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## Clinical paper

# EuReCa – The European Registry of Cardiac Arrest and the related studies <sup>☆</sup>



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### Abstract

Out-of-hospital cardiac arrest (OHCA) is a major health issue throughout Europe. Due to limited knowledge about the epidemiology of OHCA in Europe, in 2011, the European Registry of Cardiac Arrest (EuReCa) project was established. Initially based on existing resuscitation registries in a few countries, the network expanded and in October 2014 the EuReCa ONE study was launched, bringing together 27 countries and showing that appropriate data acquisition (10,682 cases submitted) is feasible within Europe. EuReCa TWO was conducted from October to December 2017 and included 37,054 cases. EuReCa THREE data collection was carried out from September to November 2022 and data analysis is currently being conducted. EuReCa TWO and THREE studies generated more robust data, with both studies covering 3-month periods in 28 countries, respectively. While EuReCa TWO focused on the bystander, EuReCa THREE investigated the impact of time-related aspects (time from call to scene, time at scene, transport times and other) on resuscitation outcomes. EuReCa is a network supporting countries in their ambition to establishing continuously running registries as quality management tools and for scientific work.

**Keywords:** Resuscitation registry, EuReCa, Out of hospital cardiac arrest, Response time, Epidemiology

## Background and history

Depending on the geographical and political definition used, Europe consists of 45–50 countries. European countries vary greatly in size and population, from Vatican City (less than 1000 inhabitants) to Germany (83.3 million inhabitants). In total, approximately 730 million people live in Europe.

The European Resuscitation Council (ERC) – comprising 33 National Resuscitation Councils – is a non-profit organisation with the objective to “preserve human life by making high quality resuscitation available to all” by providing the standard for resuscitation guidelines and training in Europe.<sup>1</sup>

In 2008, a working group of the ERC stated that knowledge about the epidemiology of Out-of-hospital cardiac arrest (OHCA) in Europe was inadequate and, based on the experience of existing resuscitation registries in some countries, work to create a framework for a European Registry of Cardiac Arrest was started.<sup>2</sup>

Since then three major studies have been conducted,<sup>3–5</sup> with subsequent subgroup analyses.<sup>6</sup> Rather than establishing a single OHCA registry, EuReCa has developed as a network of resuscitation registries throughout Europe, with members working as collaborators in extending registry coverage and optimising data quality. The newest feature of EuReCa is a dashboard provided by the ERC, showing relevant summary data on essential variables of resuscitation readily available online.<sup>7</sup>

## Resuscitation registries in Europe

There is variation in the OHCA registry models used throughout Europe, including mandatory registration of cardiac arrest in some countries e.g. Norway.<sup>8</sup> Registries can be nationwide, regional or local. Some registries are intermittent only i.e. for countries that do not have an established registry but provide data to the EuReCa-studies, the registry is live only for the study period. The breadth of

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data captured can range from cardiac arrest registries which include all patients attended by emergency medical services (EMS) for OHCA, irrespective whether CPR was started or not, while other resuscitation registries only include cases where CPR was actually started. In general, there are EMS systems with very different characteristics throughout Europe.<sup>9</sup> When interpreting data from registries and comparing these between countries, thorough knowledge of the EMS characteristics of each country is necessary for interpretation.

## The EuReCa-studies

EuReCa ONE was the first prospective observational analysis in 27 resuscitation registries in Europe, with the aim to describe differences in structure, processes and outcome related to OHCA in Europe and find explanations for these differences.<sup>10</sup> Data was recorded for one month in October 2014. The results demonstrated the feasibility of OHCA data collection across multiple countries and jurisdictions, the magnitude of the public health issue of OHCA and the huge variety in incidence, community involvement, and outcomes following OHCA.<sup>3</sup> Key findings include an OHCA incidence rate of 84 per 100,000 population for patients considered for resuscitation by the EMS (range between countries participating 19–104), a prevalence of a shockable rhythm of 22.2% (range 4.4–50.0%) and a percentage of ROSC for all countries of 28.6% (with a wide range from 9.0% to 50.0% reported).<sup>3</sup> EuReCa ONE was an important step with regard to the vision of the 2011 ERC working group to establish a European-wide registry.<sup>2</sup>

During analysis of the EuReCa ONE results and discussion with the National Coordinators (see below), the investigators noticed that definitions of OHCA related aspects – although explicitly defined in the Utstein definitions<sup>11</sup> – were interpreted differently in daily practice throughout Europe. Of particular note was the definition of a “bystander”, which is a very important component in the chain of survival.

