Incidence of Sudden Cardiac Death in the European Union

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ABSTRACT

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

OBJECTIVES The study objective was to determine the incidence of SCD and OHCA in the European Union.

METHODS The study examined 4 large (ie, >2 million inhabitants) European population-based prospective registries collecting emergency medical services (EMS)-attended (ie, with attempted resuscitation) OHCA and SCD (OHCA without obvious extracardiac causes) for >5 consecutive years from January 2012 to December 2017 in the Paris region (France), the North Holland region (the Netherlands), the Stockholm region (Sweden), and in all of Denmark.

RESULTS The average annual incidence of SCD in the 4 registries ranged from 36.8 per 100,000 (95% CI: 23.5-50.1 per 100,000) to 39.7 per 100,000 (95% CI: 32.6-46.8 per 100,000). When extrapolating to each European country and accounting for age and sex, this yields to 249,538 SCD cases per year (95% CI: 155,377-343,719 SCD cases per year). The average annual incidence of OHCA in the 4 registries ranged from 47.8 per 100,000 (95% CI: 21.2-74.4 per 100,000) to 57.9 per 100,000 (95% CI: 19.6-96.3 per 100,000), corresponding to 343,496 OHCA cases per year (95% CI: 216,472-464,922 OHCA cases per year) in the European Union. Incidence rates of SCD and OHCA increased with age and were systematically higher in men compared with women.

CONCLUSIONS By combining data from 4 large, population-based registries with at least 5 years of data collection, this study provided an estimate of the incidence of SCD and OHCA in the European Union.
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Although sudden cardiac death (SCD) is recognized as a high-priority public health topic, there are to date no reliable estimates of the incidence of SCD or, more broadly, out-of-hospital cardiac arrest (OHCA), in the European Union.[1,2] In the U.S. population, SCD (ie, an OHCA without obvious noncardiac causes) accounts for 185,000-450,000 deaths each year, representing between 7% and 18% of all deaths.[3,4] An accurate estimate of the SCD and OHCA incidences and trends is of utmost importance to help define preventive strategies and also to measure the impact of public health policies, including identification of high-risk subjects, deployment of automated external defibrillators , and implementation of education programs, 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 OHCA incidence rate ranged from 24 to 177 cases per 100,000 person-years (PY), likely illustrating consistent differences in definitions, data collections, and emergency medical services (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 (eg, public and private, emergency physician or paramedic based) involved in the EMS response, which for cultural, historical, and geographic reasons differs among countries.[10,11] In addition, 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 (Cardiac Arrest Registry to Enhance Survival) surveillance group in the United States has put considerable effort into comprehensive identification of cardiac arrest cases from all sources (911, EMS, and hospitals) and has 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 European Union and characterize its recent trends. Taking into account the previous difficulties, we have chosen to restrict the collection of data to large centers (covering regions of at least 1 million inhabitants), with ongoing prospective population-based registries collecting extensively all EMS attended cases (ie, 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 (European Sudden Cardiac Arrest network - towards Prevention, Education, and New Effective Treatments) project fulfilled the required conditions. Therefore, we studied the incidence rate of SCD and OHCA in 4 population-based registries (Table 1): the SDEC (Paris Sudden Death Expertise Center),[13] the ARREST (AmsteRdam REsuscitation STudies),[14] the SRCR (Swedish Register for Cardiopulmonary Resuscitation),[15,16] and the DCAR (Danish Cardiac Arrest Registry).[17] Patient age group, sex, and presumed cause of cardiac arrest were recorded according to the Utstein definition.[10] Reporting was made according to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.[19]

DATA COLLECTION. Paris Sudden Death Expertise Center. 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 km². The SDEC registry covers 10.1% of the French population. Every case of EMS-attended (ie, with attempted resuscitation) or unattended (ie, without attempted resuscitation) OHCA was extracted, from January 1, 2012 to December 31, 2019. The data collection process is based on extensive collection of cases from multiple sources involved in the chain of survival, as previously described.[13]

Swedish Register for Cardiopulmonary Resuscitation. The SRCR was established in 1990 and, like the Paris registry, collects data on all EMS-attended or EMS-unattended OHCA cases.[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 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.

