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## **Incidence of Sudden Cardiac Death in the European Union**

**Brief Title:** Incidence of sudden cardiac death in Europe

Empana Jean-Philippe<sup>1,2</sup> MD, PhD, Ivan Lerner<sup>1,2</sup> MD, Eugenie Valentin<sup>1,2</sup> MSc, Fredrik Folke<sup>3,4</sup> MD, PhD, Bernd Böttiger<sup>5</sup> MD, PhD, Gunnar Gislason<sup>3,4</sup> MD, PhD, Martin Jonsson<sup>6</sup> PhD, Mattias Ringh<sup>6</sup> MD, PhD, Frankie Beganton MSc,<sup>1,2</sup> Wulfran Bougouin MD, PhD,<sup>1,2,7,8</sup> Eloi Marijon<sup>1,2</sup> MD, PhD, Marieke Blom<sup>9</sup>, PhD, Hanno Tan<sup>9,10</sup> MD, PhD, Xavier Jouven<sup>1,2</sup> MD, PhD for the ESCAPE-NET Investigators

<sup>1</sup> Université de Paris, INSERM U970, Paris Cardiovascular Research Centre, Integrative Epidemiology of Cardiovascular disease, Paris, France

<sup>2</sup> Paris Sudden Death Expertise Centre (SDEC), Paris, France

<sup>3</sup> Copenhagen University Hospital – Copenhagen Emergency Medical Services, Denmark

<sup>4</sup> Department of Cardiology, Copenhagen University Hospital – Herlev and Gentofte, Copenhagen, Denmark

<sup>5</sup> Department of Anaesthesiology and Intensive Care Medicine , University Hospital of Cologne, Germany

<sup>6</sup> Karolinska Institutet, Center for Resuscitation Science, Department of clinical science and education, Södersjukhuset, Stockholm Sweden

<sup>7</sup> Medical-Surgical Intensive Care Unit, Ramsay Generale de Sante', Hôpital Privé Jacques Cartier, Massy, France;

<sup>8</sup> AfterROSC net- work, Paris, France

<sup>9</sup> Amsterdam UMC location AMC, Department of Clinical and Experimental Cardiology, Amsterdam, The Netherlands

<sup>10</sup> Netherlands Heart Institute, Utrecht, The Netherlands

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**Corresponding Author:**

Pr Xavier Jouven,

Paris Sudden Death Expertise Centre (SDEC), Paris, France; Université de Paris, INSERM U970, Paris Cardiovascular Research Centre, Integrative Epidemiology of Cardiovascular disease, Paris, France

56 Rue Leblanc, 75015 Paris, France

Xavier.jouven@inserm.fr; 33 1 56 09 36 87

**Twitter:** Data from four large population-based registries in Europe suggests that at least 249,538 [155,377 - 343,719] sudden cardiac death cases and 343,496 [216,472 - 464,922] out of hospital cardiac arrest cases occur each year in the European Union. # cardiac arrest # sudden death expertise centre #escapenet

## **Abstract**

**Background:** Although recognized as a high-priority public health topic, reliable estimates of the incidence of sudden cardiac death (SCD), or more broadly out-of-hospital cardiac arrest (OHCA) in the population are scarce, especially in the European Union.

**Objective:** The study objective was to determine the incidence of SCD and OHCA in the European Union (EU).

**Methods:** Four European large (i.e. more than 2 million inhabitants) population-based prospective registries collecting emergency medical service (EMS) attended (i.e. with attempted resuscitation) OHCA and SCD (OHCA without obvious extra cardiac causes) for more than five consecutive years from January 2012 to December 2017 in the Paris region (France), North Holland region (The Netherlands), Stockholm region (Sweden) and in all Denmark were examined.

**Results:** The average annual incidence of SCD in the four registries ranged from 36.8 [95% CI, 23.5 - 50.1] to 39.7 [32.6 - 46.8] per 100,000. When extrapolating to each European country accounting for age and sex, this yields to 249,538 [155,377 - 343,719] SCD cases per year. The average annual incidence of OHCA in the four registries ranged from 47.8 [21.2 – 74.4] to 57.9 [19.6 – 96.3] per 100,000, corresponding to 343,496 [216,472 - 464,922] OHCA cases per year in the EU. Incidence rates of SCD and OHCA increased with age and were systematically higher in men compared to women.

**Conclusions:** By combining data from four large population-based registries with at least 5 years of data collection, we provide an estimate of the incidence of SCD and OHCA in the EU.

