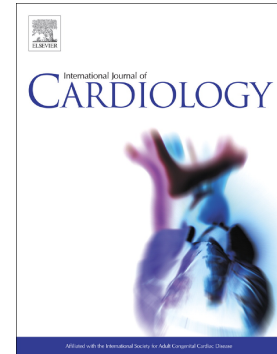


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Registered prodromal symptoms of out-of-hospital cardiac arrest among patients calling the medical helpline services

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This author takes responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation

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ABSTRACT

Background:

Early identification of warning symptoms among out-of-hospital cardiac arrest (OHCA) patients remains challenging. Thus, we examined the registered prodromal symptoms of patients who called medical helpline services within 30-days before OHCA.

Methods:

Patients unwitnessed by emergency medical services (EMS) aged ≥ 18 years during their OHCA were identified from the Danish Cardiac Arrest Registry (2014-2018) and linked to phone records from the 24-hours emergency helpline (1-1-2) and out-of-hours medical helpline (1813-Medical Helpline) in Copenhagen before the arrest. The registered symptoms were categorized into chest pain; breathing problems; central nervous system (CNS)-related/unconsciousness; abdominal/back/urinary; psychiatric/addiction; infection/fever; trauma/exposure; and unspecified (diverse from the before mentioned categories). Analyses were divided by the time-period of calls (0-7days/8-30days preceding OHCA) and call type (1-1-2/1813-Medical Helpline).

Results:

Of all OHCA patients, 18% (974/5,442) called helpline services (males 56%, median age 76 years [Q1-Q3:65-84]). Among these, 816 had 1,145 calls with registered symptoms. The most common symptom categories (except for unspecified, 33%) were breathing problems (17%), trauma/exposure (17%), CNS/unconsciousness (15%), abdominal/back/urinary (12%), and chest pain (9%). Most patients (51%) called 1813-Medical Helpline, especially for abdominal/back/urinary (17%). Patients calling 1-1-2 had breathing problems (24%) and CNS/unconsciousness (23%). Nearly half of the patients called within 7 days before their OHCA, and CNS/unconsciousness (19%) was the most registered. The unspecified category remained the most common during both time periods (32%;33%) and call type (24%;39%).

Conclusions:

Among patients who called medical helpline services up to 30-days before their OHCA, besides symptoms being highly varied (unspecified (33%)), breathing problems (17%) were the most registered symptom-specific category.

Keywords: out-of-hospital cardiac arrest (OHCA); prodromal symptoms; early warning signs; medical helpline; emergency medical services; ESCAPE-NET

Abbreviations

ATC, Anatomical Therapeutic Chemical

HF, Heart failure

COPD, Chronic obstructive lung disease

CPR, Cardiopulmonary resuscitation

CNS, Central Nervous System

EMS, Emergency medical services

ESCAPE-NET, The European Sudden Cardiac Arrest network towards Prevention,

Education, New Effective Treatment

GP, General practitioner

ICD, International Classification of Disease

IHD, Ischemic heart disease

ISCED, International Standard Classification of Education

OHCA, Out-of-hospital cardiac arrest

ROSC, Return of spontaneous circulation

1. Introduction

Despite improvements over time, including the implementation of bystander cardiopulmonary resuscitation (CPR) programs and the use of automated external defibrillators, the survival chances among out-of-hospital cardiac arrest (OHCA) patients remain low.[1] Because of its low survival chance, a key factor would be to prevent the occurrence of a cardiac arrest among patients at risk of OHCA, which remains challenging. Therefore, it is crucial to identify warning symptoms before OHCA that warrant public recognition and early action by emergency medical personnel and physicians to detect patients at high risk.

Approximately half of the individuals who suffer an OHCA are not diagnosed with traditional cardiovascular risk factors, which makes it challenging to identify them and initiate prophylactic measures.[2] Nevertheless, recent studies have shown that OHCA patients had contact with the healthcare system,[3]–[5] and often experienced prodromal symptoms (including chest pain, dyspnea) from minutes to days or months before OHCA.[6]–[8] The existing studies have interviewed survivors from OHCA, bystanders on-site, or used information documented by the emergency medical services (EMS) in the field. Thus, the data collection on prodromal symptoms was obtained after the occurrence of OHCA, and in selected populations, introducing the risk of recall bias and yielding results that are not representative of the population at large.[7]–[10] Although contact with the pre-hospital system is of considerable importance, little is known of the symptoms that individuals report when calling the medical non-emergency or emergency helpline services. In the Capital Region of Denmark, we have a unique opportunity to avoid recall bias by using the electronic records of calls to the out-of-hours medical services (1813-Medical Helpline) for non-emergency conditions and emergency calls to the EMS dispatch center (1-1-2). This data contains information on symptoms registered by healthcare professionals before OHCA. The study aimed to describe

symptoms registered by healthcare professionals from calls to the emergency and non-emergency medical helpline services up to 30 days before their OHCA.

2. Methods

Study setting and registered symptoms

In the Capital Region of Denmark, residents with non-emergency medical conditions who cannot reach their general practitioner (GP) call the 1813-Medical Helpline from 4 p.m. until 8 a.m., during weekends and public holidays. The 1813-Medical Helpline is staffed by trained nurses and doctors who provide advice or refer to emergency departments.[11] In case of a medical emergency, residents can dial the 24 hours emergency number 1-1-2, where dispatchers (doctors, nurses, and paramedics) evaluate the urgency and prioritize the dispatch of ambulances.

The 1-1-2 and the 1813-Medical Helpline is an integrated service located at one facility, the Copenhagen EMS.[12] For each call, the healthcare professionals (supported by Danish Index) assess the main reason for calling among a total of 37 chief complaint groups. Each are subdivided into five levels of emergency (A-E). In case of life-threatening symptoms, the decision support tool indicates the highest level of emergency (A).[13] A similar decision support tool is also used by the 1813-Medical Helpline to determine appropriate aid. [11] In both cases, during the telephone triage healthcare professionals follow a flowchart according to the decision support tool, which ensures that, everyone is inquired systematically about their complaint.

It is important to note that healthcare professionals only register one chief complaint per call, even if patients reported several complaints. To describe prodromal symptoms, we used these chief complaint groups originally registered by the healthcare professional. For analysis we

divided them into 8 main categories: (1) chest pain, (2) breathing problems, (3) Central Nervous System (CNS)-related symptoms including episodes of unconsciousness (CNS/unconsciousness), (4) symptoms from the abdominal/back/urinary tract (abdominal/back/urinary), (5) psychiatric/addiction-related problems (psychiatric/addiction), (6) infection/fever, (7) trauma/exposure and (8) unspecified (**Supplementary Table S1**). The latter contains a diverse group of chief complaints that did not fit into any of the others, for example, unclear problems, a complication of a known disease, etc. In some cases, the healthcare professionals did not register a chief complaint (“no registered symptom”), and we did not include them in the main analyses.

Data sources

In Denmark, all residents have a unique civil registration number, enabling linkage between the nationwide Danish registries on an individual level.[14] We used data from electronic records of calls to the medical helpline services from 1st January 2014 to 31st December 2018. This register contains information on the time and date when the healthcare professionals received a call, the chief complaint using two different criteria-based systems (respectively for 1-1-2 and 1813-Medical Helpline), and ultimately what response (including information on dispatch of ambulances or other vehicles), treatment or advice was given during the call, as described also elsewhere.[11]–[13] OHCA patients in the Capital Region of Denmark were identified from the national register, Danish Cardiac Arrest Register (2014-2018).[1] This register includes the date, location of OHCA (private home or public place), witnessed status (by a bystander, EMS, or unwitnessed), bystander-performed CPR and defibrillation, first recorded heart rhythm, and survival status on hospital arrival.

From the Danish National Patient Register, we retrieved diagnose codes, according to the International Classification of Disease (ICD 10), from the emergency department, inpatient, and outpatient hospital admissions (**Supplementary Table S2**).^[15] Information on all redeemed medical prescriptions was obtained from the Danish National Prescription Register with drugs classified according to the Anatomical Therapeutic Chemical (ATC) system (**Supplementary Table S2**).^[16] Diagnose codes up to 10 years before OHCA were used to define comorbidities and the redeemed prescriptions within 180 days before OHCA were used to define the patient's therapy. Separately, we examined the redeemed prescriptions and hospital discharge diagnoses within 180 days before the date of the call, to examine each prodromal symptom related to a previous medication or hospital discharge diagnosis. For antibiotics and QT-prolonging drugs we included prescriptions filled 30 days before the index date (*OHCA date and call date*), as usually are prescribed for short periods. Information on age, sex, and vital status were obtained from the Danish Civil Registration System.^[17] While causes of death was obtained from death certificates from the National Causes of Death Register.^[18] To study the socioeconomic status among OHCA patients we used the household income and the education level of the patient, which was calculated as a 5-year average income meaning 5 years preceding (and excluding) the year of OHCA and divided into tertiles (low, medium, and high income). This, to take yearly variations into account due to the potential influence of acute disease. Information on the educational level was obtained from the Population's Education Register^[19] and categorized into three groups by the International Standard Classification of Education (ISCED)^[20] levels: (1) Basic education, (2) General or vocational upper secondary, and (3) Bachelor, Master and Doctoral Degree or equivalent. Individuals with no information on education level or income were added respectively to the group (1) of education levels and in the low-income, as missing values were assumed to be in the lower education and income group.

Population and study design

This is a retrospective, registry-based cohort study. We included all OHCA patients of presumed cardiac cause, 18 years of age or older, and not EMS-witnessed between January 1st, 2014, and December 31st, 2018 in the Capital Region of Denmark. They were linked to electronic call records within 30 days before OHCA. EMS-witnessed arrests were excluded to obtain a more homogenous population as they differ from the rest of the OHCA. This is because EMS-witnessed arrests are considered a subset of OHCA, where the majority had a preexisting cardiac or respiratory disease and experienced prodromal symptoms before EMS personnel arrived, leading to higher survival rates.[21]

Supplementary Figure S1 illustrates all calls included in the analysis. We aimed to identify registered prodromal symptoms among patients that called before experiencing an OHCA, which represents the general OHCA population. Therefore, we excluded the call related to the OHCA event — the one resulting in an ambulance dispatch on the OHCA date, as made after or during an OHCA.

Statistics

Descriptive statistics were used to summarize categorical variables and medians with interquartile ranges (IQR) for continuous variables. Analyses of symptoms were made including all the calls with a registered symptom where one patient could have multiple calls. To analyze the baseline characteristics among OHCA patients, these patients were included in the analyses only once. Analyses were divided according to the time period (0-7 days or 8-30 days before OHCA) and the call type (either 1-1-2 or 1813- Medical Helpline). The cut-offs of 7 and 30 days were chosen to investigate the prodromal symptoms of OHCA, as previous studies have shown that patients had experienced symptoms shortly before OHCA.[8], [9] When analyzing the

characteristics of patients according to the registered prodromal symptoms, among patients with more than one call, the priority was given to chest pain, followed by this order: breathing problems, CNS/unconsciousness, abdominal/back/urinary, psychiatric/addiction, infection/fever, trauma/exposure and unspecified. This is based on the already described prodromal symptoms from minutes to days or months before OHCA.[6]–[8]

Separately, we analyzed differences in the registered prodromal symptoms and patient characteristics among those calling multiple times, according to the number of calls, subdivided into 3 groups: “1 call”, “2 calls” and “ ≥ 3 calls”. Finally, we examined differences in the registered prodromal symptoms according to sex and age, where age was categorized as ≤ 65 or >65 years old. Data management and analyses were performed with R version 3.6.1.[22]

Ethics

The study was approved by the Danish Data Protection (Agency Ref.no 3-3013-2795/1, local ref.no. P-2019-191). The information on the study population was encrypted and rendered anonymous by Statistics Denmark, and registry-based studies do not require ethical approval.

3. Results

There were 5,442 patients with OHCA in the Capital Region of Denmark from 2014 to 2018. Among these, 18% (974/5,442) made 1,488 calls to the helpline services up to 30 days before their OHCA (**Figure 1**).

3.1 Characteristics of the OHCA patients included in the study

The patients included in the study had a median age of 76 years ([Q1-Q3: 65-84]), the majority were male (56%), had basic educational level and low-income (**Table 1**). They had a high burden of comorbidities such as cardiac, respiratory, and neurological diseases. Additionally, more than half of these patients redeemed a prescription for antibiotics within 180 days before OHCA. Most of the cardiac arrests occurred in private locations (79%) and had a high rate of bystander CPR (68%). However, patients were less likely to have an initial shockable rhythm (7%), return of spontaneous circulation (23%) and 30-day survival (8%).

Separately, we examined the characteristics of the patients according to the registered symptoms as shown in **Supplementary Table S3**. Among patients with breathing problems, prior heart failure (HF) was present in 29% and respiratory diseases in 78% of patients. And, 39% of those with chest pain, had history of previous ischemic heart disease (IHD). Within 180 days before the call date, nearly half of patients (54%) with breathing problems were assigned with respiratory-related diagnoses and primarily redeemed prescriptions for antibiotics (65%).

