

Out-of-Hospital Cardiac Arrest in Portugal – A Call for a Registry Project

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Introduction: Sudden Out-of-Hospital Cardiac Arrest (OHCA) is a significant global health issue, with considerable regional variations, and is the third leading cause of death in Europe. With approximately 80% of cases being witnessed, immediate initiation of cardiopulmonary resuscitation (CPR) by lay bystanders can increase OHCA survival by a factor of 2–4. In 2007, the European Resuscitation Council (ERC) established the European Registry of Cardiac Arrest (EuReCa) to systematically collect and analyze OHCA data across Europe, identifying gaps in the chain of survival. EuReCa findings highlight the critical impact of bystander CPR and the importance of measurement for evidence-based improvement. However, previous EuReCa studies in Portugal were limited to Madeira and the Azores, representing less than 5% of the population. This exploratory study is the first to provide comprehensive nationwide OHCA data, aiming to characterize the current national context.

Objective: Characterize the current national situation in terms of sudden OHCA survival and bystander CPR.

Methods: A retrospective cohort study was conducted from September 1 to November 30, 2022. All EMS-attended OHCA cases were included, and Utstein-style guidelines were applied to ensure standardized data reporting.

Results: During the study period, 4769 OHCA cases were recorded, including 2128 witnessed by laypeople. Bystander CPR was performed in 555 cases (26%), and ROSC was achieved in 117 victims, corresponding to a 5% survival rate among witnessed OHCA cases.

Discussion: The bystander CPR rate in witnessed OHCA was 26%, which is below the average results of EuReCa One (48%) and significantly below the average results of EuReCa Two (58%).

Conclusion: Despite limitations related to the retrospective design and lack of a national OHCA registry, bystander CPR in witnessed OHCA showed a significant positive impact on ROSC ($p < 0.001$). Regional differences were observed, underscoring the need to implement ERC recommendations to increase bystander CPR rates nationwide.

Keywords: OHCA, bystander CPR, ROSC

Introduction

Sudden Out-of-Hospital Cardiac Arrest (OHCA) is a global health problem with significant regional variations.^{1,2} As the third leading cause of death in Europe,³ OHCA represents one of the greatest challenges in global healthcare,^{4,5} not only due to its incidence but also because of its profound social and economic impact.^{3,6}

Upon the onset of out-of-hospital cardiac arrest, cerebral viability in the absence of oxygen is limited to approximately 3–5 minutes, a duration that is considerably shorter than the average response time of emergency medical services.^{4,7} Consequently, the current survival rate of out-of-hospital cardiac arrest victims remains below 10%.⁴

Swift initiation of basic life support (BLS) by lay bystanders has the potential to amplify OHCA survival rates by a factor of 2–4⁸ and nearly 80% of OHCA cases are witnessed events.⁹ Lay bystanders constitute a critical link in bridging the temporal gap between collapse and the arrival of emergency medical services.⁴ Regrettably, in both Europe and the United States, bystander CPR is performed in fewer than one in five out-of-hospital cardiac arrests. Increasing this rate could result in the preservation of more than 200,000 additional lives annually, with substantial global public health implications.⁴

In 2007, the European Resuscitation Council (ERC) launched the EuReCa project, establishing a comprehensive Europe-wide registry designed to systematically record and analyze all out-of-hospital cardiac arrest incidents.⁶ The primary objective of the EuReCa project is to identify gaps and opportunities within the chain of survival across participating countries.⁶ Most registries consistently demonstrate the pivotal role of basic life support as a fundamental component of survival.^{10,11}

Despite the increasing integration of advanced therapeutic interventions, low rates of bystander CPR remain associated with reduced survival and poorer neurological and functional outcomes.¹² Consequently, the incidence of bystander CPR represents the most important modifiable determinant of survival following out-of-hospital cardiac arrest.¹³ In France alone, more than 50,000 individuals die annually from OHCA, Delhomme et al¹ highlighted the importance of widespread basic life support (BLS) training, demonstrating marked regional disparities in BLS education and a strong correlation with survival outcomes. Districts with limited BLS training exhibit survival rates as low as 5%, compared with 21% in regions with the highest levels of BLS education, underscoring the critical role of bystander CPR in improving OHCA outcomes. Comprehensive OHCA registries are essential to fully understand and quantify this impact, as meaningful improvement depends on robust measurement. Although studies such as EuReCa, EuReCa 2, and EuReCa 3 provide valuable insights, Portuguese data have been restricted to Madeira and the Azores, representing less than 5% of the population. This exploratory study is therefore the first to present comprehensive nationwide OHCA data, aiming to characterize the current national situation.