AmsteRdam REsuscitation STudies. ARREST is an ongoing prospective community-based registry of all EMS-attended OHCA cases with a medical cause since

TABLE 1 Characteristics of the 4 Registries					
Registry	Geographic Area	Population (Coverage %)	Years	OHCA Definition[a]	SCD Definition
SDEC	Paris and its suburbs, France	6.8 million (10.1)	2012-2019	EMS- or bystander-attended or unattended	Utstein on the basis of EMS records and hospital records
SRCR	Stockholm region, Sweden	2.2 million (23.6)	2010-2017	EMS- or bystander-attended or unattended	Utstein on the basis of EMS records and hospital records
DCAR	Denmark	5.8 million (100)	2012-2017	EMS- or bystander-attended with exclusion of deceased on arrival	Utstein on the basis of EMS records and hospital records
ARREST	North Holland, the Netherlands	2.4 million (16.3)	2012-2017	EMS-attended or bystander AED-treated with ROSC at EMS arrival	Utstein on the basis of EMS and patient interview, general practitioner database, hospital records

[a]EMS-attended means with attempted resuscitation.

AED = automatic external defibrillator; ARREST = AmsteRdam REsuscitation STudies; DCAR = Danish Cardiac Arrest Registry; EMS = emergency medical services; ROSC = return of spontaneous circulation; SCD = sudden cardiac death; SDEC = Sudden Death Expertise Centre; SRCR = Swedish Register for Cardiopulmonary Resuscitation.

July 2005 in the Dutch province of North Holland (2,404 km² with both urban and rural communities, population of 2.4 million people covering 16.3% of the overall population of the Netherlands).[14] Patients with OHCA who underwent defibrillation by bystanders or first responders only (automated external defibrillator) and had a return of spontaneous circulation (ROSC) on arrival of the ambulance are also included in this registry. If they were already deceased, patients with OHCA are not included in the registry.

