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SCD: Prevalence and Outcome in a German Holiday Area

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Abstract

Background: Sudden Cardiac Death (SCD) is one of the most frequent modes of death in industrial countries, resulting in approximately 180,000-300,000 deaths in the US and 70,000-100,000 in Germany. These figures show regional variations and are largely dependent on study design. We conducted a retrospective study in a German holiday area in order to determine if retrospective data can be used for the epidemiologic evaluation of SCD.

Methods: Rostock has two hospitals and one centrally organized ambulance service. Data from the two hospitals and the ambulance service as well as all death certificates were analyzed and cross-related in order to find cases of SCD in the years 2005 to 2007.

Results: Between 2005 and 2007, 276 cases of SCD were found resulting in a stable incidence of about 46 SCD per 100.000 inhabitants per year. 179 (64.9%) were male, mean age 69.7 ± 16.4 years. 186 (67%) cases occurred at home, the most common co-morbidity was coronary artery disease (n=179, 64.9%). 156 (56.5%) received CPR, 103 (37.3%) were defibrillated, only 37 (13.4%) were discharged from hospital alive. Comparing the main diagnosis of the three sources, diagnosis of death certificates differed considerably from hospital and emergency medical service files.

Conclusion: A comparison with prospective studies revealed that the incidence of SCD can be determined retrospectively, if besides ICD-codes and death certificates, multiple sources are used and cross-related.

Introduction

Cardiovascular disease, especially coronary heart disease, is the leading cause of death in industrial countries [1,2]. 54% of deaths occur suddenly in a pre-hospital setting. In about half of these cases, Sudden Cardiac Death (SCD) is the first manifestation of cardiac disease [3-6]. The outcome is still deleterious and SCD has to be considered a major public health issue.

A considerable range of 36 and 128 SCD per 100.000 people per year has been reported in literature depending on regional and methodological differences. Probably, most accurate data are derived from prospective studies. Retrospective data acquisition, which focus on death-certificates and ICD-codes are likely to overestimate the incidence of SCD [7-10]. Using multiple sources to identify cases of SCD may raise the rate of correctly identified SCD cases [11].

We conducted this study as a retrospective multiple-source surveillance study and collected data over a 3-year period. Our goal was to determine the incidence and outcome of SCD in a German holiday area city comparing and cross-relating different data sources and compare them with prospective studies.

Methods

The widely accepted definition of SCD is "sudden and unexpected death within an hour of symptom-onset" [7,8]. If un-witnessed, subjects should have been observed alive within 24 hours of death. In addition, whenever possible, it is important to exclude subjects that are likely to have had a non-cardiac cause of sudden death, e.g. such as patients that were known to be suffering from malignancy that is not in remission.

Data from three different sources were screened. These sources were death certificates, emergency medical service records and hospital medical files. To identify a case as SCD not only ICD-Codes were screened, but each case history was read thoroughly and based on this information included or discarded. If cases met the SCD criteria, survivors of cardiac arrest were included under SCD cases. All cases found were cross-related and matched. At this point a priority system was applied if inconsistent details were found. Hospital medical files received the highest priority followed by emergency medical records and death certificates. Because some cases were found through either of the different sources, the sum of all cases of all sources may exceed the total number of cases in the study (n=276).

Results

The population base during the time of this survey was 199,856 inhabitants (49.0% male). 276 cases of SCD were collected from different sources between 2005 and 2007 [12]. 179 (64.9%) patients were male, mean age 69.7 ± 16.4 years. Mean age for male victims was significantly lower than for women: 65.5 ± 15.5 vs. 77.4 ± 15.3 years ($p<0.001$). The baseline data divided by source are provided in Table 1.

A mean of 92 cases were found per year resulting in an incidence rate of 46/100.000/year. An average of 2200 people died in Rostock per year in 2005-2007, indicating that 4.2% of all deaths were SCD. 186 (67%) cases occurred at home. The most common co-morbidity was coronary artery disease (n=179, 64.9%) followed by arterial hypertension (n=100, 36.2%). An acute coronary syndrome was found in 30.8% of all cases. 21% of patients had suffered a previous myocardial infarction.

In 2005 the incidence of SCD was lower during summertime. In contrast there was no significant decrease during the following years (Figures 1 and 2).