Portugal has a centralized pre-hospital emergency medical system serving a population of approximately 10 million inhabitants. All pre-hospital emergency situations are accessed through a single national emergency number (112), which connects callers to an emergency dispatch center. Initial response is typically provided by firefighters, while differentiated medical care is delivered through a tiered system comprising Immediate Life Support units, staffed by an ambulance with a nurse, and Advanced Life Support units, consisting of a rapid response vehicle with a physician and a nurse. The availability and deployment of these resources vary according to geographic location. Prior to this study, the rate of bystander cardiopulmonary resuscitation in mainland Portugal was unknown, and the availability of automated external defibrillators remained limited compared with the European average. In cases of OHCA identified by emergency dispatch operators, the initiation of resuscitation maneuvers prior to the arrival of emergency services is recommended; however, the effectiveness of these recommendations in Portugal has not been previously established.

Objectives

Describe the current national situation regarding out-of-hospital cardiac arrest survival and rates of bystander cardiopulmonary resuscitation.

Method

A retrospective cohort study was conducted covering the period from 1 September to 30 November 2022, a timeframe previously associated with an increased incidence of out-of-hospital cardiac arrest.³ Access to the database was formally authorized by the National Institute of Medical Emergency (INEM), in full compliance with applicable ethical and regulatory requirements. The dataset was pre-existing and fully anonymized; therefore, no active data collection or direct investigator involvement with participants was required. The study received approval from the Ethics Committee of the Universidade Católica Portuguesa. All OHCA cases attended by Emergency Medical Services (EMS) during the study period were included. Although the Utstein-style,⁶ guidelines were intended to provide a standardized framework for data collection and analysis, their application was limited by the structure and scope of the existing database. The Utstein criteria constitute an internationally accepted framework for standardized reporting of OHCA, developed through expert consensus to ensure consistency and comparability across studies and healthcare systems. These guidelines encompass key domains, including event characteristics, patient data, EMS response, hospital care, and outcomes, thereby enabling reliable comparison of OHCA outcomes across regions and supporting improvements in quality of care and survival, following a preliminary and exploratory analysis of the existing database and records, it was determined that application of the Utstein criteria was not feasible, thereby necessitating an exclusive focus on the data presented in this article.

Portugal is administratively divided into three functional areas: mainland Portugal, the Azores Archipelago, and the Madeira Archipelago. Pre-hospital medical emergency services in these regions are coordinated by the Instituto Nacional de Emergência Médica (INEM I.P.), the Serviço Regional de Proteção Civil e Bombeiros dos Açores (SRPCBA), and the Serviço Regional de Proteção Civil da Madeira (SRPCRAM), respectively. For the study period, the following data were requested from each entity: total number of OHCA cases; total number of witnessed OHCA cases; total number of OHCA cases receiving bystander cardiopulmonary resuscitation prior to EMS arrival; and total number of patients presenting with signs of life upon hospital arrival.

For the purposes of this study, bystander CPR was defined as the initiation of basic life support maneuvers by laypersons before the arrival of emergency medical teams and return of spontaneous circulation (ROSC) was defined as the restoration of spontaneous circulation with the patient arriving at the hospital alive.³ Although the assessment of survival using this criterion represents a significant limitation, as it does not account for long-term neurological outcomes, alternative approaches were not feasible due to the current limitations of the national out-of-hospital cardiac arrest registry.

For the study period, flow diagram (Figure 1), shows that a total of 4769 OHCA were quantified, of which 2128 were witnessed by lay people, those 555 received BLS maneuvers by lay people (bystander CPR of 26%), with a total number of 117 patients with ROSC, which corresponds to a survival rate of 5% of all witnessed OHCA. All the OHCA not witnessed were excluded from this study.