Danish Cardiac Arrest Registry. Denmark covers 42,933 km². 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 (eg, 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. In 2015, the collection of data became digital.
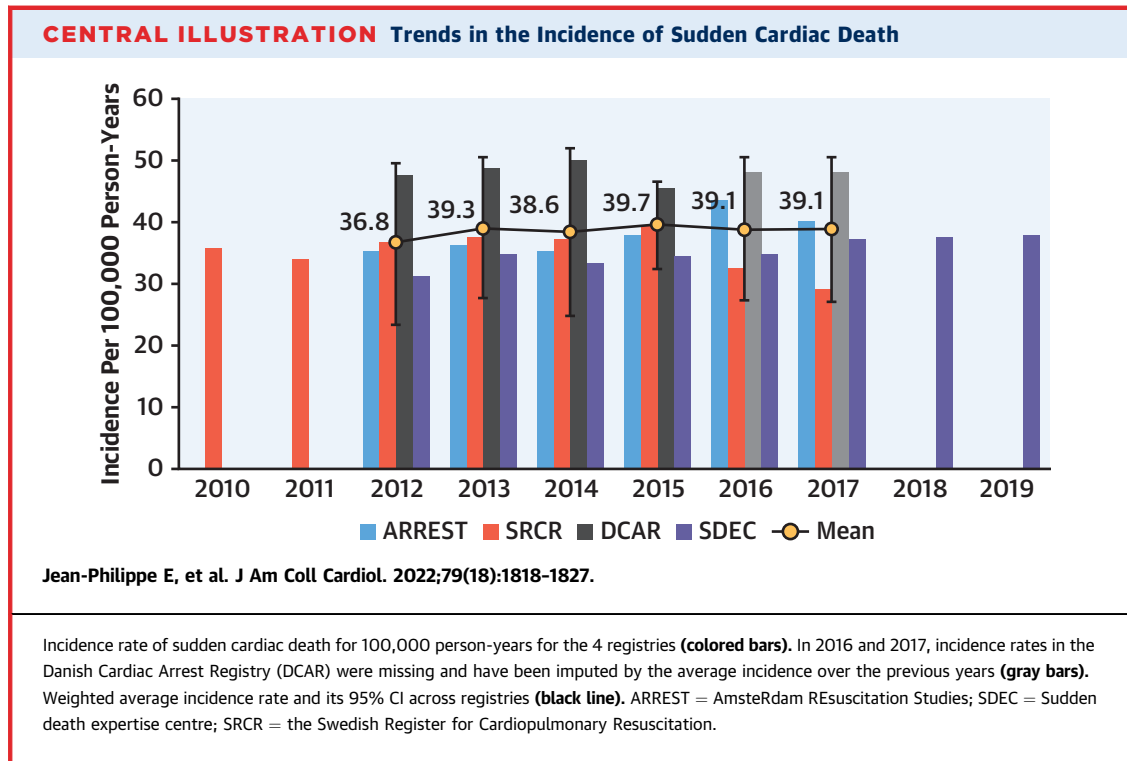
OUTCOME DEFINITION. For homogeneity among the 4 registries, only EMS-attended (ie, with attempted resuscitation) OHCA cases without dead-on-arrival status were examined and represent the main outcome study. In secondary analysis, all OHCA cases (ie, EMS attended or unattended) that were collected only in the SDEC and SRCR registries were considered as secondary outcomes. SCD was defined as an OHCA with absence of an obvious external cause according to the Utstein definition (eg, drowning or trauma).[10]

ETHICAL CONSIDERATIONS. Ethical permission was authorized by the following: 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. The incidence rate of SCD and OHCA was computed as the number of cases divided by the total PY number 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 years 2012 to 2015 because data in 2016 and 2017 were not available at the time of analysis. Nonetheless, and for descriptive purposes only, incidence rates for these 2 years were imputed according to the average incidence calculated over the previous years in the registry. Then, the weighted average incidence rate of the 4 registries was combined, and its 95% CI was computed, including a random effect on the country.[20] These rates were then stratified by age group (<18, 18-39, 40-64, 65-79,

CENTRAL ILLUSTRATION Trends in the Incidence of Sudden Cardiac Death

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Incidence rate of sudden cardiac death for 100,000 person-years for the 4 registries **(colored bars)**. In 2016 and 2017, incidence rates in the Danish Cardiac Arrest Registry (DCAR) were missing and have been imputed by the average incidence over the previous years **(gray bars)**. Weighted average incidence rate and its 95% CI across registries **(black line)**. ARREST = AmsteRdam REsuscitation Studies; SDEC = Sudden death expertise centre; SRCR = the Swedish Register for Cardiopulmonary Resuscitation.

80+ years) and sex and were applied to the age and sex population structure of each European country on the basis of 2017 census data[21] to obtain an expected number of SCD and OHCA cases 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 cases 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 cases (ie, EMS attended or unattended) together with the corresponding numbers for SCD, by using data available only in the Swedish and Parisian registries.

A 2-tailed *P* value <0.05 was considered significant. Implementation was done using R software version 3.5.1 (R Foundation) with the package meta[22] and Excel (Microsoft Corporation).