A survey confirmed substantial and important differences in the interpretation of ‘bystander CPR’ among EMS personnel, particularly in relation to the discrimination of bystanders or people sent to the scene as part of community response.<sup>12</sup> To add to knowledge on bystanders, EuReCa TWO focused on the role, age and gender profile of bystanders in OHCA in Europe. EuReCa TWO showed bystander CPR rates ranged from 13% to 82%.<sup>4</sup> ROSC rate (32.3%) and overall survival to hospital discharge (9.1%) was better when CPR was started by a bystander than when CPR was initiated by either a person sent to help or by the EMS (28.2%/4.3%). Of the cases for which the type of CPR was reported, 72% received chest compression only CPR, 28% received chest compressions and ventilations.<sup>4</sup>

By extending the study period to three months (October–December 2017) in EuReCa TWO, the robustness of estimates describing incidence and outcome were improved.<sup>13</sup> During analysis of data collected in EuReCa TWO substantial differences in response times were observed, forming a basis for further research.

The aim of the EuReCa THREE study was to build on previous work and to continue to support the promotion of quality data collection on OHCA throughout Europe. Specific research questions in this study refer to “times”, e.g. response time, on-scene-time, transport-time and others.<sup>5</sup> The study period was September to November 2022. Data analysis is ongoing but preliminary results show an

average response time of more than 12 min in Europe with substantial heterogeneity.

EuReCa studies have been carried out over the relatively short time periods of one month and three months. While it would be ideal to have longer study periods, that would help account for factors such as seasonality, considering the different types of and status of OHCA registries throughout Europe, including the fact that some are live only for the study period, it was necessary that pragmatism should outweigh idealism, and shorter time periods were used.

The multiple data sources used for EuReCa studies may give rise to concern about data quality. EuReCa studies are governed by a Steering Committee, and an experienced statistician oversees strict data control including data plausibility checks. Data quality issues are discussed with all NCs in several interactive sessions, and on an individual basis if specific data quality concerns are identified.

The large number of cases in the EuReCa studies allows for important subgroup analyses. For example, Whent et al. used EuReCa TWO results to show that full CPR including chest compressions and ventilations was associated with higher survival compared to chest compression only bystander CPR.<sup>6</sup>

## The EuReCa network

The EuReCa project is managed and organised by a Steering Committee. For each country a National Coordinator (NC) is appointed. For each EuReCa study, every participating country must nominate one NC who is an expert on the field of resuscitation and registry work in their country. The NC is representing her or his country in the study and is the main contact person for the Steering Committee. For countries that have more than one registry, the responsibility for nominating the National Coordinator is with the participating country.

The NCs have several obligations that are clearly stated in a memorandum of understanding, including assuring a valid ethical approval for their respective country. In this context, European General Data Protection Regulation (GDPR) has considerable impact on data acquisition for the EuReCa studies. Although binding in all European nations, interpretation differs from country to country. For example, in EuReCa THREE the local application of this regulation prohibited Finland’s participation.

Table 1 shows the countries participating in the EuReCa studies. Fig. 1 displays a map of Europe, highlighting countries delivering data for EuReCa THREE. EuReCa is encouraging other European countries to participate in the network to get an even better picture of epidemiology, treatment and outcome of OHCA in Europe.

Within the EuReCa network, study proposals can be submitted to the Steering Committee. The Steering Committee considers all applications thoroughly and always include the NCs of all countries involved in the respective proposal in the process of decision and data sharing.