## **Condensed abstract**

By combining data from four large population-based registries collecting emergency medical service data between 2012 and 2017 in the Paris region (France), North Holland region (The Netherlands), Stockholm region (Sweden) and in all Denmark, at least 249,538 [155,377 - 343,719] sudden cardiac death cases per year, and 343,496 [216,472 - 464,922] out of hospital cardiac arrest cases per year are estimated in the European Union. This study supports the high burden of sudden cardiac death in the European population and the need for preventative strategies.

**Key words:** cardiac arrest; sudden cardiac death; incidence rates; registries

#### **Abbreviation list**

SCD: sudden cardiac death

OHCA: out-of-hospital cardiac arrest

AED: automated external defibrillator

EMS: emerging medical service

SDEC: Paris-Sudden Death Expertise Center

ARREST: the AmsteRdam REsuscitation STudies

SRCR: the Swedish Register for Cardiopulmonary Resuscitation

DCAR: the Danish Cardiac Arrest Registry

ROSC: return of spontaneous circulation

## **Introduction**

Although recognized as a high-priority public health topic, there are to date no reliable estimates of the incidence of sudden cardiac death (SCD), or more broadly out-of-hospital cardiac arrest (OHCA), in the European Union (EU). [1,2] In the US population, SCD - i.e. an OHCA without obvious non-cardiac causes - accounts for 185,000 to 450,000 deaths each year, representing between 7% and 18% of all deaths [3,4]. Yet, an accurate estimate of the SCD as well as OHCA incidences and trends is of utmost importance to help defining preventative strategies and also in measuring the impact of public health policies, including identification of high-risk subjects, the deployment of automated external defibrillators (AEDs) and education program on the chain of survival after OHCA.

EURECA ONE was the first concrete European attempt to assess the incidence of OHCA by collecting data over 1 month all over the continent. [5] Covering 27 countries, the incidence rate ranged from 24 to 177 cases per 100,000 person years likely illustrating consistent differences in definitions, data collections and EMS organizations through Europe. [6-8] Assessing the incidence of SCD and OHCA is a difficult process indeed. The incidence rate must be calculated from an extensive and comprehensive collection of cases. The only reliable way to measure an incidence rate is from a registry, which aims at identifying all cases in a designated area. [9] The task is then that of regrouping the cases from all actors (public and private, emergency-physician or paramedic based, etc.) involved in the EMS response, which for cultural, historical and geographical reasons differ between countries [10, 11]. Also, there are difficulties in reporting and capturing cardiac arrests across regions and over time in a consistent manner. [11]

Addressing these issues is necessary, and the CARES surveillance group in the U.S. has put considerable effort into a comprehensive identification of cardiac arrest cases from all sources (911, emerging medical service (EMS) and hospitals), and stressed the use of

consistent definitions across all centers [12]. The present study is the second European attempt to determine the incidence of SCD and OHCA in the EU, and characterize its recent trends. Taking into account the previous difficulties, we have chosen to restrict the collection of data from large centers (covering regions of at least one million inhabitants), with ongoing prospective population-based registries collecting extensively all EMS attended cases (i.e. with attempted resuscitation) for more than 5 consecutive years with a constant definition of cases over time. [13–17] This study is part of the European Union funded ESCAPE-NET project aiming to identify the determinants of sudden cardiac arrest occurrence and sudden cardiac arrest survival in Europe. [18]

## **Material and methods**

### Design

Four centers that participate in the ESCAPE-NET project fulfilled the required conditions. Therefore, we studied the incidence rate of SCD and OHCA in four population-based registries (Table 1): the Paris-Sudden Death Expertise Center (SDEC) [13], the AmsteRdam REscustation STudies (ARREST) [14], the Swedish Register for Cardiopulmonary Resuscitation (SRCR) [15,16] and the Danish Cardiac Arrest Registry (DCAR) [17]. Patient age group, sex and the presumed cause of cardiac arrest were recorded according to Utstein definition [10]. Reporting was made according to STROBE guidelines [19].

### Data collection

#### *SDEC*

The SDEC registry is a population-based registry covering the entire population from Paris and its suburbs (Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne), including a residential population of approximately 6.8 million and covering 762 km<sup>2</sup>. The SDEC registry covers 10.1% of the French population. Every case of EMS attended (i.e. with attempted resuscitation) or unattended (i.e. without attempted resuscitation) OHCA was extracted, from

1 January 2012 to 31 December 2019. The data collection process is based on extensive collection of cases from multiple sources involved in the chain of survival, previously described [13].

#### *SRCR*

The SRCR was established in 1990 and, similarly to the Paris registry collects data on all EMS attended or unattended OHCA [15,16]. Since 2010, all regions in Sweden have reported to the register. Data collected in the Stockholm Region between 2010 and 2015 are included in the study. Data are reported prospectively by the EMS-personnel using an Utstein based template. The Stockholm region had a population of 2.2 million in 2015, covering 23.6% of the overall population.