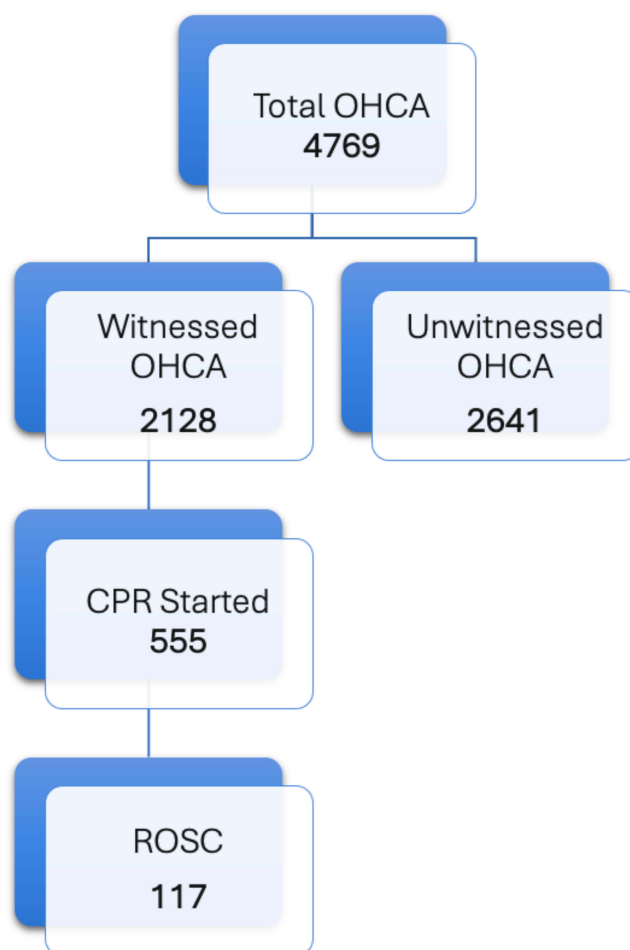


Figure 1 OHCA flow diagram.

Results

The results were stratified by functional area, namely the Azores Archipelago, the Madeira Archipelago, and mainland Portugal. The distribution of OHCA and corresponding interventions is summarized as follows. In the Azores, 59 OHCA cases were recorded, of which 34 were witnessed, 18 received bystander CPR, and 12 achieved return of spontaneous circulation. In Madeira, 173 OHCA were identified, including 97 witnessed cases, 23 instances of bystander CPR, and 19 cases achieving ROSC. In mainland Portugal, of 4537 OHCA, 1997 were witnessed, 514 received bystander CPR, and 86 resulted in ROSC (Table 1). Given the previously described limitations of the dataset, it was not possible to distinguish between bystander-initiated CPR and dispatcher-assisted CPR.

Comparative analysis across the three functional areas, performed using the Chi-square test of independence, demonstrated a statistically significant association between the performance of bystander cardiopulmonary resuscitation and the likelihood of achieving return of spontaneous circulation ($p < 0.001$), as presented in Table 2. Notably, the highest ROSC rate was observed in the Azores (35%), followed by Madeira (20%), while mainland Portugal exhibited a substantially lower rate (4%), resulting in an overall national ROSC rate of 5%.

Discussion

The present study aimed to characterize the epidemiology of OHCA in Portugal and to evaluate the impact of bystander-initiated cardiopulmonary resuscitation prior to the arrival of emergency medical services. Our findings indicate a bystander CPR rate of 26% among witnessed OHCA, which is substantially lower than the rates reported in the EuReCa ONE (48%) and EuReCa TWO (58%) studies.³ This disparity highlights a significant shortfall in Portugal's emergency response performance when compared with European benchmarks and underscores the urgent need for strengthened public health policies, community-based training initiatives, and broader CPR awareness programs, assuming that emergency dispatch centers in Portugal correctly implement dispatcher-assisted CPR protocols and recommendations, the detection and recognition of cardiac arrest by laypersons appear to represent one of the major barriers to effective intervention.