RESULTS

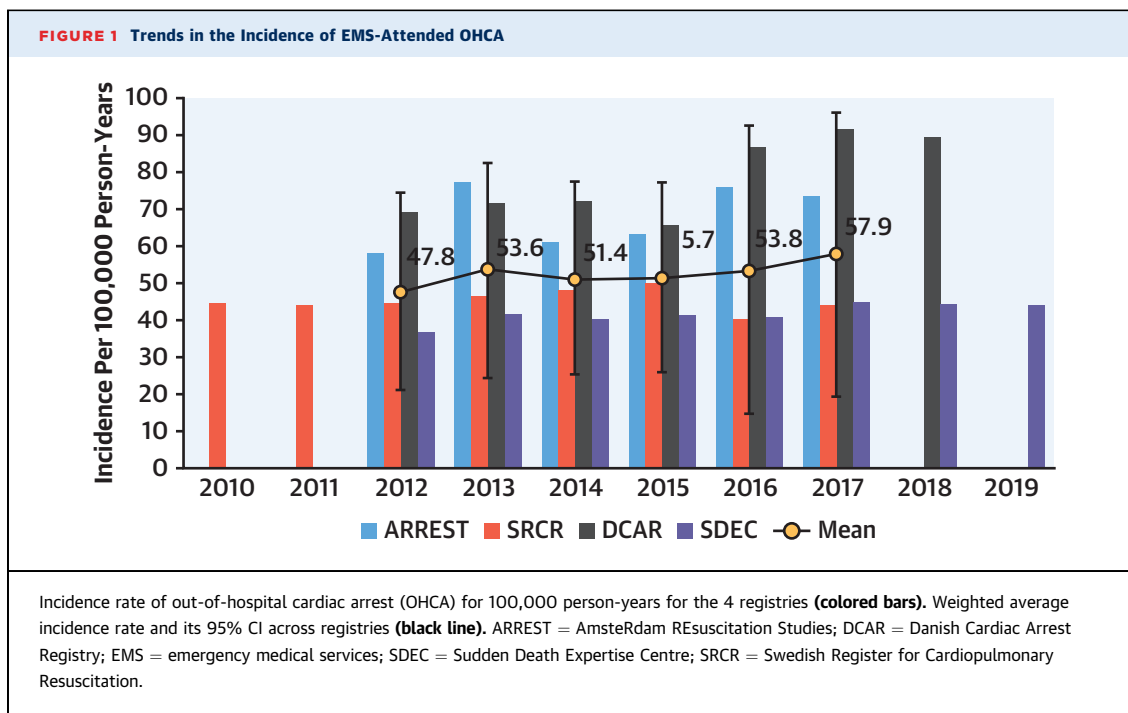**INCIDENCE RATES OF SCD ACROSS THE 4 REGISTRIES.** From January 2012 to December 2017, representing

109,350,304 PY, a total of 41,990 SCD cases were observed over the 4 registries. The average incidence rate ranged from 36.8 per 100,000 PY (95% CI: 23.5-50.1 per 100,000 PY) to 39.7 per 100,000 PY (95% CI: 32.6-46.8 per 100,000 PY), respectively (**Central Illustration**). No significant variability in the yearly incidence rates was noticed (Supplemental Figure 1).

INCIDENCE RATES OF OHCA ACROSS THE 4 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 4 registries. The average incidence rate ranged from 47.8 per 100,000 PY (95% CI: 21.2-74.4 per 100,000 PY) in 2012 to 57.9 per 100,000 PY (95% CI: 19.6-96.3 per 100,000 PY) in 2017 (*P* for trend < 0.0001), respectively (**Figure 1**). As for SCD, no significant variability in the yearly incidence rates of OHCA was observed (Supplemental Figure 1). Even so, 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 with women in each age group, with men-to-women incidence rate ratios ranging from 1.37 to 1.94 for SCD (**Figure 2A**) and

FIGURE 1 Trends in the Incidence of EMS-Attended OHCA

Incidence rate of out-of-hospital cardiac arrest (OHCA) for 100,000 person-years for the 4 registries **(colored bars).** Weighted average incidence rate and its 95% CI across registries **(black line).** ARREST = AmsteRdam REsuscitation Studies; DCAR = Danish Cardiac Arrest Registry; EMS = emergency medical services; SDEC = Sudden Death Expertise Centre; SRCR = Swedish Register for Cardiopulmonary Resuscitation.

from 1.56 to 2.17 for OHCA (**Figure 2B**) across age groups, respectively.