#### *ARREST*

ARREST is an ongoing prospective community-based registry of all EMS attended OHCA with medical cause since July 2005 in the Dutch province of North Holland (2,404 km<sup>2</sup> with both urban and rural communities, population of 2.4 million people covering 16.3% of the overall population of the Netherlands) [14]. OHCA patients with defibrillation by bystanders or first responders only (AED) and ROSC at arrival of the ambulance are also included in this registry. If already deceased, OHCA patients are not included in the registry.

#### *DCAR*

Denmark covers 42,933 km<sup>2</sup>; from 2001 to 2018, the population increased from 5.4 to 5.8 million. Since June 1, 2001, EMS personnel in Denmark have systematically reported to the DCAR every case of EMS attended OHCA [17]. The registry covers 100% of the Danish population. An OHCA was included when a clinical condition of cardiac arrest resulted in resuscitation efforts either by bystanders (with activation of the EMS system) or by EMS personnel. The capture of cardiac arrest cases is nearly complete because the EMS system is activated for all emergencies concerning cardiac arrest, and the definition excludes cases with



obvious late signs of death (e.g., *rigor mortis*) for which resuscitative efforts are not initiated. Importantly, EMS personnel are required to complete a short case report form for the DCAR for every OHCA. Since 2015, the collection of data became digital.

#### Outcome definition

For homogeneity between the four registries, only EMS attended (i.e. with attempted resuscitation) OHCA without dead on arrival were examined and represent the main outcome study. In secondary analysis, all OHCA (i.e. EMS attended or unattended) that were only collected in the SDEC and SRCR registries were considered as secondary outcomes. SCD was defined as an OHCA with absence of obvious external cause according to Utstein definition, i.e. such as drowning or trauma. [10]

#### **Ethical considerations**

Ethical permission was authorized by the ethical committee in Stockholm for the SRCR registry (Reference number 2015/1122-31/5), the Ethics Committee of the Academic Medical Center, a teaching hospital in Amsterdam, for the ARREST registry, the appropriate review boards in Paris (CNIL approval #912309 and CCTIRS approval #12336) for the SDEC registry, and the Danish Data Protection Agency (2007-58-0015, local reference No. GEH-2014–017, I-Suite No. 02735) for the DCAR registry; in Denmark, ethics approval is not required for registry-based studies.

#### **Data sharing**

The data underlying this article cannot be shared publicly in the absence of data sharing consent from the (surviving) patients.

#### ***Statistical analysis***

Incidence rate of SCD/OHCA was computed as the number of cases divided by the total person-years (PY) and reported for 100,000 PY. Within each registry, the yearly incidence rates of SCD and OHCA were estimated and then averaged over the entire follow-up. In the

Danish registry however, incidence rates of SCD are averaged over the year 2012 to 2015 since data in 2016 and 2017 were not available at the time of analysis. Still and for descriptive purposes only, incidence rates for these two years were imputed according to the average incidence calculated over the previous years in the registry. Then, the weighted average incidence rate of the four registries was combined and its 95% confidence interval (CI) was computed including a random effect on the country. [20] These rates were thereafter stratified by age group (<18, 18-39, 40-64, 65-79, 80+) and sex and applied to the age and sex population structure of each European country based on 2017 census data [21] to obtain an expected number of SCD and OHCA within each country. For countries where local registries exist (France, the Netherlands, Denmark and Sweden), the average incidence rate of each registry was used to estimate the expected number of SCD and OHCA in these countries. We also calculated the incidence rates and 95% CIs of SCD and OHCA in each country by dividing the number of estimated events by the size of the country specific population (2017 European census). Yearly trends in incidence rates of SCD and OHCA were estimated by Poisson regression, using the log of PY as the offset.

In secondary analysis, we estimated the incidence and expected numbers of all OHCA (i.e. EMS attended or unattended) together with the corresponding figures for SCD, using data only available in the Swedish and Parisian registries.

Two-tail p-value < 0.05 was considered significant. Implementation was done under R v3.5.1 with the package meta [22] and Excel (Microsoft Corporation, Redmond, Washington).

## **Results**

### *Incidence rates of SCD across the four registries*

From January 2012 to December 2017 representing 109,350,304 PY, a total of 41,990 SCD cases were observed over the four registries. The average incidence rate ranged from 36.8

[95% CI, 23.5 - 50.1] to 39.7 [32.6 - 46.8] per 100,000 PY, respectively (Central Illustration).

No significant variability in the yearly incidence rates was noticed.