## Future considerations

EuReCa THREE data is currently being analysed and will allow further research through subgroup analyses. The ERC cardiac arrest dashboard (<https://www.cpr-dashboard.erc.edu>), launched at the ERC conference in Barcelona in November 2023, will help to spread knowledge about OHCA in Europe to people with and without scientific background.<sup>7</sup>

**Table 1 – Participants in EuReCa-studies.**

	COUNTRY	ONE	TWO	THREE
AL	Albania			X
AT	Austria	X	X	X
BE	Belgium	X	X	X
BA	Bosnia-Herzegovina		(X)	X
HR	Croatia	X	X	
CY	Cyprus	X	X	X
CZ	Czech Republic	X	X	X
DK	Denmark	X	X	
FI	Finland	X	X	
FR	France	X	X	X
DE	Germany	X	X	X
GR	Greece	X	X	X
HU	Hungary	X	X	X
IS	Iceland	X	X	X
IT	Italy	X	X	X
IE	Ireland	X	X	X
LT	Lithuania			X
LU	Luxembourg	X	X	X
MT	Malta			X
NL	Netherlands	X	X	X
NO	Norway	X	X	X
PL	Poland	X	X	X
PT	Portugal	X	X	X
RO	Romania	X	X	X
RS	Serbia	X	X	X
SK	Slovakia	X	X	X
SI	Slovenia	X	X	X
ES	Spain	X	X	X
SE	Sweden	X	X	X
CH	Switzerland	X	X	X
UK	United Kingdom	X	X	X

Countries participating in EuReCa studies. Swiss data in EuReCa THREE covers Liechtenstein as well (first column: ISO 3166-1 country codes).

The EuReCa dataset is in line with the Utstein definitions.<sup>11</sup> Upcoming Utstein reporting updates will be adapted as soon as possible by all existing local/regional/nationwide registries as well as the EuReCa studies.

Prospective registries are essential to understand the health outcomes of clinical practice in the real world. Without them, new strategies and their implementation in the field cannot be evaluated.

Cardiac arrest registries in Europe hold great potential for advancing our understanding of cardiac arrest. These databases can contribute to improved insights into the prevalence, outcomes, and response dynamics across different regions. The continual expansion and enhancement of these registries may facilitate more effective strategies for prevention, intervention, and overall management of cardiac arrest.

Additionally, ongoing collaboration and standardisation efforts in data collection could enhance the comparability of findings, fostering a comprehensive approach to addressing cardiac arrest on a European scale. In addition, cardiac arrest survival can be used as a metric to evaluate the quality of the EMS, considering the critical nature of such incidents. By examining these aspects, policymakers and healthcare professionals can gauge the overall effectiveness and quality of EMS services in responding to cardiac arrest incidents. Regular assessment and continuous improvement efforts based on these measures can enhance the overall performance of the EMS.

Resuscitation of people who have an OHCA is an issue that affects the wider public and health system beyond the EMS.

It impacts the community as well as the hospital and beyond, including additional resources like rehabilitation. Resuscitation registries may therefore give hints on the wider health system performance.