3.2. Registered prodromal symptoms 30 days before OHCA

Of 1,488 calls, 23% had no symptoms registered, and this was most frequent among calls to the 1813-Medical Helpline (**Figure 1**). Overall, no baseline differences were observed between patients with no registered symptoms compared to those with a registered prodromal symptom, besides a lower drug and alcohol abuse and more diabetic disease among the 158 patients with

343 calls with no registered symptoms (**Supplementary Table S4**). The main analysis included only 816 patients with registered symptoms in 1,145 calls. Some of these patients called more than once, thus assigned with more than one registered prodromal symptom. The most common specific categories were breathing problems (17%) and trauma (17%), followed by CNS/unconsciousness (15%), **Figure 2**. Symptoms related to the unspecified category were registered in 33% of patients. This included mostly "unclear problem" (43% of the unspecified) and "complication of the known disease" (19% of the unspecified) (data not shown).

A similar distribution was observed in a major part of registered prodromal symptoms when patients were divided according to sex and age groups (**Supplementary Figure S2**). However, chest pain and abdominal/back/urinary-related symptoms were twice more registered among men compared to women. Patients aged <65 years had more psychiatric related symptoms compared to older population. (16% vs 1%)

In addition, 83% (677/816) of 816 patients with registered symptoms had also contacted a GP within 30 days before OHCA. Of those, although no information on the reasons for contact was available, more than half had phoned/emailed and 15% (12.5% of 816) had a face-to-face consultation with their GP (data not shown).

3.3. Patients divided according to time period and call type

When patients were divided according to the time periods of their calls (0-7 days and 8-30 days) (**Figure 3a**), 41% (471/1,145) of calls were made within 0-7 days before OHCA, corresponding to 399 (49%) patients. Among them, besides unspecified (32%), the most frequent categories of registered prodromal symptoms were CNS/unconsciousness (19%), followed by infection/fever (12%) and trauma/exposure (11%). Within 8-30 days before

OHCA, breathing problems (21%) and trauma/exposure (20%) remained the most common specific categories, except for the unspecified (33%).

Figure 3b shows the distribution of the registered prodromal symptoms among patients divided by call type (1-1-2 and 1813-Medical Helpline). Of these, a majority (61%) called the 1813-Medical Helpline, which comprised 59% of all calls, with the most common specific category being abdominal/back/urinary (17%), followed by trauma/exposure (15%), and infection/fever (15%). Patients that called 1-1-2, mainly registered in the categories breathing problems (24%), CNS/unconsciousness (23%), and trauma/exposure (19%). The unspecified category remained the largest with 24% and 39%, respectively for calls to 1-1-2 and 1813-Medical Helpline.

3.4. Multiple calls within 30 days before OHCA

Of all patients, 28% called more than once, where calls to 1813-Medical Helpline outnumbered calls to 1-1-2 (**Figure 4**). Characteristics of the patients within each group of calls (“1 call”, “2 calls” and “ ≥ 3 calls”) are shown in the **Supplementary Table S5**. Compared to patients that called less often, patients with ≥ 3 calls had a median age of 70 years (IQR 54-78), called more within 7 days to OHCA (73%) with mostly registered symptoms related to psychiatric conditions/addiction and mainly had a previous history of psychiatric disorders. They also had a high frequency of hospital discharge diagnoses related to mental and behavioral disorder, redeeming a prescription for antibiotics (63%), antidepressants and antipsychotic drugs (43%) within 180 days before calls.

4. Discussion

In the present study we found that, nearly one out of five patients called the medical helpline services within a month before their cardiac arrest. While the prodromal symptoms registered during these calls varied highly, breathing problems were the most common and nearly twice more common than chest pain. Almost half of the patients called within a week before their OHCA, where *CNS/unconsciousness* was the most registered specific symptom. More patients called the non-emergency number (1813-Medical Helpline) than the emergency number 1-1-2.

Previously studies have shown that OHCA patients were more likely to be in contact with the healthcare service than the control population, 2 weeks and 1 month before their arrest respectively. [3], [5], [23] In this study, the main aim was to find symptoms, also considering diagnoses and redeemed prescriptions, that could help identify future OHCA. Our findings suggest that it is difficult to predict future OHCA as the symptoms reported were highly varied. However, breathing problems might deserve increased attention in the future, as they were commonly registered.

Community-based studies have shown that 33-51% of patients experienced symptoms before their cardiac arrest, with chest pain and dyspnea being the most frequent.[6], [7], [9], [10] The majority of existing studies have been focused on EMS-witnessed cases and examined a short period before OHCA (24 hours), where information on symptoms was derived from multiple sources like family at the scene, witnesses, and survivors of the arrest. [6], [7], [9], [10]

By comparison, we excluded EMS-witnessed OHCA, to potentially detect early warnings symptoms. Additionally, we used electronic records of calls, where neither the patients

reporting the symptoms, nor the healthcare professional were aware of a future OHCA, thereby avoiding recall bias.

The high occurrence of breathing problems probably reflects (1) the fact that we studied a longer period before the OHCA event, and (2) the different mechanisms of OHCA. Nishiyama et al. also found dyspnea to be more common among EMS-witnessed OHCAs – regardless of the etiology of cardiac arrest.[7] In Denmark, one study estimated that difficulty in breathing was the fifth most reported symptom by callers to 1-1-2, and these patients are described as a complex group with severe health problems. [13], [24] This is also reflected in our data, where patients with breathing problems had a high number of comorbidities, such as respiratory- and cardiac diseases (especially HF), and within 180 days from calls most had antibiotic prescriptions. The latter could further indicate a deterioration of their chronic pulmonary condition; therefore, reduction of cardiac arrest also requires the investigation and earlier recognition of nonischemic causes of OHCA.

Although coronary heart disease is the leading cause of cardiac arrest, only 9% had chest pain in our cohort. The lower percentage compared to the previous literature could be explained by the high *comorbidity burden* and increased age among our arrest patients, which increases the likelihood of patients presenting myocardial infarction without chest pain.[25] Concerning this, previously it has been described that predictors of symptoms other than chest pain were older age and female sex,[25], [26] as women often experienced fewer chest pain symptoms compared to men.[25], [27] In our study, despite the overall frequency of the symptom distribution according to age and sex was similar, chest pain symptoms were twice more registered among men compared to women.

Presyncope/syncope has been described especially among young OHCA patients,[28] and in patients with hypertrophic cardiomyopathy, where unexplained syncope was a risk factor for sudden death.[29] In our study, the high frequency of CNS/unconsciousness-related symptoms (especially among elderly) the week before OHCA was probably due to their cardiac condition, other comorbidity and medication. Further studies are needed to investigate these patients.

Among the registered symptoms, the unspecified category was the largest, as it contains a diversity of registered symptoms not included in the other categories. It has been suggested that symptoms presented before cardiac arrest may be non-specific and therefore considered “unharmful”. [8], [30] Studies have shown that people with unstable angina or acute myocardial infarction fail to recognize the warning signs before their ischemic cardiac-related event.[31] In our study, most patients within the unspecified category called the non-emergency number, suggesting that the patient likely has perceived the symptom/condition as less urgent, or difficult to define hence not calling the emergency number instead. “Unclear problems” was the largest part of the unspecified category, its characteristics has been described elsewhere.[32] The presence of non-specific complaints also underline the difficulty for healthcare professionals to perceive a life-threatening symptom/condition. On the other hand, 12.5% of all OHCA patients that called within 30 days also had a face-to-face visit with their GPs. Altogether it reflects that identifying patients presenting symptoms before their OHCA remains challenging.

Lastly, nearly a quarter of patients called more than once, especially to the non-emergency number and with symptoms related to psychiatric conditions/addiction. Although psychiatric patients are known to be at risk of OHCA,[33] identifying these patients before a cardiac arrest is difficult.

Clinical implications

Although coronary artery disease remains the predominant cause of cardiac arrest, notably, only one-third (32%) of our OHCA-population had registered the typical classical symptoms (chest pain, breathing problems, and CNS/unconsciousness). Thus, it is important for the healthcare professionals to be aware that patients at risk of OHCA might not always present the “classical symptoms”. Our results suggest that patients experience very different symptoms before their cardiac arrest, which makes the recognition and the prevention of OHCA very challenging. Further studies investigating patients with breathing symptoms and especially patients with unspecific symptoms are warranted to improve risk stratification among these patients.

Limitations

The study is observational and has a retrospective nature of data collection. Neither the patient nor the healthcare professional on the phone knew about future OHCA during the phone call, which minimizes the potential for recall and response biases. It is important to consider that we use the most severe registered complaint, referred by patients before OHCA as a proxy for describing prodromal symptoms. A large portion of symptoms was not registered (“no reported symptoms”), which could have included specific symptoms resulting in a shift of the frequencies reported in this study. Yet, no differences were observed between the groups of patients with registered symptoms vs. those that had no registered symptoms. We do not know if patients had several severe symptoms, because of the way symptoms are registered we cannot rule out that the decision priority system used to guide healthcare professionals could influence our results. Finally, our study population is selected as based on calls to the non-emergency and EMS services in the Capital Region.

Conclusions

Among patients who called medical helpline services up to 30-days before their OHCA, besides symptoms being highly varied, breathing problems were the largest symptom-specific category. Future studies should investigate subgroups of OHCA within these symptom presentations to understand how to develop future preventive interventions.

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Legend to tables and figures

TABLES:

Table 1. Baseline characteristics of the OHCA population included in the study.

FIGURES:

Figure 1. Flowchart of the study population.

Figure 2. Overview of prodromal symptoms among patients that called the medical helpline within 30 days before OHCA.

Figure 3. Prodromal symptoms among patients that called the medical helpline divided by (A) time periods within 0-7 days or 8-30 days before OHCA, ^a and (B) call type, 1-1-2 and 1813-Medical Helpline. ^b

Figure 4. Frequency of calls within 30 days before OHCA divided by calls to *1813-Medical Helpline* (green) and calls to *1-1-2* (red).

Figures and tables

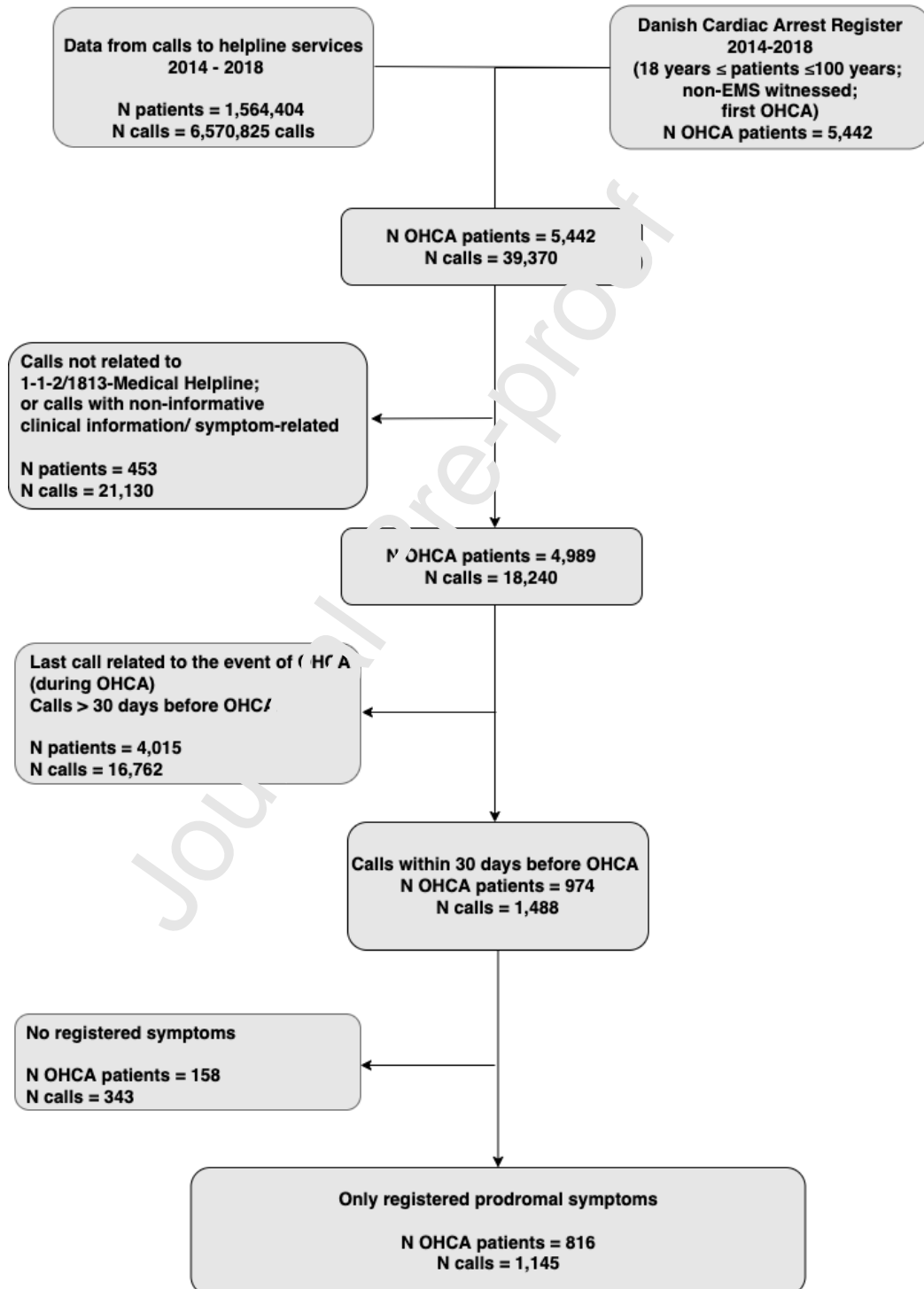
Figure 1. Flowchart of the study population.