#### *Incidence rates of OHCA across the four registries*

From January 2012 to December 2017 representing 126,587,514 PY, a total of 72,114 EMS-attended OHCA cases were observed over the four registries. The average incidence rate ranged from 47.8 [21.2 – 74.4] in 2012 to 57.9 [19.6 – 96.3] per 100,000 PY in 2017 (p for trend  $p < .0001$ ) respectively (Figure 1). As for SCD, no significant variability in the yearly incidence rates of OHCA was observed. Still, in the DCAR, incidence rates were stable between 2012 and 2015 (paper form registration of OHCA) and a marginal increase was noted between 2015 and 2017 (digital registration of OHCA).

#### *Age and sex stratified analysis*

In both men and women, the incidence of SCD and OHCA increases with age. However, the incidence was systematically higher in men as compared to women in each age group, with men to women incidence rate ratios ranging from 1.37 to 1.94 for SCD (Figure 2, panel A) and from 1.56 to 2.17 for OHCA (Figure 2, panel B) across age groups respectively.

#### *Main clinical characteristics and circumstances surrounding OHCA across the four registries*

As reported in Table 2, median age ranged from 68.0 to 72.0 years, one third of the cases were women and the vast majority of the cases (66.8 to 75.5%) occurred at home. Only one fifth of the cases had VT-VF as initial rhythm, except in the Dutch registry where VT-VF was seen in 42% of the cases. A bystander was present in more than 70% of the cases in the Paris and the Dutch registries, but only in 43.3% of the cases in the Danish registry. The rates of bystander CPR ranged from 51.2% to 76.0%. Regarding immediate prognosis, 29.2% to 41.8% had return of spontaneous circulation (ROSC), and 30.7% to 60.4% of the cases were transferred to hospital.

### *Estimated number of SCD and OHCA cases in the European Union*

After standardization, a total of 249,538 [155,377 - 343,719] SCD cases are expected each year in the EU, corresponding to an estimated incidence of 48.6 [30.3 - 67.0] per 100,000 PY (Figure 3). Similarly, a total of 343,496 [216,472 - 464,922] EMS-attended OHCA cases are expected each year in the EU, with an estimated incidence rate of 66.9 [42.2- 90.6] per 100,000 PY. Detailed estimates by country can be found in Table S1 and S2.

In secondary analyses, when also including unattended EMS cases (only available in the Swedish and Parisian registries), 60,254 SCD and 64,272 OHCA were additionally retrieved. After extrapolation, this leads to 309,792 expected SCD in the EU each year and a corresponding estimated incidence of 60.4 [49.3 - 66.9] per 100,000 PY. Similarly, this leads to 407,768 expected OHCA in the EU each year and a corresponding estimated incidence of 79.4 [67.6 - 91.1] per 100,000 PY.

### **Discussion**

By combining data from four large (i.e. more than 2 million inhabitants) population-based prospective registries covering regional (Paris area, France, North Holland region, The Netherlands and Stockholm region, Sweden) and national areas (Denmark), we attempt to estimate of the incidence of SCD and OHCA events in the EU and their respective trends over the study period from 2012 to 2017. A total of 249,538 [155,377 - 343,719] SCD and 343,496 [216,472 - 464,922] EMS attended OHCA are expected each year in the EU. When EMS unattended cases are included, the figures reach respectively 309,792 SCD and 407,768 OHCA cases each year in EU. Only slight, but no clinically meaningful trends over the study period in either SCD or OHCA incidence rates were observed.

Data on the incidence rates of SCD or OHCA in Europe are scarce and mostly rely on prospective observational studies. In a systematic review of peer-reviewed European community reports published between 1980 and 2004, Atwood et al. estimated the incidence

of EMS attended OHCA of presumed cardiac cause to be 37.7 per 100,000 PY. [1] In a more recent systematic review based on data published between 1990 and 2009, Berdowski et al. estimated the incidence of EMS attended OHCA of presumed cardiac origin in Europe to be 25.7 per 100,000 PY. [2] These rates are much lower than those 48.6 [30.3 - 67.0] cases per 100,000 PY reported in the present study. This may be due in part to the lack of exhaustiveness of OHCA cases in cohort studies as compared to population-based registries as in the present case. Using data collected during one month in 2014 in 248 regions from 27 European countries, the EuReCa ONE study reported an incidence rate of 84 per 100,000 population per year for all OHCA [5] compared to 79.4 [95% CI: 67.6 - 91.1] per 100,000 PY in the present study. Noteworthy, EuReCa ONE combines registry data (in the epidemiological sense) and local EMS data. This heterogeneity in the study design together with differences in definitions, data collections and EMS organizations through Europe is more likely contributing to the 7.38- fold variation in the incidence estimates across regions (range 24 to 177 cases per 100,000 person years), than reflecting a true epidemiological difference. To minimize these biases, we have selected population-based registries with comparable EMS- organization, data collection, and as much as possible harmonized outcome definitions. Accordingly, we calculated a 1.68- fold variation in the incidence rates estimates across the EU (range 50.8 to 85.6 per 100,000 PY). Using data collected over a three months period (October to December 2017), EuReCa-Two reported an incidence rate of EMS attended OHCA of 56 per 100,000 population per year (range 21–91 per 100,000 population per year) [23], to be compared with 66.9 [42.2 - 90.6] per 100,000 PY incidence rate in the present study. Of note, incidence estimates in EuReCa One and EuReCa Two derive respectively from one month and three months data collection [5,23], whereas seasonal variation in OHCA incidence has been reported. [24,25]

