utilization, particularly for severe conditions (5). In fact, resuscitation room activity, together with its clinical characteristics, has been studied previously, showing changes associated with strict lockdowns in the early stages (6).

Resuscitation room's deal with the most critically ill or unstable patients presenting to a hospital's emergency department. Time to stabilization should be as short as possible, with prompt performance of all tests deemed necessary to ensure rapid delivery of the best possible treatment. Especially in time-sensitive conditions, such as myocardial infarction or stroke. Fast delivery of care requires fast decisions, particularly in terms of where to direct a patient (specialized unit, surgery, intensive care...) (7). In this context, we designed a descriptive study prompted by the perception of an increase in the number of patients managed in the resuscitation room (RR).

## Methods

We conducted a retrospective descriptive study of all patients treated in the resuscitation room between 2012 and 2024.

### Resuscitation room definition and activation criteria

In our ED, the Resuscitation Room is a dedicated, geographically defined clinical area reserved for the immediate management of time-critical, potentially life-threatening conditions requiring continuous monitoring and advanced resuscitative interventions. RR care was defined operationally as any ED episode registered in the electronic health record (EHR) with patient location assigned to the RR area. RR activation follows a standardized institutional protocol and did not change during the study period (2012–2024). Activation is triggered by predefined clinical criteria and/or senior clinician judgment (e.g., cardiac arrest, airway compromise, severe respiratory failure, hemodynamic instability/shock, major trauma, severe neurologic compromise).

### Triage system

All ED patients are triaged using the Sistema Español de Triage (SET), based on the Model Andorrà de Triage (MAT), a structured 5-level triage system (level 1: immediate; level 2: very urgent; level 3: urgent; level 4: standard; level 5: non-urgent) (8).

### Variables

The unit of analysis was the calendar year (2012–2024). For each year we extracted total ED visits (*n*) and resuscitation room (RR) episodes (*n*) and computed the annual proportion of RR use (%RR = RR episodes/total ED visits × 100). We also described annual triage distribution (levels I–V and “not triaged”; *n* and %) and the proportion of women among ED visits (*n* and %). For RR episodes, we summarized the main diagnostic categories reported in Table 1 (*n* and %), including chest pain, stroke, cardiac rhythm disturbances, dyspnea, acute trauma, and altered level of consciousness.

TABLE 1 Main clinical symptoms.

Patología	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Chest pain	162 (13.9%)	168 (12.5%)	173 (11.0%)	153 (9.1%)	171 (9.4%)	173 (8.6%)	187 (8.1%)	195 (7.4%)	142 (7.3%)	173 (6.5%)	243 (7.8%)	232 (6.7%)	217 (6.3%)
Stroke	158 (13.5%)	251 (18.6%)	263 (16.7%)	285 (16.9%)	296 (16.3%)	309 (15.4%)	390 (16.9%)	411 (15.6%)	397 (20.4%)	567 (21.3%)	720 (23.1%)	796 (23.0%)	816 (23.7%)
Cardiac rhythm disturbances	109 (9.3%)	93 (6.9%)	136 (8.6%)	113 (6.7%)	129 (7.1%)	135 (6.7%)	150 (6.5%)	150 (5.7%)	92 (4.7%)	125 (4.7%)	122 (3.9%)	156 (4.5%)	131 (3.8%)
Dyspnea	85 (7.3%)	119 (8.8%)	170 (10.8%)	180 (10.7%)	192 (10.6%)	207 (10.3%)	242 (10.5%)	324 (12.3%)	251 (12.9%)	280 (10.5%)	334 (10.7%)	356 (10.3%)	300 (8.7%)
Acute trauma	174 (14.9%)	171 (12.7%)	164 (10.4%)	187 (11.1%)	200 (11.0%)	229 (11.4%)	247 (10.7%)	337 (12.8%)	257 (13.2%)	434 (16.3%)	565 (18.1%)	664 (19.2%)	806 (23.4%)
Altered level of consciousness	21 (1.8%)	26 (1.9%)	27 (1.7%)	35 (2.1%)	31 (1.7%)	50 (2.5%)	53 (2.3%)	61 (2.3%)	51 (2.6%)	48 (1.8%)	78 (2.5%)	97 (2.8%)	96 (2.8%)

TABLE 2 Emergency visits attended by year.