Table 1. Baseline characteristics of the OHCA population included in the study.

<i>Variables, n (%)</i>	OHCA-patients N = 974
<i>Demographics</i>	
Males	548 (56.3)
Age (years) median (Q1-Q3)	76 [65-84]
Education level *	
Basic education	439 (45.0)
General or vocational upper secondary	355 (36.5)
Bachelor, Master or Doctoral degree	180 (18.5)
Level of income *	
Low	432(44.4)
Medium	405 (41.5)
High	137 (14.1)
Comorbidities within 10 years †	
Cardiac disease	703 (72.2)
Respiratory disease	551 (56.6)
Neurological disease	400 (41.1)
Psychiatric disorders	205 (21.0)
Drug and alcohol abuse	200 (20.5)
Hospital admission/Emergency visit within 180 days before OHCA	363 (37.3)
Medication	
<i>180 days before OHCA</i>	
BB ‡, CCB §, digoxin	411 (42.2)
Antidepressant or antipsychiatric drugs	345 (35.4)
Anticoagulant drugs	197 (20.2)
Antibiotic drugs	533 (54.7)
<i>30 days before OHCA</i>	
QT prolonging drugs	114 (11.7)
Antibiotics	287 (29.5)

Cardiac arrest related factors	
Private location	773 (79.5)
missing	< 4
Witnessed arrest	462 (47.5)
missing	< 4
Bystander cardiopulmonary resuscitation	662 (68.2)
missing	< 4
Bystander defibrillation	27(3.0)
missing	46 (5.4)
Initial recorded shockable rhythm	68(7.1)
missing	18
Return of spontaneous circulation (ROSC)	216 (23.2)
missing	44
Patient has ROSC or has a Glasgow Coma Scale > 3 at hospital arrival	184 (20.1)
missing	60
30-day survival	76 (7.8)
<p>* Missing value (<10) were included in the lower education/income groups. † Disease categories in hold are represented in the Suppl. Table 2, according to the chapter definition ICD. ‡ BB, beta-blockers drugs; § CCB, Calcium channel blockers.</p>	

Figure 2. Overview of prodromal symptoms among patients that called the medical helpline within 30 days before OHCA.

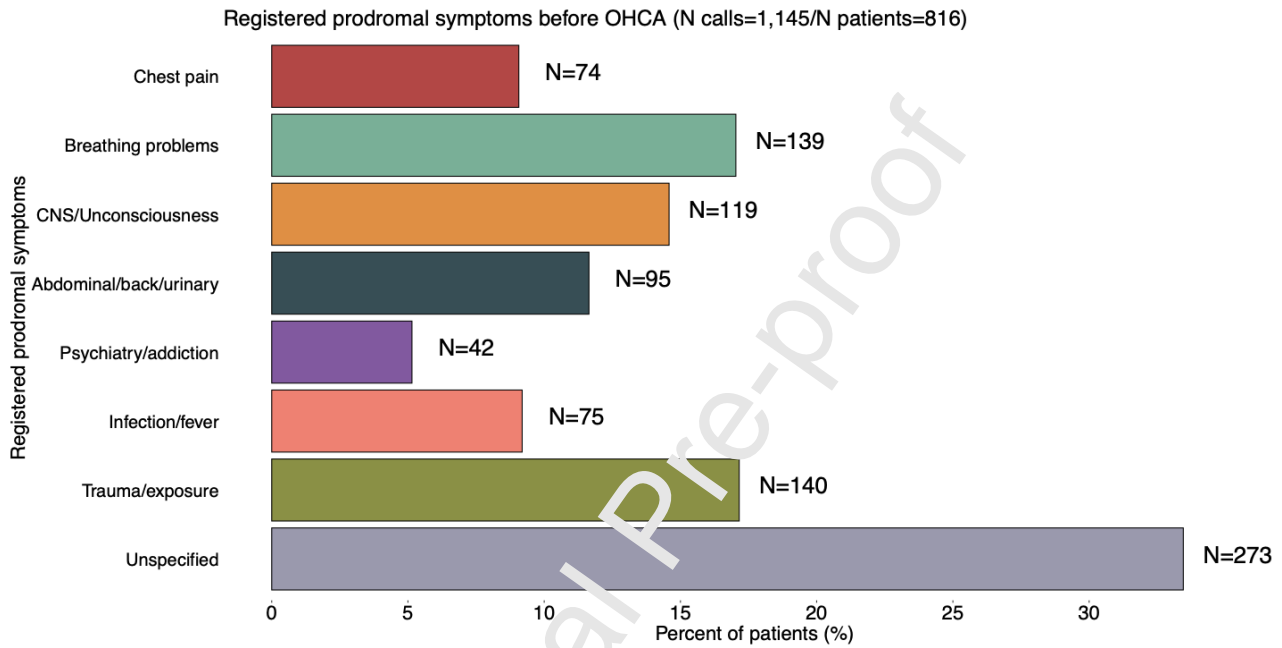
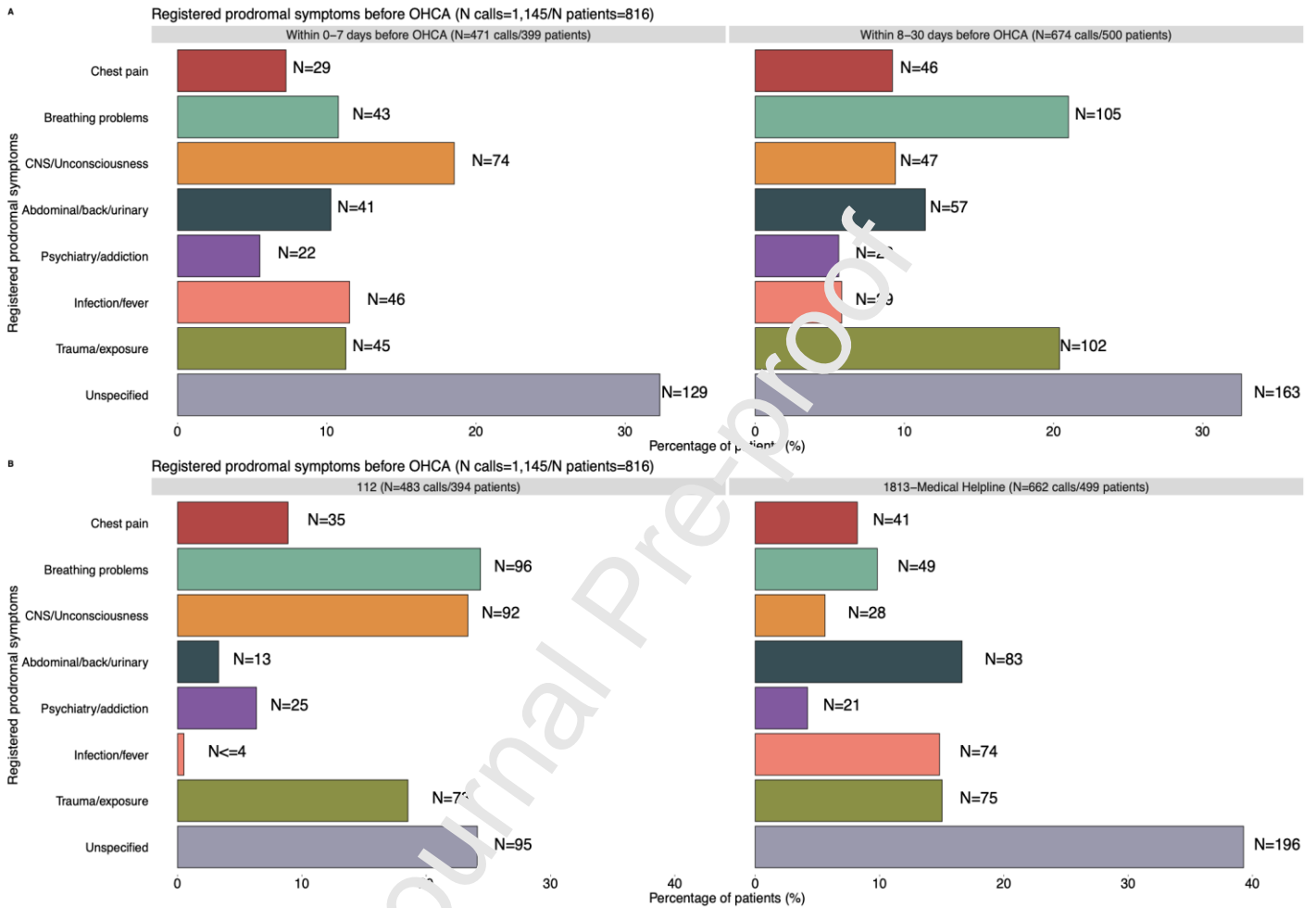


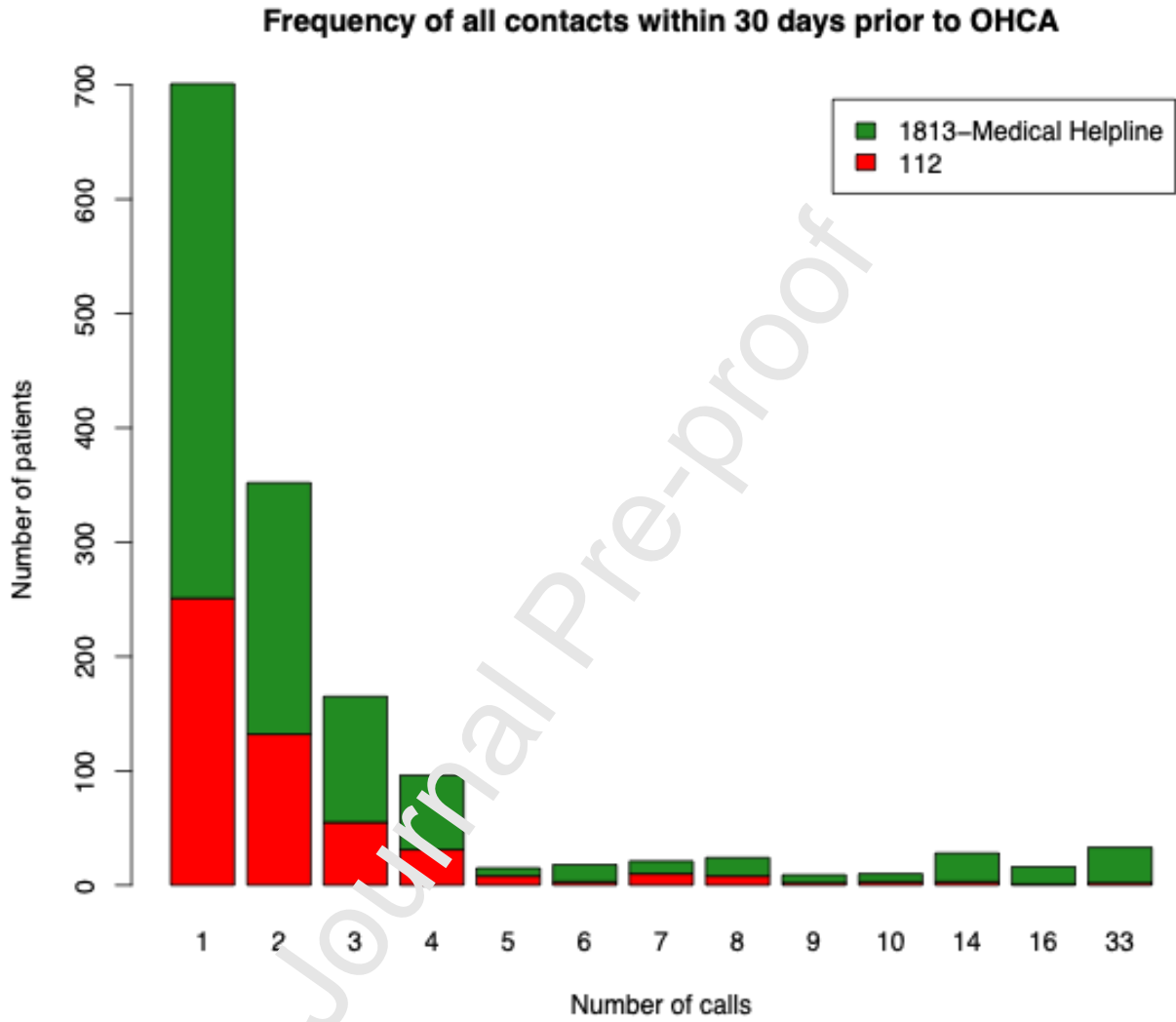
Figure 3. Prodromal symptoms among patients that called the medical helpline divided by (A) time periods within 0-7 days or 8-30 days before OHCA,^a and (B) call type, 1-1-2 and 1813-Medical Helpline.^b



^a (A) Number of calls within 0-7 days before OHCA = 471 (399 patients), number of calls within 8-30 days before OHCA = 674 (500 patients).