Data on the incidence of OHCA or SCD from population-based registries are scarce. After extrapolation of EMS data collected in registries in 8 US sites between May 2006 and April 2007, the annual incidence of OHCA in the US population in 2006-07 was estimated to be 294,851 (95% CI: 236,063-325,007), which is consistent with the figures reported in the present study, 343,496 [216,472 - 464,922]; no estimates were provided for SCD in this US study. [26] Based on the Aus-ROC Epistry collecting EMS data at several sites in Australia and New Zealand, the age and sex standardized incidence rate of attended OHCA was 99.2 [71.9- 105.6] per 100,000 per population in 2015, higher than the currently reported incidence of 66.9 [42.2- 90.6] per 100,000 population. [27] In Japan, data from the national OHCA registry (All\_Japan\_Utstein registry) reports lower incidence with an age-adjusted annual incidence of out-of-hospital cardiac arrests among adults aged 18 years or older of 54.1 per 100,000 person-years during 2005 to 2007. [28]

To our best knowledge, this is the first estimation of SCD and OHCA in EU exclusively based on population-based registries that covers a defined geographic area and uses consistent definitions across registries [13–17]. There was no major variability across the registries in the distribution of the main characteristics that may impact on incidence rates estimates, including age, sex, the location of the arrest or the delays of intervention. Variability across the registries was mainly seen for the proportions of ROSC and transported to the hospital but these do not affect incidence rates estimates of either SCD or OHCA. The study expands on previous ones by updating years of examination (2012 to 2017) and by providing trends over 5 to 8 years. The slightly increasing trend in OHCA incidence in the four registries is likely due to a change in the data collection process of the DCAR registry in 2015 from a paper to digital data collection (personal communication). Remarkably, the incidence of SCD did not show any significant variations across years and centers. Definition for SCD is more specific than for overall OHCA, minimizing classification bias. However,

given the decrease in the age-standardized prevalence of cardiovascular disease (CVD) in Western Europe, in part thanks to improvements in the control of CVD risk factors [29], one might have expected the incidence of SCD to decrease as well. The absence of such a trend in the present study supports the primary importance (although challenging) of identifying those individuals from the general population, where most SCD occur, who are the most at risk of developing SCD. [30] Previously developed risk prediction models lack specificity as they are equally predictive of non SCD events. [ 31] There are ongoing European initiatives including the ESCAPE-NET and PROFID projects that aim to develop and validate risk prediction models for SCD in the EU by combining inherited and acquired risk factors from various areas. [18,32]

The present study is not without limitations. When extrapolating incidence rates of SCD and OHCA from the 4 European population-based registries to the EU as a whole, we were only able to account for the age and sex structure of each country. We are therefore ignoring difference between the countries regarding the distribution of additional risk factors and genetic characteristics, the living settings and EMS organization. For instance, this study lacks data from East-European countries, where the prevalence of risk factors and CVD are higher than Western European countries, so that the incidence of SCD and OHCA in these countries is expected to be higher than in Western countries [28]. Also, two of the four registries cover a mostly urban population and differences in OHCA incidence according to population density has been reported. [33-34] Most patients examined in the four registries were of Caucasian descendants, while variations in OHCA incidence rates according to the continents have been reported. [2] Furthermore, the incidence of EMS unattended cases was only available in two out of the four registries and is therefore likely to be underestimated. Also, SCD and OHCA for which an EMS was not deployed were not collected in the present work. Taken together, the overall incidence rates of SCD and OHCA reported here are likely

to be underestimated. SCD were of presumed cardiac cause according to the Utstein criteria. While this approach is used in the field, autopsy data is challenging the accuracy of such definition since just over half of presumed SCDs (according to WHO definition, sudden unexpected death either within 1 hour of symptom onset (event witnessed), or within 24 hours of having been observed alive and symptom free (unwitnessed)) were actually autopsy-defined sudden arrhythmic death in the POST SCD study. [35]

### **Conclusions and Relevance**

This analysis provides estimates of the current incidence of SCD and OHCA in Europe based on four large population-based prospective registries. The findings suggest that at least, 249,538 SCD and 343,496 OHCA cases are expected each year in the EU. The results of this study can be used as a basis to evaluate future public health policies targeting risk factors for SCD or OHCA in the EU, as we will continue to provide and enrich this indicator by including more population-based registries to better reflect population, living settings and EMS organization diversity across Europe.