Notably, the Azores Archipelago demonstrated a bystander CPR rate of 53%, closely approximating the European average and contrasting sharply with the national pattern. This regional divergence suggests the presence of effective local strategies, such as targeted training programs, enhanced community engagement, or more robust public awareness initiatives, which may be contributing to higher rates of layperson intervention. These findings warrant further investigation, as such approaches could provide valuable insights and scalable models for implementation across mainland Portugal.

Table 1 Results by Functional Areas

Functional Area	OHCA	Witnessed OHCA	Bystander CPR	ROSC
Azores	59	34	18	12
Madeira	173	97	23	19
Portugal Mainland	4537	1997	514	86

Table 2 Bystander CPR versus ROSC

Functional Area	Bystander CPR	ROSC
Azores	53%	35%
Madeira	24%	20%
Portugal Mainland	26%	4%
Total	26%	5%

The study further demonstrated a statistically significant association between the provision of bystander CPR and the likelihood of achieving return of spontaneous circulation. This association reinforces the well-established role of early basic life support as a critical determinant of survival following OHCA, while simultaneously revealing marked regional disparities in outcomes. Collectively, these results emphasize both the life-saving potential of bystander CPR and the uneven effectiveness of emergency response systems within the country.

The implications of these findings are twofold. First, they provide national-level evidence supporting the effectiveness of bystander CPR in improving OHCA outcomes, thereby reinforcing international recommendations advocating widespread public training in basic life support. Second, the observed regional differences highlight an urgent need for targeted interventions aimed at increasing bystander CPR rates, particularly in mainland Portugal. The adoption and contextual adaptation of successful practices observed in the Azores may represent a pragmatic and evidence-informed pathway toward nationwide improvement.

To further elucidate the determinants of OHCA outcomes in Portugal, future research should incorporate more comprehensive datasets. Relevant variables include demographic characteristics of victims (age and sex), detailed characterization of bystanders providing CPR, rates of automated external defibrillator utilization, victim comorbidities, emergency medical services response times, differentiation between basic and advanced life support responses, time to first rhythm analysis, initial cardiac rhythms and timing of first defibrillation, and long-term neurological outcomes among survivors following hospital discharge. The systematic collection of such data through a robust national OHCA registry would be instrumental in guiding targeted interventions and improving survival and neurological outcomes at a population level.

Limitations

Owing to its retrospective design, this investigation is subject to several limitations that constrained the scope and depth of the analysis. A major limitation was the inability to accurately characterize the demographics of individuals performing cardiopulmonary resuscitation. Although differentiation between healthcare professionals and lay bystanders would be essential to better understand patterns of intervention, the retrospective nature of the dataset did not permit this distinction. This limitation restricts insight into the dynamics of bystander response and may contribute to an underestimation of the true impact of public CPR training initiatives.

Moreover, reliance on retrospectively collected data inherently depends on the accuracy and completeness of existing records, which may vary across regions and emergency medical systems. Such variability may introduce inconsistencies and potential information bias, thereby affecting the robustness and reliability of the findings.

Additionally, the study design did not allow for the assessment of neurological outcomes at 30 days following hospital discharge. The absence of standardized neurological follow-up limits the comprehensiveness of survival outcome evaluation and hampers direct comparison with international benchmarks. As neurological status is a critical component of meaningful survival, this represents a significant limitation of the present analysis.

Future research should prioritize prospective study designs capable of capturing detailed information on bystander characteristics and enabling systematic long-term follow-up of patients, including neurological outcomes. Such approaches would facilitate a more nuanced assessment of the effectiveness of bystander CPR, improve data accuracy and consistency, and support more robust comparisons with international registries, thereby strengthening the evidence base for public health interventions aimed at increasing bystander CPR rates.

Conclusions

Despite the limitations associated with the absence of a national out-of-hospital cardiac arrest registry and the retrospective design of the study, the relevance of bystander cardiopulmonary resuscitation in witnessed OHCA was clearly demonstrated, with a statistically significant positive impact on return of spontaneous circulation ($p < 0.001$). Marked disparities were observed between mainland Portugal and the Azores and Madeira archipelagos, particularly with regard to bystander CPR rates and ROSC outcomes.