^b (B) Number of calls with 1-1-2 = 483 (394 patients), number of calls with 1813-Medical Helpline = 662 (499 patients).

Figure 4. Frequency of calls within 30 days before OHCA divided by calls to *1813-Medical Helpline* (green) and calls to *1-1-2* (red).



Appendix A Supplementary material

Supplemental material

TABLES:

Supplementary Table S1. Categorization of the criteria descriptions at the 1-1-2, and 1813-Medical Helpline into symptom categories used in the analysis.

Supplementary Table S2. ICD codes and ATC codes used to define the comorbidities and pharmacotherapy used among OHCA patients.

Supplementary Table S3. Characteristics of patients according to the registered prodromal symptoms.

Supplementary Table S4. Characteristics of patients according to the presence of the registered prodromal symptoms or not.

Supplementary Table S5. Characteristics of patients according to the number of calls within 30 days before OHCA.

FIGURES:

Supplementary Figure S1. Timeline of calls included in the study analysis.

Supplementary Figure S2. Prodromal symptoms 30 days before OHCA according to (A) sex, and (B) age categorized in <65 years and ≥ 65 years.

Supplementary Table S1. Categorization of the criteria descriptions at the 1-1-2, and 1813-Medical Helpline into symptom categories used in the analysis.

Criteria code	Chief complaint	8 symptom categories used for analysis
1	Unconscious adult (from puberty)	CNS/Unconsciousness
10	Chest pain - heart disease	Chest pain
11	Diabetes	Unspecific
23	Seizure	CNS/Unconsciousness
24	Abdominal pain - back pain	Abdominal/back/urinary
26	Impaired consciousness - paralysis - vertigo	CNS/Unconsciousness
28	Breathing problems	Breathing problems
29	Alcohol - poisoning - overdose	Psychiatry/addiction
31	Extremity pain - wounds - fractures - minor injuries	Trauma/exposure
32	Traffic accident	Unspecific
33	Accidents (not traffic accident)	Trauma/exposure
6	Unclear problem	Unspecific
7	Allergic reaction	Unspecific
A.01.01	Unconscious adult (from puberty), Unconscious and abnormal breathing	CNS/Unconsciousness
A.01.03	Unconscious adult (from puberty), Unconscious but normal breathing	CNS/Unconsciousness
A.06.01	Unclear problem, Unresponsive and abnormal breathing	CNS/Unconsciousness
A.06.02	Unclear problem, Conscious but about to pass out	Unspecific
A.06.03	Unclear problem, Breathing problems. Exhausted	Unspecific
A.06.04	Unclear problem, Pale and clammy	Unspecific
A.06.05	Unclear problem, Suddenly ill and unwell	Unspecific
A.06.06	Unclear problem, Uncomfortable and sudden onset of weakness	Unspecific
A.06.09	Unclear problem, Communication difficulty and suspicion of acute problem	Unspecific
A.06.10	Unclear problem, Assumed red criterion. (Further information not readily available)	Unspecific
A.06.11	Unclear problem, Other red criterion. (No other suitable criterion in Index)	Unspecific
A.06.99	Unclear problem, No suitable criterion	Unspecific
A.07.02	Allergic reaction, Can hardly breathe	Unspecific

A.07.05	Allergic reaction, Strikingly lethargic or restless	<i>Unspecific</i>
A.07.07	Allergic reaction, Has previously experienced allergy shock and has symptoms now	<i>Unspecific</i>
A.07.08	Allergic reaction, Allergic reaction which is rapidly worsening	<i>Unspecific</i>
A.07.99	Allergic reaction, No suitable criterion	<i>Unspecific</i>
A.08.08	Bleeding - no trauma, fresh, red hemorrhage from rectum.	<i>Unspecific</i>
A.08.09	Bleeding - no trauma, larger black tar-like stools, and patient is feeling unwell.	<i>Unspecific</i>
A.08.12	Bleeding - no trauma, Bleeding has stopped, but the patient is still pale and clammy, and feels unwell.	<i>Unspecific</i>
A.10.01	Chest pain - heart disease, Unresponsive	<i>Chest pain</i>
A.10.02	Chest pain - heart disease, Chest pain and about to pass out	<i>Chest pain</i>
A.10.03	Chest pain - heart disease, New onset of central pain in the chest lasting more than 5 min	<i>Chest pain</i>
A.10.04	Chest pain - heart disease, Chest pain or chest discomfort and breathing problems	<i>Chest pain</i>
A.10.05	Chest pain - heart disease, Chest pain or chest discomfort and - pale, clammy skin and radiation of pain to jaw / shoulder / arm / back and / or sudden weakness in the arms	<i>Chest pain</i>
A.10.06	Chest pain - heart disease, Chest pain or chest discomfort and - pale, clammy skin	<i>Chest pain</i>
A.10.07	Chest pain - heart disease, Chest pain or chest discomfort and radiation of pain to jaw / shoulder / arm / back	<i>Chest pain</i>
A.10.08	Chest pain - heart disease, Chest pain or chest discomfort and - sudden weakness in the arms	<i>Chest pain</i>
A.10.09	Chest pain - heart disease, Chest pain or chest discomfort and - ECG showing myocardial infarction (STEMI)	<i>Chest pain</i>
A.10.10	Chest pain - heart disease, Chest pain or chest discomfort and - only transient effect of nitroglycerin	<i>Chest pain</i>
A.10.11	Chest pain - heart disease, Possible serious cardiac problem with atypical symptoms	<i>Chest pain</i>
A.10.12	Chest pain - heart disease, Shock from ICD. Patient is exhausted	<i>Chest pain</i>
A.10.13	Chest pain - heart disease, Patient have had 4-5 shocks from ICD	<i>Chest pain</i>
A.10.14	Chest pain - heart disease, Chest pain – otherwise ok	<i>Chest pain</i>
A.10.99	Chest pain - heart disease, No suitable criterion	<i>Chest pain</i>
A.11.01	Diabetes, Unresponsive	<i>Unspecific</i>
A.11.02	Diabetes, Breathing problems	<i>Unspecific</i>
A.11.04	Diabetes, Unwell and pain or discomfort in chest, shoulder, arm or jaw	<i>Unspecific</i>
A.11.05	Diabetes, Pale and clammy. Patients does not drink	<i>Unspecific</i>
A.11.99	Diabetes, No suitable criterion	<i>Unspecific</i>
A.19.03	Headache, Sudden, intense and different headaches, like "lightning from a clear sky". Exhausted	<i>CNS/Unconsciousness</i>
A.19.99	Headache, No suitable criterion	<i>CNS/Unconsciousness</i>

A.23.01	Seizure, The seizure is over, but patient is still unconscious with abnormal breathing	<i>CNS/Unconsciousness</i>
A.23.02	Seizure, Unconscious with ongoing seizures	<i>CNS/Unconsciousness</i>
A.23.03	Seizure, Patient have had a seizure and - the seizure has lasted> 5 min	<i>CNS/Unconsciousness</i>
A.23.99	Seizure, No suitable criterion	<i>CNS/Unconsciousness</i>
A.24.04	Abdominal pain - back pain, Sudden onset of severe abdominal or back pain, pale and clammy	<i>Abdominal/back/urinary</i>
A.24.05	Abdominal pain - back pain, Intense continuing abdominal pain and weak and exhausted	<i>Abdominal/back/urinary</i>
A.24.07	Abdominal pain - back pain, Vomit with old blood, which resembles coffee grounds, and seems exhausted and weak	<i>Abdominal/back/urinary</i>
A.24.99	Abdominal pain - back pain, No suitable criterion	<i>Abdominal/back/urinary</i>
A.26.01	Impaired consciousness - paralysis - vertigo, unresponsive	<i>CNS/Unconsciousness</i>
A.26.03	Impaired consciousness - paralysis - vertigo, Suspicion of apoplexy (STROKE): Drooping face/weakness in arms / legs, and / or speech difficulties	<i>CNS/Unconsciousness</i>
A.26.04	Impaired consciousness - paralysis - vertigo, Increasingly fuzzy / lethargic - suspicion of apoplexy (STROKE).	<i>CNS/Unconsciousness</i>
A.26.05	Impaired consciousness - paralysis - vertigo, Pale and clammy	<i>CNS/Unconsciousness</i>
A.26.99	Impaired consciousness - paralysis - vertigo, No suitable criterion	<i>CNS/Unconsciousness</i>
A.28.01	Breathing problems, Unresponsive	<i>Breathing problems</i>
A.28.02	Breathing problems, Can hardly breathe.	<i>Breathing problems</i>
A.28.03	Breathing problems, Breathing problems with sound from upper airways	<i>Breathing problems</i>
A.28.04	Breathing problems, Can barely speak coherently	<i>Breathing problems</i>
A.28.06	Breathing problems, Breathing problems and increasingly fuzzy / lethargic	<i>Breathing problems</i>
A.28.07	Breathing problems, Trauma and breathing problems	<i>Breathing problems</i>
A.28.08	Breathing problems, Chest pain and breathing problems	<i>Breathing problems</i>
A.28.10	Breathing problems, Patient known with asthma but is rapidly getting worse despite use of medication	<i>Breathing problems</i>
A.28.11	Breathing problems, "Boiling" chest and breathing problems	<i>Breathing problems</i>
A.28.12	Breathing problems, Pale and clammy	<i>Breathing problems</i>
A.28.13	Breathing problems, Recently underwent surgery and suddenly got breathing problem	<i>Breathing problems</i>
A.28.14	Breathing problems, Bedridden and suddenly acquired breathing problems	<i>Breathing problems</i>
A.28.99	Breathing problems, No suitable criterion	<i>Breathing problems</i>
A.29.01	Alcohol - poisoning - overdose, Unresponsive	<i>Psychiatry/addiction</i>
A.29.99	Alcohol - poisoning - overdose, No suitable criterion	<i>Psychiatry/addiction</i>

A.32.01	Traffic accident, Unresponsive	<i>Trauma/exposure</i>
A.33.01	Accident, Unresponsive	<i>Trauma/exposure</i>
A.33.02	Accident, Possible serious injury	<i>Trauma/exposure</i>
A.33.11	Accident, Major blood loss, still bleeding excessively	<i>Trauma/exposure</i>
A.33.99	Accident, No suitable criterion	<i>Trauma/exposure</i>
B.03.01	Foreign body in airway, No acute breathing problems, suspected foreign body in bronchi	<i>Trauma/exposure</i>
B.06.01	Unclear problem, Patient is exhausted (Unclear information)	<i>Unspecific</i>
B.06.02	Unclear problem, Severe pain without clear cause - and otherwise normal ABCD	<i>Unspecific</i>
B.06.03	Unclear problem, Passed out several times but has recovered	<i>Unspecific</i>
B.06.04	Unclear problem, Vertigo and very exhausted	<i>Unspecific</i>
B.06.05	Unclear problem, Repeated inquiries and unclear issue. Possibly serious problem	<i>Unspecific</i>
B.06.06	Unclear problem, Communication difficulties and unclear issue. Possibly serious problem	<i>Unspecific</i>
B.06.07	Unclear problem, Assumed orange criterion (Further information not readily available)	<i>Unspecific</i>
B.06.08	Unclear problem, Other orange criterion (No other suitable criterion in Index)	<i>Unspecific</i>
B.06.99	Unclear problem, No suitable criterion	<i>Unspecific</i>
B.07.01	Allergic reaction, Allergic reaction which has worsened	<i>Unspecific</i>
B.07.03	Allergic reaction, Fear of new allergic shock with same cause as earlier. Has common symptoms	<i>Unspecific</i>
B.08.01	Bleeding - no trauma, Vomit with some red fresh blood. Patient is otherwise ok and unaffected	<i>Unspecific</i>
B.08.02	Bleeding - no trauma, Severe nose bleeding that lasted more than 20 minutes. Unwell	<i>Unspecific</i>
B.08.99	Bleeding - no trauma, No suitable criterion	<i>Unspecific</i>
B.09.05	Fire accident - electrical accident, 220-230V through the body and was stuck in the power source	
B.10.01	Chest pain - heart disease, Sudden palpitations and feeling unwell	<i>Chest pain</i>
B.10.02	Chest pain - heart disease, Irregular heartbeats and feeling unwell	<i>Chest pain</i>
B.10.99	Chest pain - heart disease, No suitable criterion	<i>Chest pain</i>
B.11.02	Diabetes, Impaired consciousness/lethargy and has measured /suspicion of low blood sugar	<i>Unspecific</i>
B.11.03	Diabetes, Impaired consciousness/lethargy and has measured /suspicion of low blood sugar or undiagnosed diabetes	<i>Unspecific</i>
B.11.99	Diabetes, No suitable criterion	<i>Unspecific</i>