## **PERSPECTIVES**

*Competences in Medical Knowledge:* Data from population-based registries provide as minimum estimates 249,538 cases of sudden cardiac death and 343,496 cases of out-of-hospital cardiac arrest annually in the European Union.

*Translational Outlook:* Public health policies targeting risk factors for sudden cardiac death and out-of-hospital cardiac arrest should account for variations in demographics, living settings, and emergency medical services organization across Europe.

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## Figure Legends

### **Figure 1. Trends in the incidence of EMS attended out-of-hospital cardiac arrest**

Incidence rate of out-of-hospital cardiac arrest for 100,000 person-years for the four registries (color bars). Weighted average incidence rate and its 95% confidence interval across registries (black line).

SDEC: Sudden death expertise centre; DCAR: Danish Cardiac Arrest Registry; SRCR: the Swedish Register for Cardiopulmonary Resuscitation; ARREST: the AmsteRdam REscustation Studies

### **Figure 2. Incidence rates of sudden cardiac death and out-of-hospital cardiac arrest**

Panel A. Incidence rates of sudden cardiac death by age and sex.

Panel B. Incidence rates of EMS attended out-of-hospital cardiac arrest by age and sex.

The average incidence rates of sudden cardiac death and out-of-hospital cardiac arrest by age and sex across the 4 registries, together with the corresponding incidence rate ratios of men vs. women by age are reported.

SDEC: Sudden death expertise centre; DCAR: Danish Cardiac Arrest Registry; SRCR: the Swedish Register for Cardiopulmonary Resuscitation; ARREST: the AmsteRdam REscustation Studies

### **Figure 3. Burden of sudden cardiac death in the European Union**

The average incidence rates of sudden cardiac death (SCD) by age and sex across the 4 registries were applied to the age and sex population structure of each European country based on 2017 census data to estimate the yearly numbers of SCD within each country. Those numbers were thereafter divided by the size of the country specific population (2017 European census) to estimate the incidence rates of SCD in each country.

PY stands for person-years

**Central Illustration. Trends in the incidence of sudden cardiac death.**



Incidence rate of sudden cardiac death for 100,000 person-years for the four registries (colored bars). In 2016 and 2017, incidence rates in the DCAR were missing and have been imputed by the average incidence over the previous years (dashed bars). Weighted average incidence rate and its 95% confidence interval across registries (black line).

SDEC: Sudden death expertise centre; DCAR: Danish Cardiac Arrest Registry; SRCR: the Swedish Register for Cardiopulmonary Resuscitation; ARREST: the AmsteRdam REscustation Studies

**Table 1. Characteristics of the four registries**

<b>Registry</b>	<b>Geographic area</b>	<b>Population (Coverage %)</b>	<b>Years</b>	<b>OHCA definition</b>	<b>SCD definition</b>
<b>SDEC</b>	Paris and its suburbs, France	6.8 million (10.1)	2012-2019	EMS or bystander attended or unattended	Utstein based on EMS records and hospital records
<b>SRCR</b>	Stockholm region, Sweden	2.2 million (23.6)	2010-2017	EMS or bystander attended or unattended	Utstein based on EMS records and hospital records
<b>DCAR</b>	Denmark	5.8 million (100)	2012-2017	EMS or bystander attended with exclusion of deceased on arrival	Utstein based on EMS records and hospital records
<b>ARREST</b>	North Holland, the Netherlands	2.4 million (16.3)	2012-2017	EMS attended or bystander AED-treated with ROSC at EMS arrival	Utstein based on EMS and patient interview, general practitioner database, hospital records