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The mean time between emergency call and arrival of medical services at site was 6.37 ± 2.55 minutes, mean distance to the emergency location was 4.18 ± 3.2 kilometers. 20.6% of patients survived if arrival time was lower than 7 minutes, 30.2% when emergency services needed longer than 7 minutes (ns).

The incidence rate of each zip code area of Rostock was examined (Figure 3). It ranged from 28.6 (Lichtenhagen) to 69.9 (KTV). The SCD rate was not associated with unemployment rate (r Pearson = 0.04758) or age (r Pearson = 0.079322), but with migration (r Pearson = 0.31889, Table 2).

In emergency medical records most cases of SCD were diagnosed as ventricular fibrillation or ACS (40.7% and 46.9%, Figure 4). In death certificates, unspecified SCD was the leading diagnosis (36.4%). VF as well as ACS was diagnosed in 13.8%, only. Heart failure was the reason of death in 16.1%. The underlying cause of survived SCD was VF in 41.3% and ACS in 37.9% of patients in hospital medical files. Only 6.8% were assumed to be due to heart failure. Main diagnosis of hospital files and emergency records together was ACS in 42.8% and in 46.4% of patients VF. Only 3.4% were heart failure.

	All sources	Death certificates	Medical services	Hospital files
n	276 (100%)	217 (78.6%)	47 (16.3%)	61 (22.1%)
Age	69 years	72 years	61 years	67 years
Sex (male)	179 (64.9%)	129 (59.5%)	40 (85.1%)	46 (75.5%)
Diabetes	77 (27.9%)	58 (26.7%)	17 (36.1%)	21 (34.4%)
Coronary artery disease	179 (64.9%)	141 (64.9%)	32 (68%)	40 (65.5%)
Hypertension	100 (36.2%)	77 (35.4%)	18 (38.3%)	21 (34.4%)
Chronic heart failure	58 (21%)	44 (20.2%)	14 (29.8%)	16 (26.2%)
Myocardial infarction	143 (51.8%)	107 (49.3%)	31 (66%)	33 (54.1%)
Arrhythmia	97 (35.1%)	71 (32.7%)	19 (40.4%)	23 (37.7%)

Table 1: Baseline data.

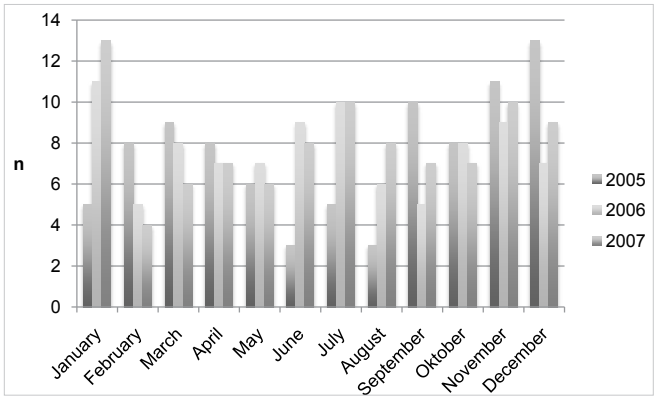

Figure 1: Incidence of SCD by month.

Zip code area	Migration (2000-2009)	Incidence rate
18059 Sudstadt	9.04%	37.428
18055 Mitte	35.94%	36.356
18106 Evershagen	-1.75%	36.260
18147 Toitenwinkel	-17.41%	35.773
18069 Reutershagen	1.44%	35.453
18107 Lütten Klein	-11.73%	35.221
18057 Hansaviertel	12.70%	31.477
18109 Lichtenhagen	-7.02%	30.861
18146 Dierkow	-8.54%	26.873
18119 Warnemunde	-7.61%	24.860
		r (Pearson) 0.31889

Table 2: Association of migration and SCD incidence rate.

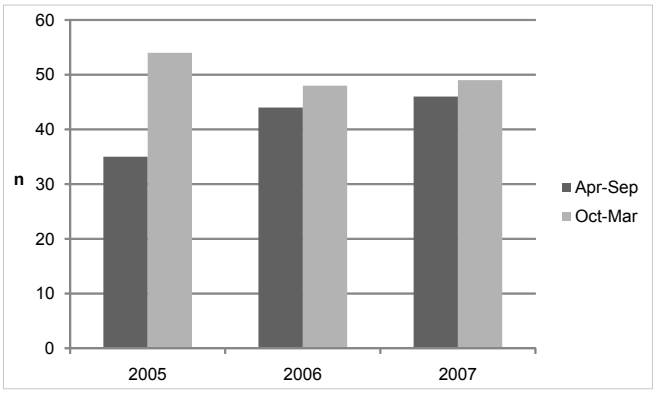

Figure 2: Incidence by season.