B.15.04	Fever, Child coughing constantly. Seems weak and exhausted	<i>Infection/fever</i>
B.15.07	Fever, Impaired immune system and fever	<i>Infection/fever</i>
B.19.99	Headache, No suitable criterion	<i>CNS/Unconsciousness</i>
B.21.99	Hypotermi - Hyperthermia, No suitable criterion	<i>Trauma/exposure</i>
B.23.02	Seizure, Patient has had a seizure, but it has ended. Normal breathing – and seizure lasted in less than 5 min.	<i>CNS/Unconsciousness</i>
B.23.05	Seizure, Patient has had a seizure, but it has ended. Normal breathing – and patient is still lethargic/confused >20 min. after	<i>CNS/Unconsciousness</i>
B.24.01	Abdominal pain - back pain, Persistent abdominal pain and patient is feeling sick	<i>Abdominal/back/urinary</i>
B.24.04	Abdominal pain - back pain, Severe reoccurring pain in abdomen, lower back or side	<i>Abdominal/back/urinary</i>
B.24.06	Abdominal pain - back pain, Back pain and reduced mobility in legs. Normal breathing. Besides the pain, unaffected	<i>Abdominal/back/urinary</i>
B.24.99	Abdominal pain - back pain, No suitable criterion	
B.26.02	Impaired consciousness - paralysis - vertigo, Lost consciousness several times during the past 24 hours	<i>CNS/Unconsciousness</i>
B.26.04	Impaired consciousness - paralysis - vertigo, Was unconscious, but is currently awake. Lethargic and unwell	<i>CNS/Unconsciousness</i>
B.26.05	Impaired consciousness - paralysis - vertigo, Vertigo and exhausted	<i>CNS/Unconsciousness</i>
B.26.99	Impaired consciousness - paralysis - vertigo, No suitable criterion	<i>CNS/Unconsciousness</i>
B.28.01	Breathing problems, Patient is known with COPD, which is getting worse despite use of medication	<i>Breathing problems</i>
B.28.02	Breathing problems, Other acute breathing difficulties, which is gradually worsening	<i>Breathing problems</i>
B.28.99	Breathing problems, No suitable criterion	<i>Breathing problems</i>
B.29.03	Alcohol - poisoning - overdose, Drunk. Cannot take care of himself	<i>Psychiatry/addiction</i>
B.29.99	Alcohol - poisoning - overdose, No suitable criterion	<i>Psychiatry/addiction</i>
B.31.03	Extremity pain - wounds - fractures - minor injuries, Severe pain / malalignment (possible fracture/joint injury) in femoral neck	<i>Trauma/exposure</i>
B.31.04	Extremity pain - wounds - fractures - minor injuries, Severe pain / malalignment (possible fracture/joint injury) in knee, ankle or foot	<i>Trauma/exposure</i>
B.31.99	Extremity pain - wounds - fractures - minor injuries, No suitable criterion	<i>Trauma/exposure</i>
B.33.02	Accident, Severe pain / malalignment (possible fracture/joint injury) in face, shoulder, arm, hand, femoral neck, knee, calf, ankle or foot	<i>Trauma/exposure</i>
B.33.04	Accident, Bleeding which is now stopped or is possible to stop	<i>Trauma/exposure</i>
B.33.05	Accident, Head trauma, patient has nausea, is unwell or vertigo	<i>Trauma/exposure</i>
B.33.99	Accident, No suitable criterion	<i>Trauma/exposure</i>
B.34.01	Urinary track, Severe and reoccurring pain in back or lower back	<i>Abdominal/back/urinary</i>

C.06.01	Unclear problem, Suspected infection in patient with impaired immune system	<i>Unspecific</i>
C.10.01	Chest pain - heart disease, Pain (not severe) and patient feels ok	<i>Chest pain</i>
C.10.02	Chest pain - heart disease, Sustained effect of 1-4 nitroglycerin tablets / spray doses	<i>Chest pain</i>
C.10.03	Chest pain - heart disease, Superficial pain or discomfort in the side of the chest	<i>Chest pain</i>
C.10.06	Chest pain - heart disease, Sudden palpitations, but otherwise feels OK	<i>Chest pain</i>
C.10.07	Chest pain - heart disease, Short stabs of chest pain	<i>Chest pain</i>
C.24.02	Abdominal pain - back pain, Severe back pain. Otherwise unaffected	<i>Abdominal/back/urinary</i>
C.29.01	Alcohol - poisoning - overdose, Patient has taken cocaine, amphetamine, ecstasy or other stimulant and feels unwell	<i>Psychiatry/addiction</i>
C.33.01	Accident, Head trauma and memory loss	<i>Trauma/exposure</i>
D.06.01	Unclear problem, Assumed green criterion. (Further information not readily available)	<i>Unspecific</i>
D.06.02	Unclear problem, Other green criterion. (No other suitable criterion in Index)	<i>Unspecific</i>
E.06.03	Unclear problem, Assumed blue criterion. (Further information not readily available)	<i>Unspecific</i>
E.06.04	Unclear problem, Other blue criterion. (No other suitable criterion in Index)	<i>Unspecific</i>
E.06.05	Unclear problem, Not a health-related problem. Referred to other solution	<i>Unspecific</i>
E.06.99	Unclear problem, No suitable criterion	<i>Unspecific</i>
E.10.02	Chest pain - heart disease, Anxious for heart disease	<i>Chest pain</i>
E.10.99	Chest pain - heart disease, No suitable criterion	<i>Chest pain</i>
E.14.04	Animal Bite - Insect Bite, Bite > 12 hours ago. Fever. Painful swelling at the bite site	<i>Trauma/exposure</i>
E.24.02	Abdominal pain - back pain, Abdominal pain, but otherwise ok.	<i>Abdominal/back/urinary</i>
E.24.03	Abdominal pain - back pain, Back pain but otherwise ok.	<i>Abdominal/back/urinary</i>
E.24.99	Abdominal pain - back pain, No suitable criterion	<i>Abdominal/back/urinary</i>
E.28.03	Breathing problems, some trouble breathing, but generally ok.	<i>Breathing problems</i>
E.28.99	Breathing problems, No suitable criterion	<i>Breathing problems</i>
E.29.99	Alcohol - poisoning - overdose, No suitable criterion	<i>Psychiatry/addiction</i>
E.31.02	Extremity pain - wounds - fractures - minor injuries, Minor injury without suspicion of damage to nerves or vessels. Moderate pain. Can sit in a normal car	<i>Trauma/exposure</i>
E.31.99	Extremity pain - wounds - fractures - minor injuries, No suitable criterion	<i>Trauma/exposure</i>
SS.01	Infections Adults	<i>Infection/fever</i>
SS.01.01	Infections Adults, Fever primary symptom > 38	<i>Infection/fever</i>
SS.01.02	Infections Adults, Sore throat	<i>Infection/fever</i>

SS.01.04	Infections Adults, Cough / Respiratory difficulties	<i>Infection/fever</i>
SS.01.09	Infections Adults, Skin infections, acne / ulcers	<i>Infection/fever</i>
SS.02	Motor apparatus without trauma.	<i>Unspecific</i>
SS.02.02	Motor apparatus without trauma, Symptoms from the neck without trauma	<i>Unspecific</i>
SS.02.04	Motor apparatus without trauma, Symptoms from the back, lower back and chest without trauma	<i>Unspecific</i>
SS.02.05	Motor apparatus, Symptoms in arms and legs after trauma	<i>Trauma/exposure</i>
SS.02.06	Motor apparatus without trauma, Symptoms from arms and legs without trauma	<i>Unspecific</i>
SS.02.08	Motor apparatus without trauma, Symptoms from hands and feet without trauma	<i>Unspecific</i>
SS.03	Skull, Brain, Nervous System	<i>CNS/Unconsciousness</i>
SS.03.02	Skull, Brain, Nervous System, Common symptoms without trauma	<i>CNS/Unconsciousness</i>
SS.03.03	Skull, Brain, Nervous System, Neurological symptoms (new) without trauma	<i>CNS/Unconsciousness</i>
SS.03.04	Skull, Brain, Nervous System, Headache without trauma	<i>CNS/Unconsciousness</i>
SS.03.05	Skull, Brain, Nervous System, Vertigo without trauma	<i>CNS/Unconsciousness</i>
SS.03.07	Skull, Brain, Nervous System, Passed out, but awake again	<i>CNS/Unconsciousness</i>
SS.04	Heart and lungs	<i>Chest pain</i>
SS.04.01	Heart and lungs, Pain/discomfort in chest	<i>Chest pain</i>
SS.04.02	Heart and lungs, Breathing problem	<i>Breathing problems</i>
SS.04.03	Heart and lungs, Fainting	<i>Chest pain</i>
SS.04.04	Heart and lungs, Palpitation	<i>Chest pain</i>
SS.04.05	Heart and lungs, Known cardiac patient / Pacemaker problems	<i>Chest pain</i>
SS.04.06	Heart and lungs, Pacemaker problem	<i>Chest pain</i>
SS.04.07	Heart and lungs, Abnormal blood pressure	<i>Chest pain</i>
SS.05	Gastrointestinal, Urinary and Male Genitals	<i>Abdominal/back/urinary</i>
SS.05.00	Gastrointestinal, Urinary and Male Genitals, Abdominal pain	<i>Abdominal/back/urinary</i>
SS.05.01	Gastrointestinal, Urinary and Male Genitals, Foreign bodies in the gastrointestinal tract	<i>Abdominal/back/urinary</i>
SS.05.02	Gastrointestinal, Urinary and Male Genitals, Foreign bodies in the gastrointestinal tract	<i>Abdominal/back/urinary</i>
SS.05.03	Gastrointestinal, Urinary and Male Genitals, Diarrhea +/- vomit	<i>Abdominal/back/urinary</i>
SS.05.04	Gastrointestinal, Urinary and Male Genitals, Abdominal/bowel bleedings	<i>Abdominal/back/urinary</i>
SS.05.05	Gastrointestinal, Urinary and Male Genitals, Symptoms from rectum	<i>Abdominal/back/urinary</i>

SS.05.06	Gastrointestinal, Urinary and Male Genitals, Constipation	<i>Abdominal/back/urinary</i>
SS.05.07	Gastrointestinal, Urinary and Male Genitals, Difficulty urinating	<i>Abdominal/back/urinary</i>
SS.07	Ear, nose, throat and mouth	<i>Unspecific</i>
SS.07.05	Ear, nose, throat and mouth, Vertigo	<i>Unspecific</i>
SS.07.10	Ear, nose, throat and mouth, Oral cavity problems	<i>Unspecific</i>
SS.07.11	Ear, nose, throat and mouth, Toothache	<i>Unspecific</i>
SS.08.03	Eyes, Pain/reddening in eyes	<i>Unspecific</i>
SS.09	Dermatological symptoms	<i>Unspecific</i>
SS.09.05	Dermatological symptoms, Spontaneous occurring of wounds	<i>Unspecific</i>
SS.09.07	Dermatological symptoms, Known skin disease	<i>Unspecific</i>
SS.11.04	Depression / depression, Sadness / loneliness / need for conversation	<i>Psychiatry/addiction</i>
SS.15.04	Abuse / Addiction, Drinking with risk of withdrawal symptoms and complication of somatic disease / / long-term intake of large amounts of alcohol / previous delirium / previous severe withdrawal symptoms / previous withdrawal epilepsy	<i>Psychiatry/addiction</i>
SS.17.02	Psychotic symptoms, Known psychosis disease with worsening of symptoms	<i>Psychiatry/addiction</i>
SS.20	Eating disorders	<i>Psychiatry/addiction</i>
SS.22.00	Trauma / Injury, High Energy Trauma (Serious injury / Fall from height / Traffic accident / Drowning etc.)	<i>Trauma/exposure</i>
SS.22.01	Trauma / Injury, Head / Neck	<i>Trauma/exposure</i>
SS.22.02	Trauma / Injury, Shoulders / Arms / Hands	<i>Trauma/exposure</i>
SS.22.03	Trauma / Injury, Chest / Back / Abdomen / Pelvis / Hip	<i>Trauma/exposure</i>
ss.22.04	Trauma / Injury, Legs / Knee / Ankle / Foot	<i>Trauma/exposure</i>
SS.23	Burns / Frostbite / Ulcers / Bites / Etching / Electrical accidents / bandage	<i>Trauma/exposure</i>
SS.23.03	Burns / Frostbite / Ulcers / Bites / Etching / Electrical accidents / bandage, Animal/ insect bite	<i>Trauma/exposure</i>
SS.24	Foreign body in the eye / ear / nose / stomach / skin / rectum	<i>Trauma/exposure</i>
SS.26	Complication of known disease	<i>Unspecific</i>
SS.26.01	Complication of known disease, Diabetes	<i>Unspecific</i>
SS.26.02	Complication of known disease, Cancer/ Increased pain	<i>Unspecific</i>
SS.26.13	Complication of known disease, Other disease	<i>Unspecific</i>
SS.26.14	Complication of known disease, Terminal patient	<i>Unspecific</i>
SS.26.15	Complication of known disease, Exacerbation of COPD/ lung disease	<i>Unspecific</i>
SS.26.17	Complication of known disease, Dialysis / Nephrology	<i>Unspecific</i>