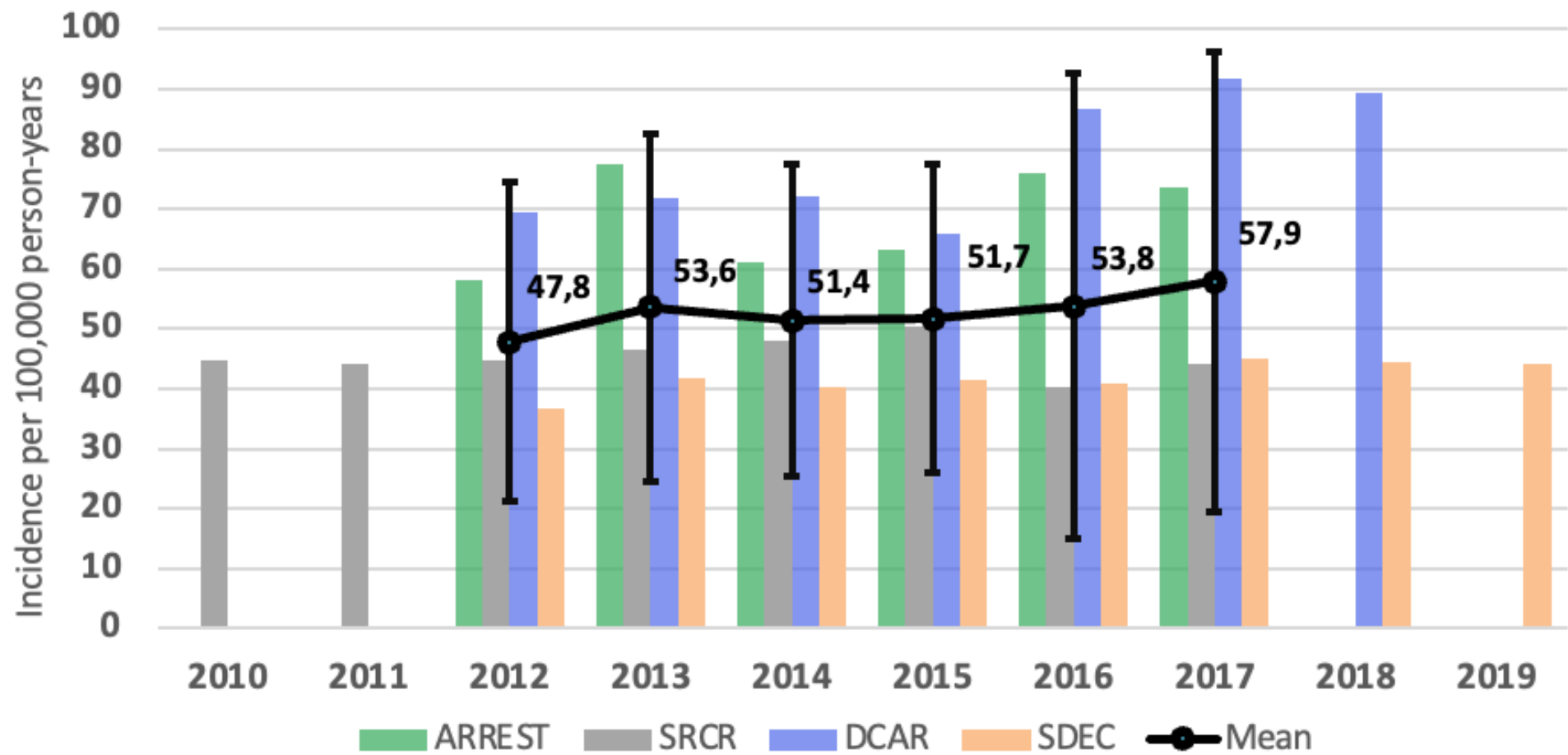
SDEC: Sudden death expertise centre; DCAR: Danish Cardiac Arrest Registry; SRCR: the Swedish Register for Cardiopulmonary Resuscitation; ARREST: the AmsteRdam REscustation Studies; EMS: Emergency Medical Services; ROSC: Return of spontaneous circulation; AED: automatic external defibrillator.

EMS attended means with attempted resuscitation

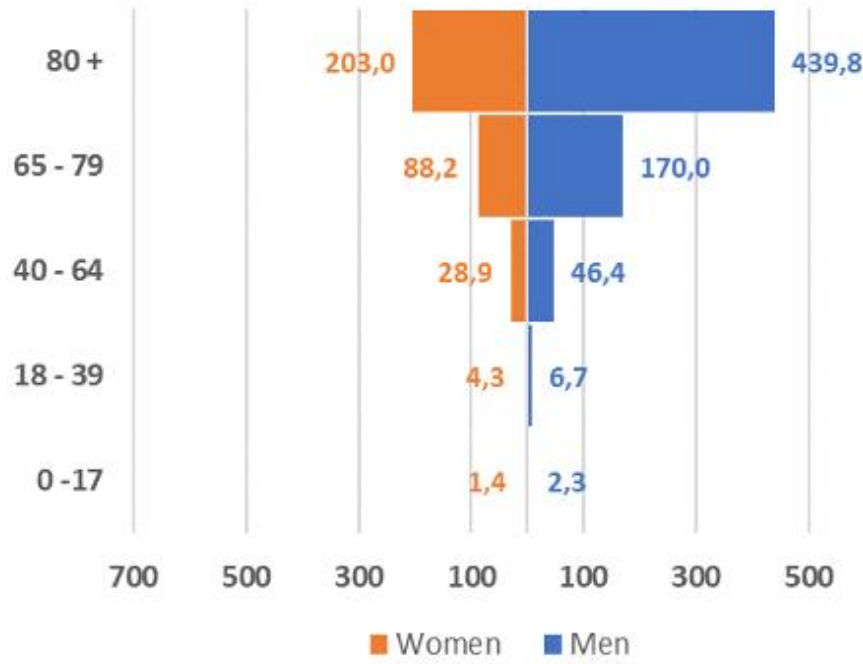
**Table 2. Main clinical characteristics and circumstances surrounding OHCA across the four registries**