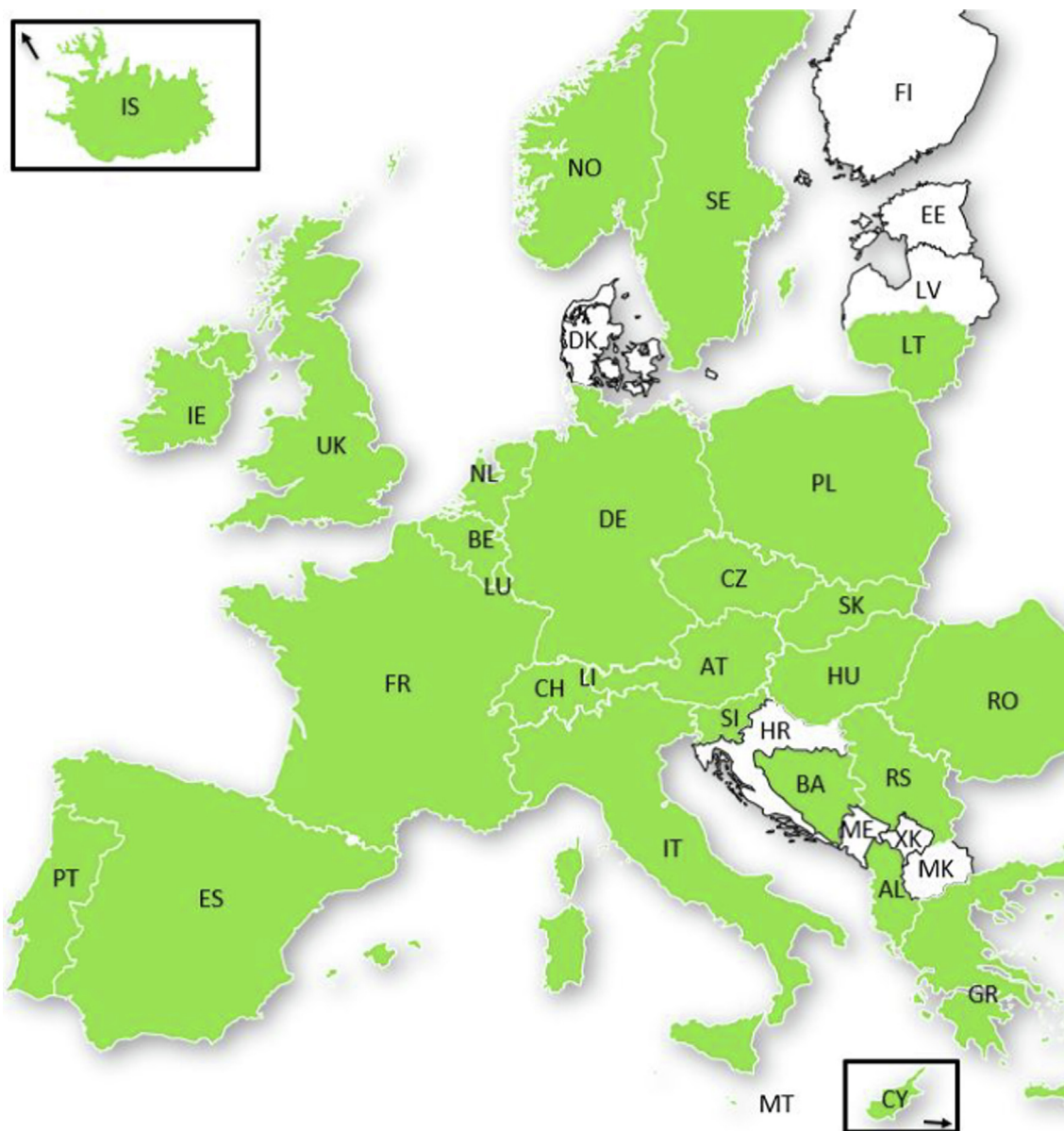
The EuReCa network is an active community and striving for expansion in Europe with all involved sharing the underlying objective of improving outcomes for patients who have an OHCA. The Steering Committee appreciates the huge work done by all contributors to the studies and the network.

### **CRedit authorship contribution statement**

**Holger Maurer:** Writing – original draft, Data curation. **Siobhán Masterson:** Writing – review & editing, Methodology. **Ingvild Beathe Myrhaugen Tjelmeland:** Writing – review & editing, Resources. **Anneli Strömsöe:** Writing – review & editing. **Fernando Rosell Ortiz:** Validation. **Jan-Thorsten Gräsner:** Supervision, Conceptualization. **Jan Wnent:** Writing – review & editing, Project administration.

### **Declaration of competing interest**

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: 'JTG is the leader of the EuReCa steering committee, the principal investigator of EuReCa ONE, TWO and THREE and the Leader



**Fig. 1 – Map of countries participating in EuReCa THREE study (ISO 3166-1 country codes).**

of the German Resuscitation Registry steering committee. JTG is an Guest Editor for Resuscitation Plus and was not involved in the editorial review or the decision to publish this article. JW is member of the EuReCa steering committee and the German Resuscitation Registry steering committee and declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. All other authors are members of the EuReCa steering committee and declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper’.

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