Year	2.012	2.013	2.014	2.015	2.016	2.017	2.018	2.019	2.020	2.021	2.022	2.023	2.024
ED visits	85.277	84.103	89.252	91.519	94.183	93.618	96.691	100.480	72.842	85.979	100.676	106.282	109.649
% women	44,336 (51.99%)	43,692 (51.95%)	46,313 (51.89%)	47,233 (51.61%)	48,457 (51.45%)	48,391 (51.69%)	49,544 (51.24%)	51,185 (50.94%)	36,887 (50.64%)	43,239 (50.29%)	51,405 (51.06%)	54,363 (51.15%)	56,228 (51.28%)
<b>Triage levels</b>													
Level I	179 (0.21%)	235 (0.28%)	250 (0.28%)	302 (0.33%)	292 (0.31%)	337 (0.36%)	338 (0.35%)	311 (0.31%)	240 (0.33%)	421 (0.49%)	618 (0.61%)	840 (0.79%)	877 (0.8%)
Level II	10,574 (12.4%)	9,857 (11.72%)	10,371 (11.62%)	12,392 (13.54%)	11,095 (11.78%)	11,019 (11.77%)	11,158 (11.54%)	9,505 (9.46%)	6,862 (9.42%)	7,747 (9.01%)	8,618 (8.56%)	8,503 (8%)	8,717 (7.95%)
Level III	27,365 (32.09%)	28,334 (33.69%)	32,452 (36.36%)	35,775 (39.09%)	35,149 (37.32%)	37,485 (40.04%)	41,007 (42.41%)	41,137 (40.94%)	29,822 (40.94%)	37,014 (43.05%)	44,378 (44.08%)	44,483 (42.23%)	46,743 (42.63%)
Level IV	22,223 (26.06%)	19,974 (23.75%)	19,778 (22.16%)	26,824 (29.31%)	30,713 (32.61%)	29,050 (31.03%)	31,937 (33.03%)	36,354 (36.18%)	26,281 (36.08%)	30,411 (35.37%)	36,636 (36.39%)	40,164 (37.79%)	41,283 (37.65%)
Level V	6,728 (7.89%)	7,721 (9.18%)	7,363 (8.25%)	10,525 (11.5%)	12,413 (13.18%)	11,384 (12.16%)	10,839 (11.21%)	11,726 (11.67%)	8,195 (11.25%)	9,062 (10.54%)	8,950 (8.89%)	10,416 (9.8%)	10,658 (9.72%)
No triage	18,208 (21.35%)	17,982 (21.38%)	19,038 (21.32%)	5,701 (6.22%)	4,521 (4.8%)	4,344 (4.64%)	1,412 (1.46%)	1,447 (1.43%)	1,442 (1.98%)	1,324 (1.54%)	1,480 (1.47%)	1,476 (1.38%)	1,371 (1.25%)
Num. resuscitations	1.169	1.347	1.577	1.684	1.815	2.009	2.308	2.633	1.948	2.663	3.119	3.460	3.443
% resuscitations	1.37	1.6	1.77	1.84	1.93	2.15	2.39	2.62	2.67	3.1	3.1	3.26	3.14

ED, emergency department.

## Data sources, extraction, and validation

We extracted annual ED visit counts, triage level distributions, and RR episodes from the ED EHR/administrative database. RR episodes were identified using the EHR “location” field because the RR is coded as a discrete ED area. Annual RR counts obtained from the EHR location field were cross-checked against the manual RR log (recording RR entry, responsible physician and nurse, and diagnosis) to confirm consistency of RR episode ascertainment.

This study used ED operational/EHR administrative data (annual ED visits, triage levels, and RR episodes identified by location). Downstream outcomes (hospital admission, ICU admission, mortality) were not available with validated linkage across the full study period and were therefore not analyzed in this brief report.