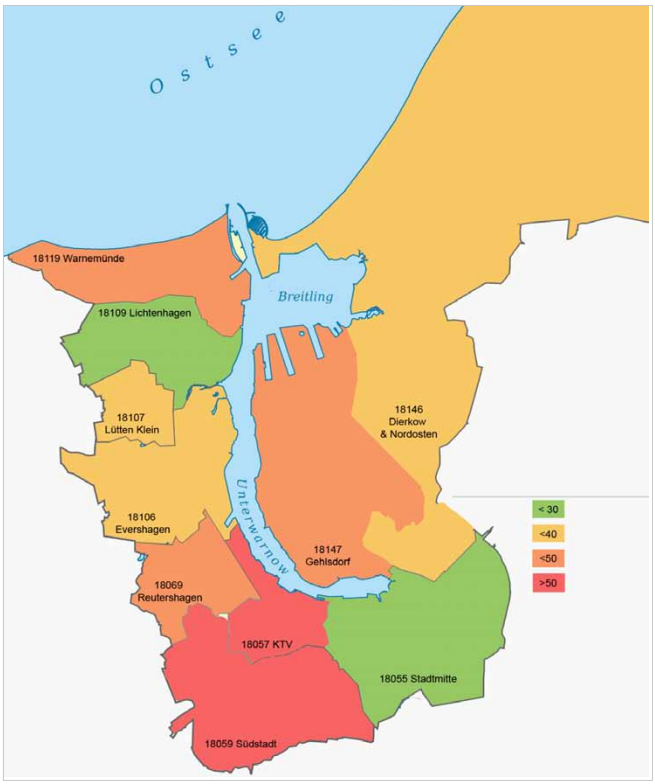

Figure 3: Incidence rate by zip code (range from <30 to >50 per 100.000 inhabitants cumulative over 3 years).

156 (56.5%) patients received CPR, 65 (23.6%) of which were initially successful establishing effective circulation. Only 41.3% of all CPRs were successful, 103 (37.3%) patients were initially defibrillated.

CPR with defibrillation resulted in a significantly better outcome than CPR without defibrillation: in 60.2% of patients initial circulation could be reestablished with defibrillation vs. 5.7% without. 216 patients (78.3%) died within one hour after onset of symptoms. 23 (8.3%)

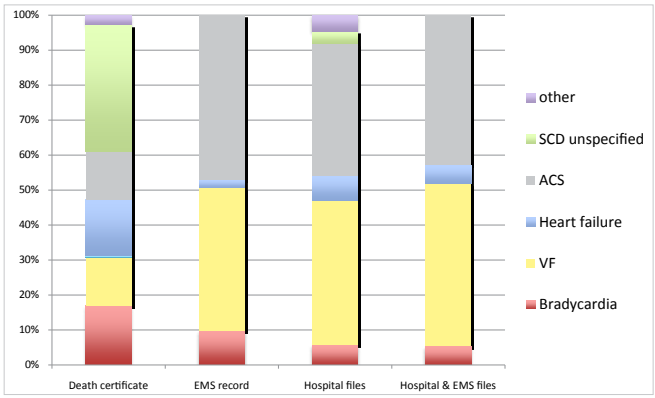

Figure 4: Diagnosis divided by source.

survived the first hour but died during treatment. Only 37 patients (13.4%) were discharged from hospital alive.