MAIN CLINICAL CHARACTERISTICS AND CIRCUMSTANCES OF OHCAs ACROSS THE 4 REGISTRIES. As reported in **Table 2**, median age ranged from 68.0 to 72.0 years, one-third of the cases were women, and most of the cases (66.8%-75.5%) occurred at home. Only one-fifth of the cases had ventricular tachycardia or ventricular fibrillation as the initial rhythm, except in the Dutch registry, where ventricular tachycardia or ventricular fibrillation was seen in 42% of the cases. A bystander was present in >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 cardiopulmonary resuscitation ranged from 51.2% to 76.0%. Regarding immediate prognosis, 29.2%-41.8% had an ROSC, and 30.7%-60.4% of the cases were transferred to the hospital.

ESTIMATED NUMBER OF SCD AND OHCA CASES IN THE EUROPEAN UNION. After standardization, a total of 249,538 SCD cases (95% CI: 155,377-343,719 SCD cases) are expected each year in the European Union, corresponding to an estimated incidence of 48.6 per 100,000 PY (95% CI: 30.3-67.0 per 100,000 PY) (**Figure 3**). Similarly, a total of 343,496 EMS-attended OHCA cases (95% CI: 216,472-464,922 EMS-attended OHCA cases) are expected each year in the European Union, with an estimated incidence rate of 66.9 per 100,000 PY (95% CI: 42.2-90.6 per 100,000 PY).

Detailed estimates by country can be found in Supplemental Tables 1 and 2.

In secondary analyses, when also including unattended EMS cases (available only in the Swedish and Parisian registries), 60,254 SCD and 64,272 OHCA cases were additionally retrieved. After extrapolation, this leads to 309,792 expected SCDs in the European Union each year and a corresponding estimated incidence of 60.4 per 100,000 PY (95% CI: 49.3-66.9 per 100,000 PY). Similarly, this leads to 407,768 expected OHCAs in the European Union each year and a corresponding estimated incidence of 79.4 per 100,000 PY (95% CI: 67.6-91.1 per 100,000 PY).

DISCUSSION

By combining data from 4 large (ie, >2 million inhabitants), population-based prospective registries covering regional (Paris area, France; North Holland region, the Netherlands; and Stockholm region, Sweden) and national (Denmark) areas, we attempted to estimate of the incidence of SCD and OHCA events in the European Union and their respective trends over the study period from 2012 to 2017. A total of 249,538 (95% CI: 155,377-343,719) SCD cases and 343,496 (95% CI: 216,472-464,922) EMS-attended OHCA cases are expected each year in the European Union. When EMS-unattended cases are included, the numbers reach 309,792 SCD and 407,768 OHCA cases each year in the European Union. Only slight, not