SS.27	Unclear problem / Disease	<i>Unspecific</i>
SS.27.00	Unclear problem / Disease, Unknown state of patient– possible dangerous situation (General Sepsis affected / ABCDE affected)	<i>Unspecific</i>
SS.27.01	Unclear problem / Disease, Unwell	<i>Unspecific</i>
SS.27.02	Unclear problem / Disease, Vertigo and exhausted/ dehydrated	<i>Unspecific</i>
SS.27.03	Unclear problem / Disease, Communication difficulties, possible critical disease	<i>Unspecific</i>
SS.27.05	Unclear problem / Disease, Patient is exhausted / uncertain / unclear symptoms / unresolved pain	<i>Unspecific</i>
SS.27.06	Unclear problem / Disease, Unclear symptoms. Generally ok. No signs of critical disease	<i>Unspecific</i>
SS.27.07	Unclear problem / Disease, Elderly / walking impaired. Cannot get up after fall / no injury	<i>Unspecific</i>
SS.32	Unclear problem / Trauma	<i>Unspecific</i>
SS.40	Request a prescription / medicine	<i>Unspecific</i>
SS.40.01	Request a prescription / medicine, Wants prescription	<i>Unspecific</i>
SS.40.02	Request a prescription / medicine, Effect and ingest guidance/ experiencing side effects	<i>Unspecific</i>
SS.40.03	Request a prescription / medicine, Advice regarding medication	<i>Unspecific</i>
SS.40.04	Request a prescription / medicine, Reaction to medication	<i>Unspecific</i>
SS.40.10	Request a prescription / medicine, Possible medication error, poisoning	<i>Unspecific</i>
SS.41.03	Home visit, the unresolved patient, with uncertainty about the nature of newly emerged symptoms (where it is not obvious whether direct hospitalization should be done or whether it can await own physician the day after	<i>Unspecific</i>
SS.41.05	Home visits, Residents of nursing home, patient with dementia in their own home and people with intellectual disabilities must all be offered home visits by an 181 physician if there is a need for urgent medical supervision	<i>Unspecific</i>
SS.50	Complication after examination / treatment	<i>Unspecific</i>
SS.91	Triage to psychiatry	<i>Psychiatry/addiction</i>

Supplementary Table S2. ICD codes and ATC codes used to define the comorbidities and pharmacotherapy used among OHCA patients.

Table 1. ICD and ATC codes		
Comorbidity	ICD code	ATC code
Myocardial Infarct	I21, I22	
Ischemic heart disease	I20, I23, I24, I25, T823D, T823E	
Heart failure	I509, I500, I501, I420, I429, I422, I426, I110	
Arrhythmia	I44, I45, I47, I49, R000	
Atrial fibrillation	I48	
Cerebrovascular disease (CVD)	I60-I69, G45-46	
Stroke	I649, I639, G459, I635, I634	
Chronic obstructive pulmonary disease	J44	
Chronic kidney disease	N02, N03, N04, N05, N06, N07, N08, N11, N12, N14, N18, N19, N26, N158, N159, N160, N162, N163, N164, N168, Q61, Q62, E1-1-2, E132, E142, I120, Q612, Q613, Q615, Q619	
Alcohol abuse	F186, E244, G312, I426, Z714, Z721, G621, G292, L278A	
Drug abuse	F10-F19, F55, K70, E52, I426, G621, K852, K860, K292, G721, G312, O354, ICD8:"29430", "29438", "29439", "291", "303", "304"	
Neurologic disease (Parkinson, Dementia, Epilepsy)	F00-F03, G300, 301, G308, G309, G311, G312, G40, G41, G20, G21	
Diabetes type 2 (≥ 18 years old)		A10A

Hypertension (≥ 2 drugs within 180 days to Index Date)		<p>Antiadrenergic: C02A, C02B, C02C</p> <p>Diuretics: C02DA, C03A, C03B, C03D, C03E, C03X, C02DA, C07B, C07C, C07D, C08G, C09BA, C09DA, C09XA52, C02L</p> <p>Vasodilators: C02DB, C02DD, C02DG</p> <p>BetaBlockers: C07A, C07B, C07C, C07D, C07F</p> <p>Calciumantagonists: C07FB, C08, C08G, C09BB, C09DB</p> <p>Reninangiotensin-inh: C09AA, C09BA, C09BB, C09CA, C09DA, C09DB, C09XA02, C09XA52</p>
<i>Diagnoses chapters according to ICD-10 (within 180 days to index date)</i>		
Circulatory diseases	I00-I99	
Respiratory	J00-J99	
Infection	A00-A99, B00-B99	
Cancer	C00-C97, D37-D48	
Hematologic disorders	D50-D89	
Endocrine disorders	E00-E90	
Mental and behavioral diseases	F00-F99	
Central nervous System	G00-G99	
Eye- and ear- related diseases	H00-H59; H60-H95	
Muscular diseases	M00-M99	
Disease of the urinary system	N00-N39	
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	R00-R99	
Injury, poisoning	I00-I99	
<i>Medications (within 180 days to index date)</i>		
Non-selective beta blockers		C07AA, C07AB, C07CA, C07B, C07D

Antiarrhythmics drugs I, III		C01BA, C01BB, C01BC, C01BD, C01BG
Calcium-antagonists		C08C, C08D, C08E, C08G
Statins		C10AA
Angiotensin-converting enzyme (ACE) inhibitors		C09AA, C09BA, C09C, C09D, C09X
Diuretics		C02LA01, C03AA, C03AB, C03B, C03C, C03D, C03E, C07CA, C07CB, C07D, C08G, C09BA, C09DA
Vitamin K antagonists (VKA)		B01AA03, B01AA04
NOACs (Dabigatran Rivaroxaban Apixaban Edoxaban)		B01AE07, B01AF01, B01AF02, B01AF03
Antipsychotic drugs		N05A
Antidepressants		N06A
Diabet lower drugs		A10A, A10B, A10X
Drug-abuse		N07BB01, N07BC02, N07BC51, N07BB04, N07BB05, N07BB03
Antibiotics		J01A, J01B, J01C, J01D, J01E, J01F, J01G, J01M, J01R, J01X, A07AA, P01A, J04AB, J06BB, D06A, D07C, S01AA, S03CA, L01D
QT prolonging drugs		Amiodarone: C01BD01, Chloroquine: P01BA01, Chlorpromazine: N05AA01, Cisapride: A03FA02, Citalopram: N06AB04, Domperidone: A03FA03, Donepezil: N06DA02, Dronedarone: C01BD07, Escitalopram: N06AB10, Flecainide: C01BC04, Haloperidol: N05AD01, Methadone: N07BC02, Ondansetron: A04AA01, Pimozide: N05AG02, Quinidine: C01BA01, Sotalol: C07AA07, Sulpirine: N05AL01, Terfenadine: R06AX12, Thiotridazine: N05AC02
Heart-related operation codes		

<i>Coronary artery bypass graft surgery (CABG)</i>	KFNA, KFNB, KFNC, KFND, KFNE, KFNH20	
Percutaneous coronary intervention (PCI)	KFNG, KFNF	
Pacemaker	BFCA	
Coronary Artery Angiography	UXAC40, UXAC85, UXAC85A, UXAC85B, UXAC85C, UXAC85D, UXAC90, UXUC85, UXUC86, UXUC87	

Supplementary Table S3. Characteristics of patients according to the registered prodromal symptoms.

Variable n (%)	Chest pain* (n=74)	Breathing problems (n=134)	CNS/Unconsciousness (n=107)	Abdominal/back/urinary (n=88)	Psychiatry/addiction (n=32)	Infection/fever (n=60)	Trauma/exposure (n=118)	Unspecified (n=203)	No registered symptoms (n=158)
Males n (%)	51 (68.9)	76 (56.7)	57 (53.3)	58 (65.9)	17 (53.1)	31 (51.7)	64 (54.2)	109 (53.7)	85 (53.8)
Age (years) [I, III IQR]	73 [61.8,80.8]	76.5 [67, 84]	79 [68, 88]	74 [65, 83]	55.5 [44.8, 65.0]	77 [68.8,86.5]	77 [66.0, 86.8]	75 [64, 84]	76 [66, 85]
Socio-economic status									
Education level									
Basic education	29 (39.2)	61 (45.5)	49 (45.8)	47 (47.7)	12 (37.5)	27 (45.0)	53 (44.9)	104 (51.5)	60 (38.2)
General or vocational upper secondary	29 (39.2)	56 (41.8)	38 (35.5)	30 (34.1)	11 (34.4)	21 (35.0)	42 (35.6)	68 (33.7)	60 (38.2)
Bachelor, Master or Doctoral degree	16 (21.6)	17 (12.7)	20 (18.7)	16 (18.2)	9 (28.1)	12 (20.0)	23 (19.5)	30 (14.9)	37 (23.6)
Income level									
Low	16 (21.6)	38 (28.4)	25 (23.4)	26 (29.5)	12 (37.5)	11 (18.3)	28 (23.7)	54 (26.6)	36 (22.8)
Medium	36 (48.6)	76 (56.7)	51 (47.7)	39 (44.3)	15 (46.9)	33 (55.0)	61 (51.7)	95 (46.8)	79 (50.0)

High	22 (29.7)	20 (14.9)	31 (29.0)	23 (26.1)	5 (15.6)	16 (26.7)	29 (24.6)	55 (26.6)	44 (27.2)
<i>Comorbidity up to 10 years before OHCA</i>									
Hypertension	59 (79.7)	88 (65.7)	62 (57.9)	54 (61.4)	10 (31.2)	34 (56.7)	62 (52.5)	127 (62.6)	101 (63.9)
Diabetes	9 (12.2)	14 (10.4)	18 (16.8)	11 (12.5)	< 4	11 (18.3)	14 (11.9)	52 (25.6)	38 (24.1)
Ischemic heart disease	29 (39.2)	31 (23.1)	24 (22.4)	18 (20.5)	< 4	10 (16.7)	14 (11.9)	43 (21.2)	36 (22.8)
Heart failure	20 (27.0)	39 (29.1)	20 (18.7)	18 (20.5)	< 4	9 (15.0)	16 (13.6)	36 (17.7)	38 (24.1)
Atrial fibrillation	19 (25.7)	37 (27.6)	22 (20.6)	21 (23.9)	< 4	10 (16.7)	22 (18.6)	47 (23.2)	47 (29.7)
Respiratory Disease [†]	40 (54.1)	104(77.6)	39 (36.4)	41 (46.5)	11 (40.6)	37 (61.7)	44 (37.3)	87 (42.9)	77 (48.7)
Chronic obstructive pulmonary disease (COPD) [†]	22 (29.7)	66 (49.3)	14 (13.1)	15 (14.8)	5 (15.6)	14 (23.3)	17 (14.4)	32 (15.8)	28 (17.7)
Neurological disease	23 (31.1)	45 (33.6)	41 (38.3)	31 (35.2)	19 (59.4)	22 (36.7)	50 (42.4)	69 (34.0)	45 (28.5)
Psychiatric disorders	14 (18.9)	29 (21.6)	17 (15.9)	19 (21.6)	20 (62.5)	12 (20.0)	21 (17.8)	37 (18.2)	23 (14.6)
Drug and alcohol abuse	18 (24.3)	19 (14.2)	16 (15.0)	18 (20.5)	15 (46.9)	9 (15.0)	28 (23.7)	36 (17.7)	17 (10.8)
<i>Diagnoses according to chapters ICD 10--180 days before calls with the registered symptoms</i>									

Diseases of the circulatory system	24 (32.4)	44 (32.8)	14 (13.1)	18 (20.5)	< 4	6 (10.0)	18 (15.3)	45 (22.2)	34 (21.5)
Respiratory diseases	12 (16.2)	72 (53.7)	7 (6.5)	15 (17.0)	6 (18.8)	12 (20.0)	13 (11.0)	33 (16.3)	33 (20.9)
Infectious diseases	4 (5.4)	12 (9.0)	< 4	13 (14.8)	< 4	5 (8.3)	8 (6.8)	18 (8.9)	12 (7.6)
Mental and behaviour disorders	7 (9.5)	17 (12.7)	10 (9.3)	6 (6.8)	11 (34.4)	< 4	11 (9.3)	21 (10.3)	5 (3.2)
<i>Medicine use 180 days before calls</i>									
BB,CCB and digoxin [‡]	31 (41.9)	60 (44.8)	32 (29.9)	36 (40.9)	5 (15.6)	18 (30.0)	35 (29.7)	85 (41.9)	62 (39.2)
Antidepressant and antipsychiatric drugs	17 (23.0)	53 (39.6)	25 (23.4)	12 (27.3)	12 (37.5)	24 (40.0)	42 (35.6)	59 (29.1)	46 (29.1)
Antibiotics	29 (39.2)	87 (64.9)	25 (23.4)	47 (53.4)	14 (43.8)	35 (58.3)	54 (45.8)	92 (45.3)	67 (42.4)
Qt prolong drugs	10 (13.5)	38 (28.4)	12 (11.2)	17 (19.3)	5 (15.6)	12 (20.0)	29 (24.6)	34 (16.7)	29 (18.4)
<i>Call type</i>									
1813-Medical Helpline	41 (55.4)	48 (35.8)	30 (28.0)	71 (80.7)	17 (53.1)	57 (95.0)	60 (50.8)	144 (70.9)	148 (93.7)
1-1-2	33 (44.6)	86 (64.2)	77 (72.0)	17 (19.3)	15 (46.9)	< 4	58 (49.2)	59 (29.1)	10 (6.3)
<i>Calls within 7 days and 8-30 days before OHCA</i>									