Discussion

The European Society of Cardiology Task Force on SCD estimates the incidence of SCD to be between 36 and 128 deaths per 100 000 population per year [13]. We conducted this study to gather data about the incidence of SCD in a holiday area with a mid-sized German city. The data were collected from multiple sources between 2005 through 2007 and found an incidence of 48 deaths per 100 000 inhabitants, although the incidence ranged from 29 to 70 deaths (Figure 3) depending on the zip code area. The incidence was not associated with age, income or unemployment rate but with migration. The average incidence of 48 is at the lower range of the reported incidence rate. The reasons for this low rate may be that different studies used significantly different definitions and sources. Retrospective data acquisition which focused on death-certificates and ICD-codes, only, are likely to overestimate the incidence of SCD [7-10]. The reason for this is most probably that cardiac cause falsely assumed to be the cause of a sudden death without post-mortem examination [8,11,14]. Byrnes et al integrated prospectively collected data from multiple sources (emergency service resuscitation records, autopsy reports and hospital records) to improve accuracy of SCD detection [15]. This study approached data collection retrospectively and included emergency service resuscitation records, death certificates and hospital records in 2004. Chugh et al. compared a retrospective approach using death certificates and ICD-10-Codes. He also found a significant overestimation of SCD incidence for death certificate statistics [11].

Our approach was different, as we did not only use the ICD-10-Codes, but three different sources of information to find as many cases and collect as much information as possible to decide whether or not a SCD was the most likely diagnosis. Analyzing the data per source showed a significantly different distribution of diagnosis. This is most likely due to the lack of diagnostic facilities when a physician records the death of a patient out-of-hospital. Emergency medical records and hospital files may be more accurate. When comparing these two sources, no significant differences where found. Hennessy et al. also found that 85% of emergency medical records were consistent with diagnosis recorded in the hospital files [16].

Comparing our retrospectively collected data with prospective studies we found accordance for incidence rate (46 per 100.000 population per year), share of SCD by overall mortality (4.2%) [11,15], ratio of at-home-SCD (67%) [15,17,18] and ratio of patients discharged from hospital (13.4%) [19-21]. The finding of a 65% male predominance as well as the finding of a mean age of 69.7 years also correlated well with most previous studies of SCD [3,17,18]. The strong increase in incidence after the age of 45 has also been found in previous studies [15] and could be explained by an increase of coronary artery disease at this age and has been validated by multiple autopsy studies [6,22-24]. We therefore conclude that our multiple source approach provides valid data on the incidence of SCD in a certain region.

The distribution of SCD cases throughout the year did not show a lower incidence rate during summer for the years 2006 and 2007. Previous studies found lower incidence rates during summertime [25,26]. The reason for this is unclear, but one explanation may be two large events during summer of these years (2006: soccer world cup, 2007: G8 summit in Rostock). One study was able to show a higher prevalence of cardiovascular incidents during large public events [27].

Though retrospectively collected, our data did not overestimate the incidence rate of SCD when compared with prospective studies. The use of retrospective data from multiple sources may enhance the quality of data for epidemiologic SCD evaluation.

Reference

1. Murray CJ, Lopez AD (1997) Mortality by cause for eight regions of the world: Global Burden of Disease Study. Lancet 349: 1269-1276.
2. Huikuri HV, Castellanos A, Myerburg RJ (2001) Sudden death due to cardiac arrhythmias. N Engl J Med 345: 1473-1482.
3. Gorgels AP, Gijsbers C, de Vreede-Swagemakers J, Lousberg A, Wellens HJ (2003) Out-of-hospital cardiac arrest--the relevance of heart failure. The Maastricht Circulatory Arrest Registry. Eur Heart J 24: 1204-1209.
4. Albert CM, Chae CU, Grodstein F, Rose LM, Rexrode KM, et al. (2003) Prospective study of sudden cardiac death among women in the United States. Circulation 107: 2096-2101.
5. Chugh SS, Kelly KL, Titus JL (2000) Sudden cardiac death with apparently normal heart. Circulation 102: 649-654.
6. Zipes DP, Wellens HJ (1998) Sudden cardiac death. Circulation 98: 2334-2351.
7. Saito I (2004) Review of death certificate diagnosis of coronary heart disease and heart failure in Japan. Nihon Koshu Eisei Zasshi 51: 909-916.
8. Iribarren C, Crow RS, Hannan PJ, Jacobs DR Jr, Luepker RV (1998) Validation of death certificate diagnosis of out-of-hospital sudden cardiac death. Am J Cardiol 82: 50-53.
9. Goraya TY, Jacobsen SJ, Belau PG, Weston SA, Kottke TE, et al. (2000) Validation of death certificate diagnosis of out-of-hospital coronary heart disease deaths in Olmsted County, Minnesota. Mayo Clin Proc 75: 681-687.
10. Fox CS, Evans JC, Larson MG, Lloyd-Jones DM, O'Donnell CJ, et al. (2005) A comparison of death certificate out-of-hospital coronary heart disease death with physician-adjudicated sudden cardiac death. Am J Cardiol 95: 856-859.
11. Chugh SS, Jui J, Gunson K, Stecker EC, John BT, et al. (2004) Current burden of sudden cardiac death: multiple source surveillance versus retrospective death certificate-based review in a large U.S. community. J Am Coll Cardiol 44: 1268-1275.
12. http://rathaus.rostock.de/
13. Priori SG, Aliot E, Blomstrom-Lundqvist C, Bossaert L, Breithardt G, et al. (2001) Task Force on Sudden Cardiac Death of the European Society of Cardiology. Eur Heart J 22: 1374-1450.
14. Every NR, Parsons L, Hlatky MA, McDonald KM, Thom D, et al. (1997) Use and accuracy of state death certificates for classification of sudden cardiac deaths in high-risk populations. Am Heart J 134: 1129-1132.
15. Byrne R, Constant O, Smyth Y, Callagy G, Nash P, et al. (2008) Multiple source surveillance incidence and aetiology of out-of-hospital sudden cardiac death in a rural population in the West of Ireland. Eur Heart J 29: 1418-1423.