FIGURE 2 Incidence Rates of SCD and OHCA by Age and Sex
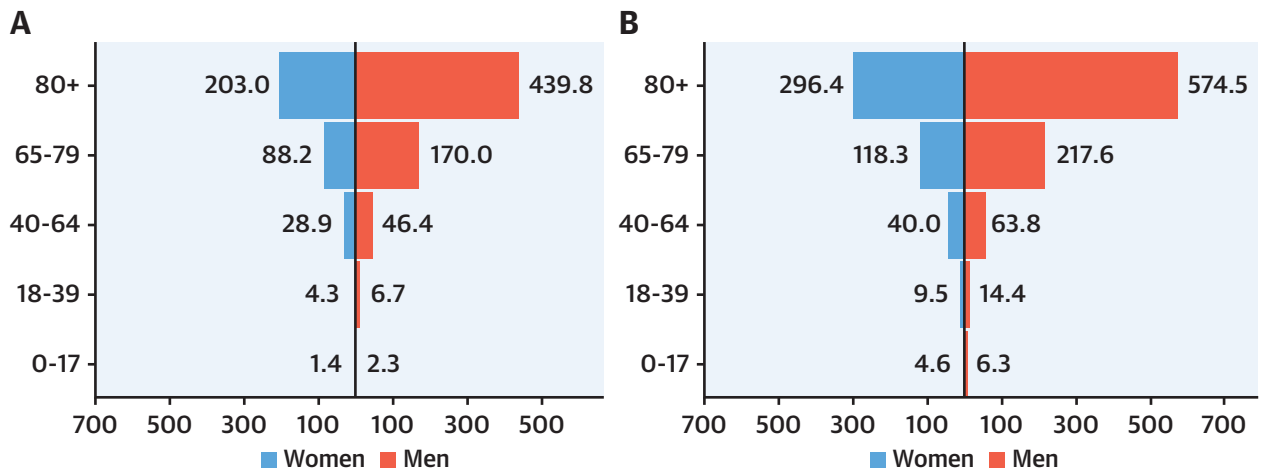
(A) Incidence rates of sudden cardiac death (SCD) by age and sex. **(B)** Incidence rates of emergency medical services-attended out-of-hospital cardiac arrest (OHCA) by age and sex. The average incidence rates of sudden cardiac death and out-of-hospital cardiac arrest by age and sex across the 4 registries, together with the corresponding incidence rate ratios of men vs women by age, are reported.

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[1] estimated the incidence of EMS-attended OHCA of presumed cardiac cause to be 37.7 per 100,000 PY. In a more recent systematic review that was based on data published between 1990 and 2009, Berdowski et al[2] estimated the incidence of EMS-attended OHCA of presumed cardiac origin in Europe to be 25.7 per 100,000 PY. These rates are much lower than those 48.6 cases per 100,000 PY (95% CI: 30.3-67.0 cases per 100,000 PY) reported in the present study. The reason may be in part the lack of exhaustiveness of OHCA cases in cohort studies as compared with population-based registries, as in the present case. Using data collected during 1 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 cases,[5] compared with 79.4 per 100,000 PY (95% CI: 67.6-91.1 per 100,000 PY) in the present study. EuReCa ONE combines registry data (in the epidemiologic sense) and local EMS data. This heterogeneity in 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 incidence estimates across regions (range 24-177 cases per 100,000 PY) than reflecting a true epidemiologic difference. To minimize these biases, we have selected population-based registries with comparable EMS organizations, data collection, and as much as possible harmonized outcome definitions. Accordingly, we calculated a 1.68-fold variation in the incidence rate estimates across the European Union (range 50.8-85.6 per 100,000 PY). Using data collected over a 3-month period (October to December 2017), EuReCa TWO

TABLE 2 Main Clinical Characteristics and Circumstances Surrounding OHCAs Across the 4 Registries

	ARREST (n = 5,825)	SDEC (n = 14,581)	SRCR (n = 6,346)	DCAR (n = 15,238)
Female	29.2	35.3	34.3	36.6
Age	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 in nonpublic place	73.2	75.5	66.8	73.3
OHCA in 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 ambulance arrival, min	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

Values are % or median (IQR).