This study enabled, for the first time, a characterization of the current OHCA landscape in Portugal, underscoring the urgent need to align national practice with European Resuscitation Council (ERC) recommendations. To increase

bystander CPR rates, several key measures should be prioritized, including the expansion of CPR training among the general population, improved accessibility to automated external defibrillators, and the systematic integration of basic life support education within school curricula. Timely intervention in these domains is essential to improve OHCA outcomes.

Nevertheless, meaningful improvement is contingent upon accurate and systematic measurement, highlighting the critical need for the implementation of a national OHCA registry, which should be regarded as an emerging priority within the national health system. While the study identifies encouraging indicators of effective bystander intervention in specific regions, it also clearly demonstrates the broader necessity for intensified, nationwide educational and training strategies. Enhancing public awareness and preparedness to respond to cardiac emergencies remains a pivotal step toward closing the gap with European benchmarks and ultimately improving survival outcomes.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Delhomme C, Njeim M, Varlet E, et al. Automated external defibrillator use in out-of-hospital cardiac arrest: current limitations and solutions. *Archiv Cardiovasc Dis.* **2019**;112(3):217–222. doi:10.1016/j.acvd.2018.11.001
2. Myat A, Song KJ, Rea T. Out-of-hospital cardiac arrest: current concepts. *Lancet.* **2018**;391(10124):970–979. doi:10.1016/S0140-6736(18)30472-0
3. Gräsner JT, Wnent J, Herlitz J, et al. Survival after out-of-hospital cardiac arrest in Europe - results of the EuReCa TWO study. *Resuscitation.* **2020**;148:218–226. doi:10.1016/j.resuscitation.2019.12.042
4. Böttiger BW, Van Aken H. Kids save lives - Training school children in cardiopulmonary resuscitation worldwide is now endorsed by the world health organization (WHO). *Resuscitation.* **2015**;94:A5–7. doi:10.1016/j.resuscitation.2015.07.005
5. Bateman RM, Sharpe MD, Jagger JE, et al. 36th international symposium on intensive care and emergency medicine. *Crit Care.* **2016**;20(S2):347.
6. Gräsner JT, Masterson S. EuReCa and international resuscitation registries. *Curr Opin Crit Care.* **2015**;21(3):215–219. doi:10.1097/MCC.0000000000000206
7. Christian M, Gregers T, Kjøbye JS, et al. Forbedring af overlevelsen efter hjertestop Forbedring af overlevelsen efter hjertestop uden for hospital uden for hospital. *Ugeskr Læger.* **2022**;184:V05220356.
8. Holmberg M, Holmberg S, Herlitz J. Effect of bystander cardiopulmonary resuscitation in out-of-hospital cardiac arrest patients in Sweden. *Resuscitation.* **2000**;47(1):59–70. doi:10.1016/S0300-9572(00)00199-4
9. Yamaguchi T, Nakai M, Kodama T, et al. Impact of a national initiative to provide civilian cardiopulmonary resuscitation training courses on the rates of bystander intervention by citizens and survival after out-of-hospital cardiac arrest. *Resuscitation.* **2024**;195:110116. doi:10.1016/j.resuscitation.2024.110116
10. Nishiyama C, Kiguchi T, Okubo M, et al. Three-year trends in out-of-hospital cardiac arrest across the world: second report from the international Liaison committee on resuscitation (ILCOR). *Resuscitation.* **2023**;186:109757. doi:10.1016/j.resuscitation.2023.109757
11. Nolan JP, Berg KM, Bray JE. Recent advances in ICU Out-of-hospital cardiac arrest. *Intensive Care Med.* **2023**;49(4):447–450. doi:10.1007/s00134-023-07028-5
12. Havranek S, Fingrova Z, Rob D, et al. Initial rhythm and survival in refractory out-of-hospital cardiac arrest. Post-hoc analysis of the Prague OHCA randomized trial. *Resuscitation.* **2022**;181:289–296. doi:10.1016/j.resuscitation.2022.10.006
13. Lascarrou JB, Nichol G. Treatment of out-of-hospital cardiac arrest. *JAMA Cardiol.* **2022**;7(6):643. doi:10.1001/jamacardio.2022.0803

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