## Statistical analysis

We report annual resuscitation room (RR) utilization as (i) the proportion of emergency department (ED) visits managed in the RR (%RR) and (ii) RR episodes per 1,000 ED visits. For each year, %RR was calculated as RR episodes divided by total ED visits multiplied by 100, and 95% confidence intervals (95% CIs) for annual proportions were computed using the Wilson method for binomial proportions. Temporal trends in %RR across 2012–2024 were assessed using linear regression with calendar year as the independent variable (intercept + year), reporting the slope and its 95% CI. Additionally, mean %RR was compared between the pre-pandemic period (2012–2019) and the later period (2020–2024) using Welch’s two-sided *t*-test with  $\alpha = 0.05$ . All analyses were performed using Python.

## Results

From 2012 to 2024, a total of 1,210,551 ED visits were recorded, of which 29,175 required care in the resuscitation room. The %RR increased from 1.37% in 2012 to 3.14% in 2024, with a peak in 2023 (3.26%). Linear regression showed a slope of +0.165 percentage points per year (95% CI 0.146–0.183;  $R^2 = 0.97$ ;  $p < 0.0001$ ). The mean %RR was 1.96% in 2012–2019 vs. 3.05% in 2020–2024 (difference +1.10 percentage points; Welch’s *t*-test:  $t = 6.23$ ,  $df \approx 10.9$ ,  $p = 6.7 \times 10^{-5}$ ).

The distribution by triage level showed decreases in “not triaged” (from 21.35 to 1.25%) and level II (from 12.4 to 7.95%), with increases in levels III (from 32.09 to 42.63%), IV (from 26.06 to 37.65%) and I (from 0.21 to 0.80%), suggesting greater relative severity and better completeness of triage over the study period. The proportion of women remained stable at approximately 51%.

Over these 12 years, our ED went from 85,277 visits in 2012 to 109,649 in 2024, a 28.6% increase in total visits. Table 2 shows the annual number of visits, the distribution of triage categories and the main sociodemographic characteristics of the patients.

About patients treated in the resuscitation room, 1,169 were seen in 2012, accounting for 1.37% of all ED visits. In 2024, 3,443 patients were treated in the resuscitation room, representing 3.14% of all ED visits and a 94.5% increase in resuscitation activity. This steady growth only declined in 2020. However, in 2021 the number of resuscitation cases recovered, with an upward trend that appears to have stabilized in the most recent year, as shown in Figure 1.

Regarding diagnoses, Table 1 presents the most frequent conditions over the study period. There was a sustained increase in acute cerebrovascular disease (13.5→ 23.7%) and acute trauma (14.9→ 23.4%). In contrast, chest pain (13.9→ 6.3%) and cardiac rhythm disturbances (9.3→ 3.8%) decreased. Dyspnea increased until 2018–2021 and then declined (8.7 in 2024), while altered level of consciousness remained low and stable (~2–3%).