	ARREST N=5825	SDEC N=14581	SRCR N=6346	DCAR N=15238
Female sex	29.2%	35.3%	34.3%	36.6%
Median age (q1-q3)	68.0 (59.0-78.0)	68.5 (55.6 – 81.4)	71.0 (59.0- 81.0)	72.0 (61.0- 82.0)
OHCA at non-public place	73.2%	75.5%	66.8%	73.3%
OHCA at public place	26.8%	24.5%	33.2%	26.7%
Witnessed OHCA	71.9%	79.2%	-	43.3%
Bystander CPR performed	76.0%	71.7%	51.2%	66.4%
Bystander AED used	10.6%	3.2%	2.3%	3.2%
VT-VF as first recorded rhythm	42.2%	26.7%	20.5%	20.4%
Median time between dispatch call and ambulances arrival, minutes (q1-q3)	8.5 (6.6-10.8)	9.0 (7.0-12.0)	9.0 (6.0- 13.0)	-
ROSC	41.8%	40.7%	33.2%	29.2%
Transferred to hospital alive	59.6%	30.7%	60.4%	36.3%

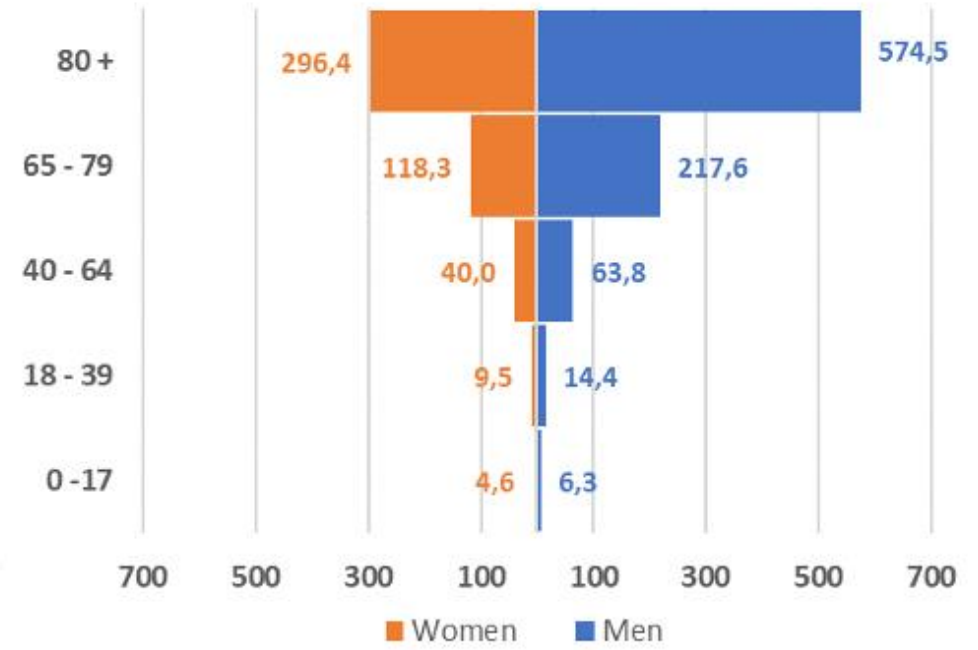
SDEC: Sudden death expertise centre; DCAR: Danish Cardiac Arrest Registry; SRCR: the Swedish Register for Cardiopulmonary Resuscitation; ARREST: the AmsteRdam REsuscitation Studies  
ROSC: return of spontaneous circulation



**Panel A**



**Panel B**



**Incidence rate ratio men vs. women**

Age group	OHCA	SCD
0 - 17	1,37	1,65
18 - 39	1,51	1,56
40 - 64	1,60	1,61
65 - 79	1,84	1,93
80 +	1,94	2,17

Incidence rate per 100 000 PY :