Within 0-7 days before OHCA	38 (51.4)	52 (38.8)	73 (68.2)	49 (55.7)	20 (62.5)	40 (66.7)	42 (35.6)	99 (48.8)	79 (50.0)
Within 8-30 days before OHCA	36 (48.6)	82 (61.2)	34 (31.8)	39 (44.3)	12 (37.5)	20 (33.3)	76 (64.4)	104 (51.2)	79 (50.0)
<i>Response after the call</i>									
<i>Self-care</i>	22 (29.7)	18 (13.4)	18 (16.8)	42 (47.7)	14 (43.8)	32 (53.3)	36 (30.5)	110 (54.2)	76 (48.1)
Ambulance A	44 (59.5)	63 (47.0)	75 (70.1)	9 (10.2)	11 (34.4)	3 (5.0)	14 (11.9)	29 (14.3)	9 (5.7)
<i>Send directly to the hospital (no ambulance)</i>	25 (33.8)	46 (34.3)	31 (29.0)	47 (53.4)	11 (34.4)	34 (56.7)	35 (29.7)	71 (35.00)	79 (50.0)
<i>Cardiac arrest related factors</i>									
Private home	53 (71.6)	112 (83.6)	83 (78.3)	70 (79.5)	16 (50.0)	47 (78.3)	93 (78.8)	169 (83.7)	130 (82.3)
Witnessed	39 (52.7)	61 (45.5)	50 (46.7)	46 (52.3)	12 (37.5)	29 (48.3)	56 (47.5)	92 (45.3)	77 (49.0)
CPR§	50 (67.6)	86 (64.2)	83 (78.3)	57 (64.8)	21 (65.6)	42 (70.0)	93 (78.8)	129 (63.9)	101 (64.3)
Defibrillation	4 (5.6)	< 4	< 4	< 4	< 4	< 4	< 4	6 (3.1)	4 (2.8)
Shockable rhythm	19 (25.7)	< 4	7 (6.6)	6 (6.8)	< 4	< 4	7 (6.0)	14 (7.0)	12 (7.8)
ROSC	29 (39.7)	29 (22.5)	17 (16.7)	16 (19.0)	< 4	15 (27.3)	26 (22.6)	46 (23.5)	35 (24.0)

Patient has ROSC or has a Glasgow Coma Score > 8 at the hospital arrival	27 (37.0)	27 (21.6)	16 (16.2)	12 (14.5)	< 4	13 (24.1)	24 (21.2)	34 (17.8)	28 (19.2)
30-days mortality	57 (77.0)	125 (93.3)	94 (87.9)	82 (93.2)	30 (93.8)	57 (95.0)	1-1-2 (94.9)	195 (96.1)	146 (92.4)

* If a patient had more than one registered prodromal symptom (within 30 days before OHCA) chest pain was prioritized among the others – in the same order as shown in the table.

† COPD is included in the group of Respiratory Diseases,

‡ BB, beta-blockers, and CCB, Calcium channel blockers,

§ CPR, Cardio-pulmonary resuscitation,

||ROSC, Return of spontaneous circulation.

Supplementary Table S4. Characteristics of patients according to the presence of the registered prodromal symptoms or not.

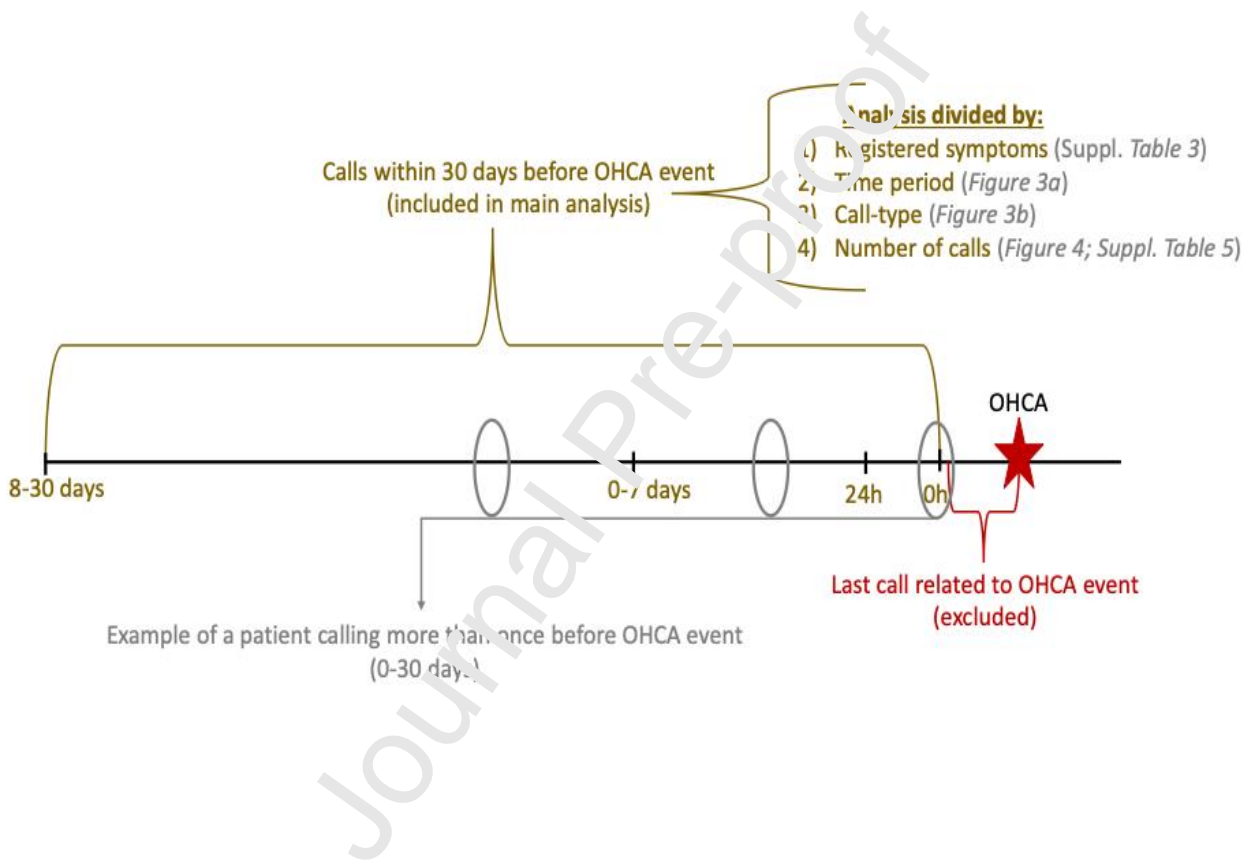
Variable n (%)	Patients with not registered symptoms (n=158)	Patients with registered symptoms (n=816)	p-value
<i>Males</i>	85 (53.8)	463 (56.7)	0.55191
<i>Age (years) (IQR)</i>	76 [66, 85]	76 [65, 84]	0.32102
<i>Education level</i>			
Primary or lower secondary	61 (38.6)	378 (46.3)	
General or vocational upper secondary	60 (38.0)	295 (36.2)	
Bachelor, Master or Doctoral degree	37 (23.4)	143 (17.5)	0.13719
<i>Income level</i>			
Low	36 (22.8)	210 (25.7)	
Medium	79 (50.0)	406 (49.8)	
High	43 (27.2)	200 (24.5)	0.65502
<i>Calls within 7 days before OHCA</i>	79 (50.0)	413 (50.6)	0.95687
<i>Comorbidity up to 10 years before OHCA</i>			
Hypertension	101 (63.9)	496 (60.8)	0.51414
Diabetes	52 (24.1)	131 (16.1)	0.02063
Cardiac Disease	106 (67.1)	517 (63.4)	0.42168
Respiratory Disease	77 (48.7)	405 (49.6)	0.90467
Neurological disease	45 (28.5)	300 (36.8)	0.05719
Psychiatric disorders	23 (14.6)	169 (20.7)	0.09483
Drug and alcohol abuse	17 (10.8)	159 (19.5)	0.01255
<i>Medicine use 180 days before OHCA</i>			
BB, CCB, and digoxin*	73 (46.2)	338 (41.4)	0.30500
Antidepressant and antipsychiatrics drugs	54 (34.2)	291 (35.7)	0.79004
Anticoagulant drugs	38 (24.1)	159 (19.5)	0.23036
Antibiotics	47 (29.7)	240 (29.4)	100.000

QT prolonging drugs	19 (12.0)	95 (11.6)	0.99845
Cardiac arrest related factors			
Private home	130 (82.3)	643 (79.0)	0.40711
Witnessed	77 (49.0)	385 (47.2)	0.73320
CRP †	101 (64.3)	561 (68.9)	0.30002
Defibrillation	4 (2.8)	23 (3.0)	100.000
Shockable rhythm	12 (7.8)	56 (7.0)	0.83227
ROSC ‡	35 (24.0)	181 (23.1)	0.89972
Patient has ROSC or has a Glasgow Coma Score > 8 at the hospital arrival	28 (19.2)	156 (20.3)	0.84088
30-days mortality	146 (92.4)	712 (92.2)	100.000
*BB, beta-blockers, and CCB, Calcium channel blockers, † CPR, Cardio-pulmonary resuscitation, ‡ ROSC, Return of spontaneous circulation.			

Supplementary Table S5. Characteristics of patients according to the number of calls within 30 days before OHCA.

Variables n (%)	1 (n=701)	2 (n=176)	>=3 (n=97)	p-value
Males	390 (55.6)	104 (59.1)	54 (55.7)	0.7053082
Age (years) (IQR)	77 [66, 85]	74 [64.0, 83.2]	70 [54, 78]	0.0001560
Education level				
Bachelor, Master or Doctoral degree	129 (18.4)	20 (17.1)	21 (21.6)	
Basic education	312 (44.6)	77 (44.0)	48 (49.5)	0.5481270
Income level				
Low	173 (24.7)	45 (25.6)	28 (28.9)	
Medium	247 (35.2)	90 (51.1)	48 (49.5)	
High	181 (25.8)	41 (23.3)	21 (21.6)	0.8254363
Symptoms registered				
Chest pain	48 (6.8)	12 (6.8)	14 (14.4)	0.0277365
Breathing problems	84 (12.0)	37 (21.0)	18 (18.6)	0.0040586
CNS/Unconsciousness	73 (10.4)	27 (15.3)	19 (19.6)	0.0132973
Abdominal/back/urinary	46 (6.6)	31 (17.6)	18 (18.6)	< 1e-04
Psychiatry/addiction	16 (2.3)	6 (3.4)	20 (20.6)	< 1e-04
Infection/fever	43 (6.1)	18 (10.2)	14 (14.4)	0.0061358
Trauma/exposure	90 (12.8)	25 (14.2)	25 (25.8)	0.0030465
Unspecified	153 (21.8)	61 (34.7)	59 (60.8)	< 1e-04
No registered symptoms	148 (21.1)	66 (37.5)	61 (62.9)	< 1e-04
Comorbidity up to 10 years before OHCA				
Cardiac Disease	448 (63.9)	119 (67.6)	56 (57.7)	0.2654909
Respiratory Disease	331 (47.2)	96 (54.5)	55 (56.7)	0.0719180
Neurological disease	226 (32.2)	70 (39.8)	49 (50.5)	0.0008167
Psychiatric disorders	114 (16.3)	38 (21.6)	40 (41.2)	< 1e-04
Drug and alcohol abuse	108 (15.4)	34 (19.3)	34 (35.1)	< 1e-04
Hospital diagnoses 180 days before calls				

<i>(inpatient-, outpatient admissions and Emergency Department visits)</i>				
Diseases of the circulatory system	136 (19.4)	45 (25.6)	24 (24.7)	0.1284019
Respiratory diseases	129 (18.4)	44 (25.0)	30 (30.9)	0.0056440
Infectious diseases	45 (6.4)	21 (11.9)	10 (10.3)	0.0320188
Mental and behaviour disorders	43 (6.1)	21 (11.9)	27 (27.8)	< 1e-04
<i>Medicine use 180 days before calls</i>				
BB,CCB and digoxin *	263 (37.5)	71 (40.3)	30 (30.9)	0.3026693
Antidepressant and antipsychiatric drugs	204 (29.1)	75 (31.8)	42 (43.3)	0.0174638
Antibiotics	285 (40.7)	101 (59.1)	61 (62.9)	< 1e-04
Qt prolong drugs	121 (17.3)	48 (27.3)	17 (17.5)	0.0095667
<i>Call type</i>				
1813-Medical Helpline	150 (14.2)	103 (58.5)	63 (64.9)	
1-1-2	251 (35.8)	73 (41.5)	34 (35.1)	0.3532695
<i>Calls within 7 days and 8-30 days before OHCA</i>				
Within 8-30 days before OHCA	376 (53.6)	85 (48.3)	21 (21.6)	
Within 0-7 days before OHCA	325 (46.4)	91 (51.7)	76 (78.4)	< 1e-04
<i>Response after the call</i>				
Ambulance A	166 (23.7)	54 (30.7)	37 (38.1)	0.003664
Self-care	199 (28.4)	96 (54.4)	73 (75.3)	< 1e-04
Send directly to the hospital	238 (34.0)	83 (47.2)	58 (59.8)	< 1e-04
<i>Cardiac arrest related factors</i>				
Private home	565 (80.8)	138 (78.4)	70 (72.2)	0.1292040
Witnessed	343 (49.0)	77 (43.8)	42 (43.3)	0.3149785
Cardio-pulmonary resuscitation (CRP)	472 (67.6)	120 (68.2)	70 (72.2)	0.6669043
Defibrillation	18 (2.7)	4 (2.4)	5 (5.6)	0.3072884
Shockable rhythm	56 (8.1)	8 (4.7)	4 (4.2)	0.1549201
Return of spontaneous circulation (ROSC)	165 (24.6)	31 (18.7)	20 (21.7)	0.2583802
Patient has ROSC or has a Glasgow Coma Score > 8 at the hospital arrival	139 (21.1)	29 (17.7)	16 (17.4)	0.4855851
<i>30-days mortality</i>	643 (91.7)	166 (94.3)	89 (91.8)	0.5108215
*BB, beta-blockers, and CCB, Calcium channel blockers.				