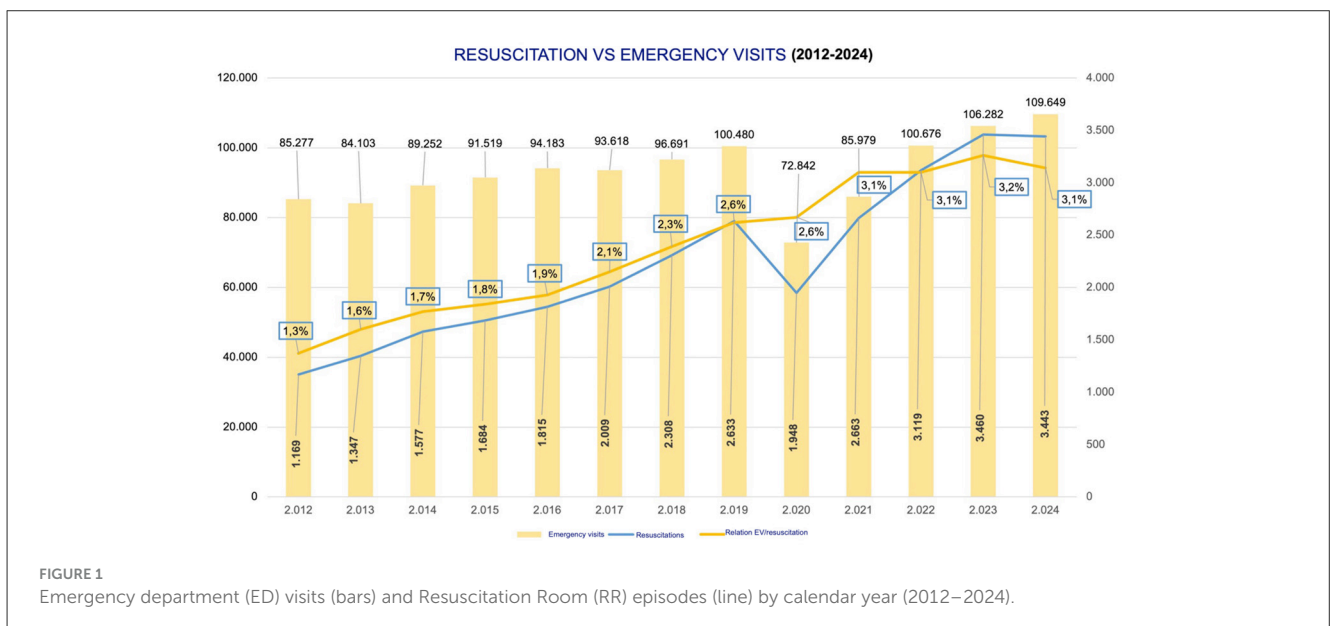


TABLE 3 Annual counts and ED-standardized rates.

Year	ED visits (n)	RR episodes (n)	%RR	95% CI (%RR, Wilson)	RR per 1,000 ED visits
2012	85,277	1,169	1.37	1.29–1.45	13.71
2013	84,103	1,347	1.60	1.52–1.69	16.02
2014	89,252	1,577	1.77	1.68–1.86	17.67
2015	91,519	1,684	1.84	1.75–1.93	18.40
2016	94,183	1,815	1.93	1.84–2.02	19.27
2017	93,618	2,009	2.15	2.06–2.24	21.46
2018	96,691	2,308	2.39	2.29–2.49	23.87
2019	100,480	2,633	2.62	2.52–2.72	26.20
2020	72,842	1,948	2.67	2.56–2.79	26.74
2021	85,979	2,663	3.10	2.98–3.22	30.97
2022	100,676	3,119	3.10	2.99–3.21	30.98
2023	106,282	3,460	3.26	3.15–3.36	32.55
2024	109,649	3,443	3.14	3.04–3.24	31.40

95% CIs calculated using the Wilson method for binomial proportions.

Annual counts and ED-standardized rates are summarized in Table 3, including %RR with 95% confidence intervals (Wilson) and RR episodes per 1,000 ED visits. RR utilization increased from 1.37% in 2012 to 3.14% in 2024, equivalent to 13.71 to 31.40 RR episodes per 1,000 ED visits.

## Discussion

Over 12 years, RR utilization increased substantially, from 1.37% of ED visits in 2012 to 3.14% in 2024, indicating a marked growth of ED resuscitative care activity. This pattern aligns with broader reports of increasing high-intensity ED care and rising illness severity and crowding metrics in other settings (9).

The apparent divergence between increasing RR utilization and shifts in triage distribution warrants interpretation. Triage level reflects urgency at initial assessment, whereas RR activation may be triggered by prehospital alerts and direct-to-RR pathways, rapid clinical deterioration after triage, and senior clinician judgment. Therefore, changes in triage category proportions do not necessarily mirror trends in RR activation. Additionally, operational constraints (e.g., room availability) may occasionally influence placement decisions, potentially leading to RR use for some patients who may not strictly require resuscitation-level care, while some patients may deteriorate unexpectedly outside the RR. In our setting, activation criteria remained unchanged over the study period, and RR episodes were ascertained by EHR location, which supports consistency of measurement over time.