CPR = cardiopulmonary resuscitation; VF = ventricular fibrillation; VT = ventricular tachycardia; other abbreviations as in Table 1.
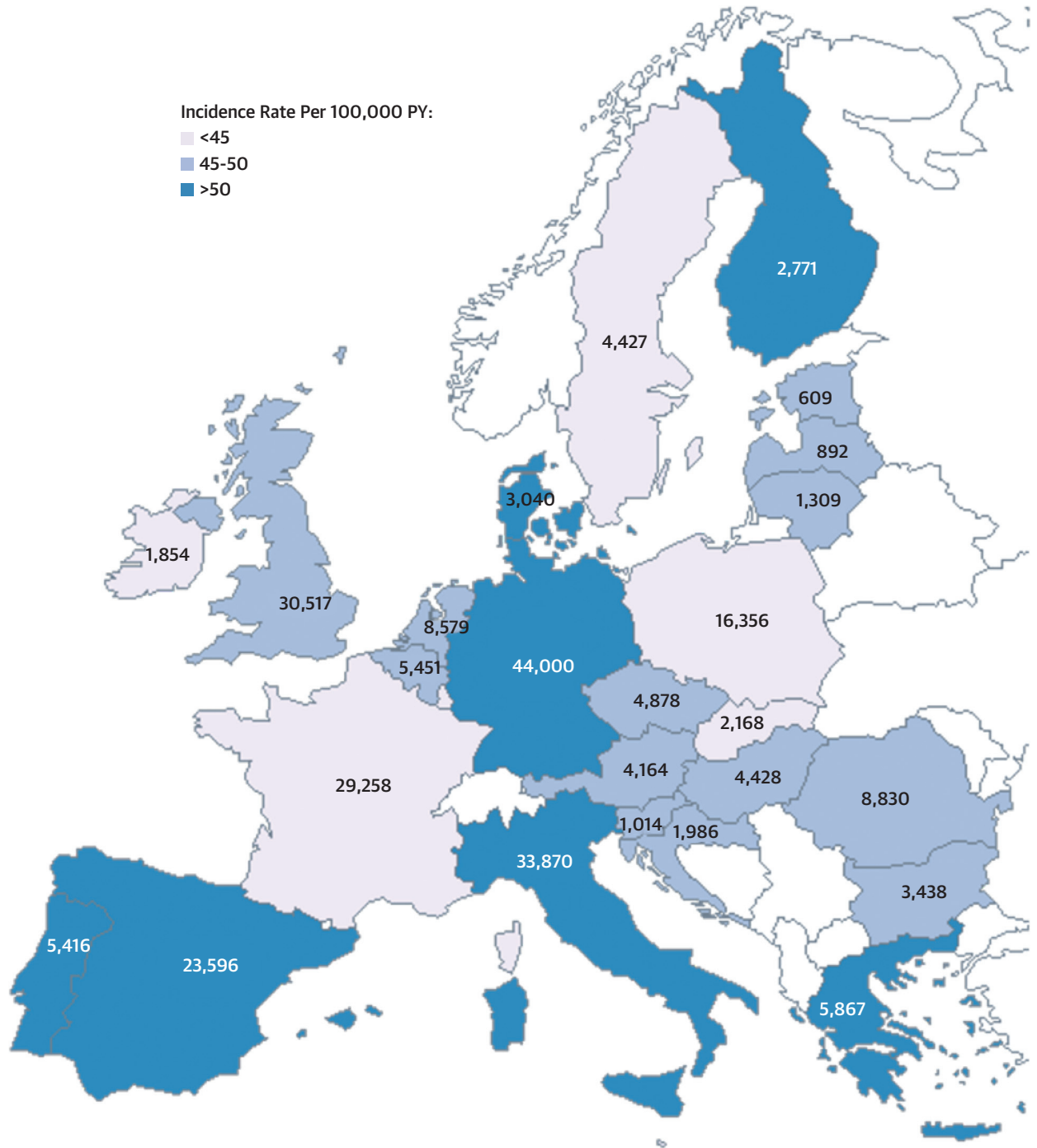
reported an incidence rate of EMS-attended OHCA of 56 per 100,000 population per year (range 21-91 per 100,000 population per year),[23] compared with the 66.9 (95% CI: 42.2-90.6) per 100,000 PY incidence rate in the present study. The incidence estimates in EuReCa ONE and EuReCa TWO derive from 1-month and 3-month data collection, respectively,[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 U.S. sites between May 2006 and April 2007, the annual incidence of OHCA in the U.S. population in 2006 and 2007 was estimated to be 294,851 (95% CI: 236,063-325,007), a finding consistent with the numbers reported in the present study, 343,496 (95% CI: 216,472-464,922); no estimates were provided for SCD in this U.S. study.[26] On the basis of the Aus-ROC Epistry (Australian Resuscitation Outcomes Consortium OHCA epidemiological registry) collecting EMS data at several sites in Australia and New Zealand, the age and sex standardized incidence rate of attended OHCA was 99.2 per 100,000 population (95% CI: 71.9-105.6 per 100,000 population) in 2015, higher than the currently reported incidence of 66.9 per 100,000 population (95% CI: 42.2-90.6 per 100,000 population).[27] In Japan, data from the national OHCA registry (All Japan Utstein registry) reported a lower incidence with an age-adjusted annual incidence of OHCAs among adults aged 18 years or older of 54.1 per 100,000 PY during 2005 to 2007.[28]