Supplementary Figure S1. Timeline of calls included in the study analysis.

Supplementary Figure S2. Prodromal symptoms 30 days before OHCA according to (A) sex, and (B) age categorized in <65 years and ≥65 years.

(A) N female=485 calls (353 patients) and N males=660 calls (463 patients); (B) N calls=345; N patients=203) and ≥65 years (N calls=800; N patients=613).

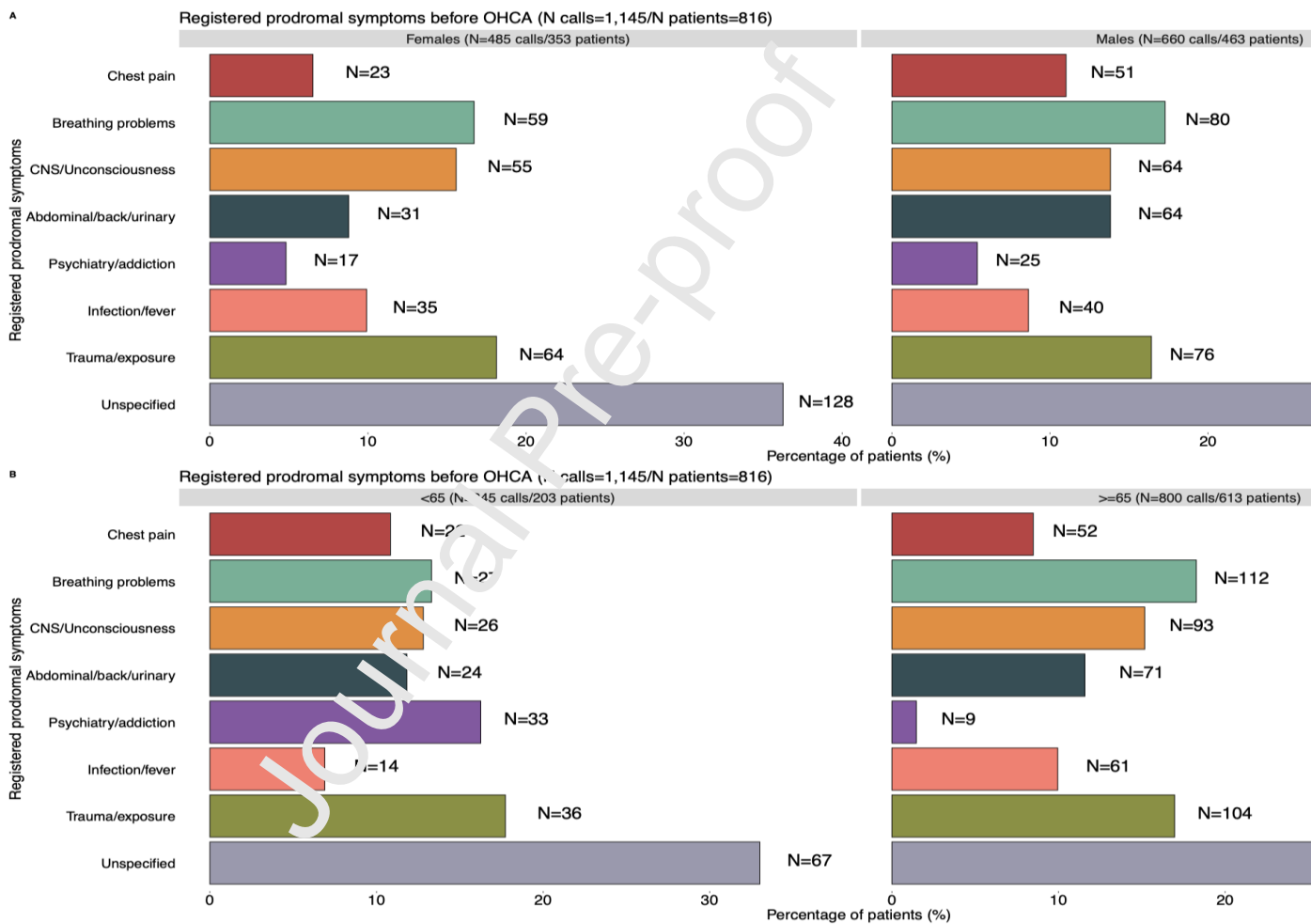


Table 1. Baseline characteristics of the OHCA population included in the study.

<i>Variables, n (%)</i>	OHCA-patients N = 974
Demographics	
Males	548 (56.3)
Age (years) median (Q1-Q3)	76 [65-84]
Education level *	
Basic education	439 (45.0)
General or vocational upper secondary	355 (36.5)
Bachelor, Master or Doctoral degree	180 (18.5)
Level of income *	
Low	432(44.4)
Medium	405 (41.5)
High	137 (14.1)
Comorbidities within 10 years †	
Cardiac disease	703 (72.2)
Respiratory disease	551 (56.6)
Neurological disease	400 (41.1)
Psychiatric disorders	205 (21.0)
Drug and alcohol abuse	200 (20.5)
Hospital admission/Emergency visit within 180 days before OHCA	363 (37.3)
Medication	
<i>180 days before OHCA</i>	
BB ‡, CCB §, digoxin	411 (42.2)
Antidepressant or antipsychiatric drugs	345 (35.4)
Anticoagulant drugs	197 (20.2)
Antibiotic drugs	533 (54.7)
<i>30 days before OHCA</i>	
QT prolonging drugs	114 (11.7)

Antibiotics	287 (29.5)
Cardiac arrest related factors	
Private location	773 (79.5)
missing	< 4
Witnessed arrest	462 (47.5)
missing	< 4
Bystander cardiopulmonary resuscitation	662 (68.2)
missing	< 4
Bystander defibrillation	27(3.0)
missing	46 (5.4)
Initial recorded shockable rhythm	68(7.1)
missing	18
Return of spontaneous circulation (ROSC)	216 (23.2)
missing	44
Patient has ROSC or has a Glasgow Coma Scale > 8 at hospital arrival	184 (20.1)
missing	60
30-day survival	76 (7.8)
<p>* Missing value (<10) were included in the lower education/income groups. † Disease categories in hold are represented in the Suppl. Table 2, according to the chapter definition ICD. ‡ BB, beta-blockers drugs; § CCB, Calcium channel blockers.</p>	

Author Contributions:

N Zyllyftari: Dr. Zyllyftari contributed to the conception and design of the study, the data acquisition, the data analysis, the data interpretation, the manuscript drafting, and the critical revision of the manuscript. Dr. Zyllyftari has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

C J Lee: Dr. Lee contributed to the conception and design of the study, the supervision, the data acquisition, the data analysis, the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

F Gnesin: Mr. Gnesin contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

A L Møller: Mrs. L Møller contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

E H A Mills: Dr. Mills contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

S G Møller: Dr. G Møller contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

B Jensen: Mrs. Jensen contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

K B Ringgren: Dr. Ringgren contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

K Kragholm: Dr. Kragholm contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

H C Christensen: Dr. Christensen contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

S N Fasmer Blomberg: Mr. Fasmer Blomberg contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

H L. Tan: Dr Tan contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

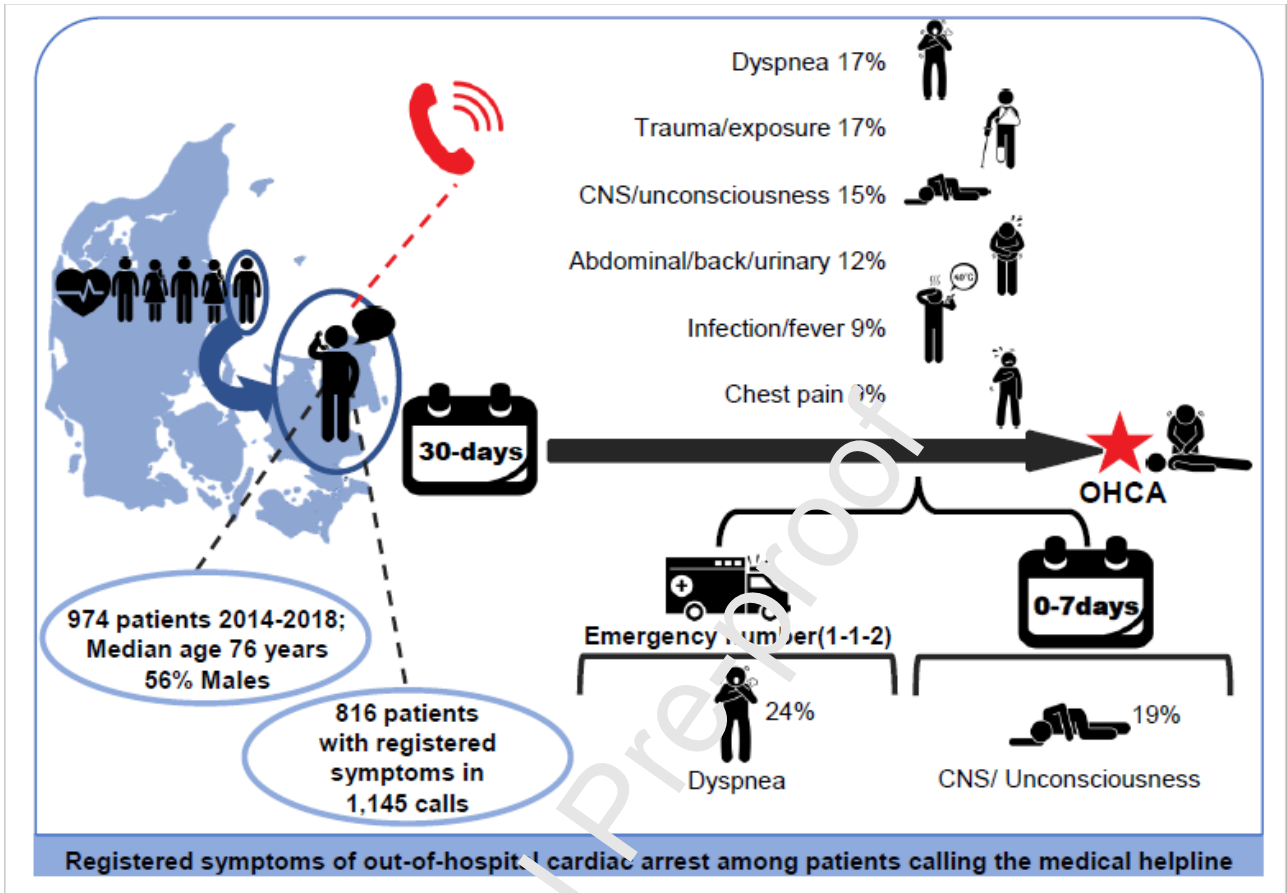
F Folke: Dr. Folke contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

L Køber: Dr. Køber contributed to the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

G Gislason: Dr. Gislason contributed to the conception and design of the study, the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

C Torp-Pedersen: Dr. Torp-Pedersen contributed to the conception and design of the study, the supervision, the data acquisition, the data analysis, the data interpretation, the manuscript drafting, the critical revision of the manuscript and the final approval of the version to be submitted.

Graphical Abstract



Highlights

- Nearly 1 out of 5 patients called the medical helpline services within a month before their cardiac arrest.
- Despite prodromal symptoms being highly varied during these calls, breathing problems were the most registered symptom-specific category and nearly twice more common than chest pain.
- Almost half of the patients called within the week before their OHCA, where *CNS-related symptoms/unconsciousness* was the most registered symptom specific category.
- More patients called the non-emergency number than the emergency number.