We did not identify any Spanish studies describing a comparable historical series. However, Herring’s group (3) in the United States previously reported a progressive increase in the clinical complexity of ED patients, and a review published in 2018 analyzed factors associated with the overuse of emergency services (2).

The pattern observed in our ED likely reflects a combination of: (1) population aging and multimorbidity; (2) greater detection and referral of time-sensitive conditions (stroke, acute coronary syndromes, sepsis); (3) improvements in triage and reduced under-recording; and (4) organizational changes (expanded scope of the resuscitation room, point-of-care ultrasound, non-invasive ventilation, protocols) that lower the threshold for activation and enable definitive management of critical patients in the ED. The transient drop in 2020, followed by rapid recovery, supports a real increase in relative severity in the post-pandemic period, not merely higher visit volume.

We cannot rule out a supply-side effect (expansion of physical space and the establishment of a dedicated resuscitation team since 2022) or the inclusion of cases without severe acute pathology but with high social vulnerability that still require intensive resource use in the ED. Even so, the magnitude and consistency of the trend, together with the triage data, support a structural change in the case-mix. The main limitation of this study is that it is a single-center, aggregated time series without adjustment for age, comorbidity or diagnosis.

Our reference population increased from 436,774 inhabitants in 2012 to 451,996 in 2024. Population growth (~+3.5%) was clearly lower than the increase in ED utilization (~+24%), suggesting that the greater care burden is driven by a real increase in demand per

capita and by changes in case-mix, rather than by demographic expansion alone.

These results indicate that emergency departments are dealing with greater clinical and social complexity, beyond time-dependent conditions activated through specific codes. This requires strengthening medical and nursing staffing, prioritizing professionals with experience in critical care, and considering the implementation of ED-based intermediate care or step-down units within resuscitation room (10), much as short-stay units were introduced in the past. In fact, a recent study showed that ED step-down units can improve quality of care without a substantial increase in overall healthcare costs.

The persistence of a resuscitation rate above 3% since 2021 supports consolidating these additional resources and incorporating specific quality indicators. Our group has already proposed a set of indicators for the resuscitation room (11), but we should go one step further and develop indicators such as time to haemodynamic or respiratory stabilization, time to first antibiotic dose and short- and medium-term mortality.

## Strengths and limitations

Strengths include the long observation period (2012–2024), complete single-center capture of ED activity, and a robust RR definition based on a discrete EHR location code with the possibility of cross-validation through an independent manual RR log. Limitations include the single-center design and the use of RR location as a process-of-care proxy that may be affected by unexpected deterioration outside RR or operational placement. Finally, this brief report does not include linked outcomes (ICU admission, in-hospital mortality), which are a priority of our ongoing work linking RR episodes to downstream outcomes and disposition.

## Conclusions

Over the last decade, our emergency department has experienced a marked increase in the proportion and absolute number of patients requiring care in the resuscitation room, alongside only moderate growth in total visits and reference population. This sustained rise, together with changes in triage distribution and diagnostic profiles, suggests a structural shift toward greater clinical and social complexity in the case-mix of emergency patients, rather than a transient fluctuation or a mere artifact of coding practices.

These findings support the need to reinforce medical and nursing staffing in emergency departments, prioritizing professionals with specific skills in critical care, advanced monitoring and time-sensitive pathologies. They also argue for the development of ED-based intermediate or step-down care areas integrated into the resuscitation room, and for the implementation of specific quality indicators focused on stabilization times, early treatment and short- and medium-term outcomes. Multicentre studies are warranted to confirm whether this pattern is occurring

in other Spanish hospitals and to inform strategic planning and resource allocation at the regional and national level.

## Data availability statement

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

## Author contributions

JO: Conceptualization, Writing – review & editing, Investigation, Data curation, Writing – original draft. MD-O: Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing. CL: Resources, Writing – original draft, Visualization, Conceptualization, Writing – review & editing, Supervision. MV: Writing – review & editing, Writing – original draft, Conceptualization, Project administration. SG: Methodology, Data curation, Writing – review & editing, Writing – original draft. OY: Validation, Project administration, Visualization, Conceptualization, Methodology, Writing – review & editing, Investigation, Writing – original draft.

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