16. Hennessy S, Leonard CE, Freeman CP, Deo R, Newcomb C, et al. (2010) Validation of diagnostic codes for outpatient-originating sudden cardiac death and ventricular arrhythmia in Medicaid and Medicare claims data. Pharmacoepidemiol Drug Saf 19: 555-562.

17. Holmberg M, Holmberg S, Herlitz J, Gårdelöv B (1998) Survival after cardiac arrest outside hospital in Sweden. Swedish Cardiac Arrest Registry. Resuscitation 36: 29-36.

18. Herlitz J, Eek M, Holmberg M, Engdahl J, Holmberg S (2002) Characteristics and outcome among patients having out of hospital cardiac arrest at home compared with elsewhere. Heart 88: 579-582.

19. de Vreede-Swagemakers JJ, Gorgels AP, Dubois-Arbouw WI, Dalstra J, Daemen MJ, et al. (1998) Circumstances and causes of out-of-hospital cardiac arrest in sudden death survivors. Heart 79: 356-361.

20. de Vreede-Swagemakers JJ, Gorgels AP, Dubois-Arbouw WI, van Ree JW, Daemen MJ, et al. (1997) Out-of-hospital cardiac arrest in the 1990's: a population-based study in the Maastricht area on incidence, characteristics and survival. J Am Coll Cardiol 30: 1500-1505.

21. Böttiger BW, Grabner C, Bauer H, Bode C, Weber T, et al. (1999) Long term outcome after out-of-hospital cardiac arrest with physician staffed emergency medical services: the Utstein style applied to a midsized urban/suburban area. Heart 82: 674-679.

22. Schmermund A, Schwartz RS, Adamzik M, Sangiorgi G, Pfeifer EA, et al. (2001) Coronary atherosclerosis in unheralded sudden coronary death under age 50: histo-pathologic comparison with 'healthy' subjects dying out of hospital. Atherosclerosis 155: 499-508.

23. Fornes P, Lecomte D, Nicolas G (1993) Sudden out-of-hospital coronary death in patients with no previous cardiac history. An analysis of 221 patients studied at autopsy. J Forensic Sci 38: 1084-1091.

24. Kannel WB, Gagnon DR, Cupples LA (1990) Epidemiology of sudden coronary death: population at risk. Can J Cardiol 6: 439-444.

25. Scherlag BJ, Patterson E, Lazzara R (1990) Seasonal variation in sudden cardiac death after experimental myocardial infarction. J Electrocardiol 23: 223-230.

26. Gerber Y, Jacobsen SJ, Killian JM, Weston SA, Roger VL (2006) Seasonality and daily weather conditions in relation to myocardial infarction and sudden cardiac death in Olmsted County, Minnesota, 1979 to 2002. J Am Coll Cardiol 48: 287-292.

27. Wilbert-Lampen U, Leistner D, Greven S, Pohl T, Sper S, et al. (2008) Cardiovascular events during World Cup soccer. N Engl J Med 358: 475-483.

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