To the best of our knowledge, this is the first estimation of SCD and OHCA in the European Union that is exclusively based on population-based registries, that covers a defined geographic area, and that uses consistent definitions across registries.[13-17] There was no major variability across the registries in the distribution of the main characteristics that could affect 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 patients transported to the hospital, but these do not affect incidence rate estimates of either SCD or OHCA. The study expands on previous investigations by updating years of examination (2012-2017) and by providing trends over 5-8 years. The slightly increasing trend in OHCA incidence in the 4 registries is likely the result of a change in the data collection process of the DCAR registry in 2015 from a paper method to digital data collection. Remarkably, the incidence of SCD did not show any significant variations across years and centers. The definition of SCD is more specific than that of overall OHCA, thus 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 could 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 SCDs occur, who are the most at risk of SCD.[30] Previously developed risk prediction models lack specificity because 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 European Union by combining inherited and acquired risk factors from various areas.[18,32]

STUDY LIMITATIONS. When extrapolating incidence rates of SCD and OHCA from the 4 European population-based registries to the European Union as a whole, we were able to account only for the age and sex structure of each country. We are therefore ignoring differences among 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 Eastern European countries, where the prevalence of risk factors and CVD is higher than in Western European countries, so the incidence of SCD and OHCA in these countries is expected to be higher than in

FIGURE 3 Burden of SCD in the European Union

Incidence Rate Per 100,000 PY:
- <45
- 45-50
- >50

2,771

4,427

609

892

1,309

3,040

1,854

30,517

8,579

5,451

44,000

16,356

4,878

2,168

4,164

4,428

8,830

1,014

1,986

29,258

33,870

3,438

5,416

23,596

5,867

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 on the basis of 2017 census data to estimate the yearly numbers of sudden cardiac death within each country. Those numbers were then divided by the size of the country-specific population (2017 European census) to estimate the incidence rates of sudden cardiac death in each country. PY = person-years.

Western countries.[28] Moreover, 2 of the 4 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 4 registries were of Caucasian descent, whereas variations in OHCA incidence rates by continent have been reported.[2] Furthermore, the incidence of EMS-unattended cases was available only in 2 of the 4 registries and is therefore likely to be underestimated. In addition, SCD and OHCA for which EMS attendance 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 cases were of presumed cardiac cause according to the Utstein criteria. Although this approach is used in the field, autopsy data are challenging the accuracy of such a definition because just over one-half of presumed SCDs (according to the World Health Organization 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]) actually had autopsy-defined sudden arrhythmic death in the POST SCD (POstmortem Systematic InvesTigation of Sudden Cardiac Death) study.[35]

CONCLUSIONS

This analysis provides estimates of the current incidence of SCD and OHCA in Europe on the basis of 4 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 European Union. 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 European Union. 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.

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PERSPECTIVES

COMPETENCES IN MEDICAL KNOWLEDGE: Data from population-based registries provide as minimum estimates 249,538 cases of SCD and 343,496 cases of OHCA annually in the European Union.

TRANSLATIONAL OUTLOOK: Public health policies targeting risk factors for SCD and OHCA should account for variations in demographics, living settings, and EMS organizations across Europe.

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