The Registry as a Basis for Epidemiological Surveillance and Optimization of Care in Out-of-hospital Cardiac Arrest

A.A. Birkun[1]*, A.V. Altukhov[2]

[1] **Department of Anesthesiology and Resuscitation and Emergency Care**
S.I. Georgiyevsky Medical Academy of V.I. Vernadsky Crimean Federal University
bulvar Lenina, 5/7, Simferopol 295006, Russian Federation
[2] **Crimean Republican Center of Disaster Medicine and Emergency Medical Services**
60-letiya Oktiabria, 30, Simferopol 295024, Russian Federation

* Contacts: Aleksey A. Birkun, Cand. Med. Sci., Assistant of the Department of Anesthesiology and Resuscitation and Emergency Care, S.I. Georgiyevsky Medical Academy of V.I. Vernadsky Crimean Federal University, Simferopol. E-mail: birkunalexei@gmail.com

ABSTRACT Despite significant progress in medicine, out-of-hospital cardiac arrest (OHCA) remains one of the leading causes of death around the world. Epidemiological data suggest wide distribution of OHCA, low incidence of cardiopulmonary resuscitation attempts and low efficiency of resuscitation in the Russian Federation. Both implementation of measures for reducing mortality from OHCA and monitoring of their efficiency should be based on up-to-date, reliable data on national and regional OHCA epidemiology and performance of emergency medical services. The aim of this review is to provide a rationale for establishment of the national OHCA registry as a main instrument of collection, arrangement, storage, processing and presentation of data on OHCA epidemiology and efficiency of care provided. The review includes the analysis of OHCA epidemiological studies carried out in Russia, describes general concept and international experience of developing OHCA registries, and discusses Utstein guidelines for uniform reporting of OHCA data.

Keywords: cardiac arrest, cardiopulmonary resuscitation, registry, Utstein, emergency medical service

Affiliations

Birkun Aleksey Alekseyevich, Cand. Med. Sci., Assistant of the Department of Anesthesiology and Resuscitation and Emergency Care, S.I. Georgiyevsky Medical Academy of V.I. Vernadsky Crimean Federal University, ORCID: 0000-0002-2789-9760.

Altukhov Andrey Valeryevich, Deputy Director for Medicine Crimean Republican Center of Disaster Medicine and Emergency Medical Services, Head of the Emergency Medical Service of the Republic of Crimea, ORCID: 0000-0001-6644-6636.

CPR – cardiopulmonary resuscitation
EMS – emergency medical service
OHCA – out-of-hospital circulatory arrest
RSC – restoration of spontaneous circulation

BACKGROUND

Currently, out-of-hospital circulatory arrest (OHCA) is regarded as a global threat [1]. In the countries of the European Union and the United States, circulatory arrest outside the hospital develops annually in approximately 275,000 and 420,000 people, which corresponds to the incidence of 38 and 55 cases per 100,000 population per year, respectively, and comprises 5–16% in the structure of total mortality [2, 3]. The epidemic situation is no less alarming in other countries of the world, including in the Russian Federation [1, 4–6].

The results of numerous studies indicate that rational transformations of the first aid and medical care systems can significantly reduce mortality in OHCA, which is achieved, above all, by introducing measures improving the links of the chain of survival. (Fig. 1) [7]. Examples include the effective implementation of programs aimed at ensuring access to defibrillation of people without medical education [8] and dispatching algorithms for cardiopulmonary resuscitation (CPR) for the management of the circulatory arrest [9].
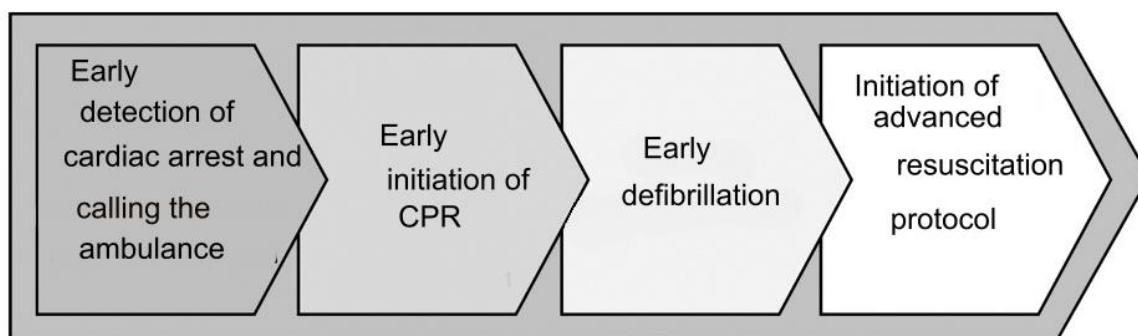
Fig. 1. The chain of survival [7]

At the same time, judgments about the appropriateness, priority, and effectiveness of various administrative interventions should be based on objective epidemiological data and information on the current state of the first aid system and medical care for OHCA in the relevant geographical region [10, 11].

The optimal tool for the formation of the necessary information base is the registry of cases of circulatory arrest [12, 13]. The analysis of the registry data, in particular, allows identifying groups and risk factors for OHCA, trends related to the place and time of circulatory arrest, assessing the effectiveness of existing components of the first aid system and medical care, and determining additional measures which may have a positive effect on the survival rate of patients with OHCA [12, 13].

UTSTEIN RECOMMENDATIONS

Indicators of the frequency of occurrence and outcomes of OHCA differ significantly depending on the geographic region, which is associated not only with differences in the distribution of risk factors, the structure and activity of systems that help in circulatory arrest, but also different approaches to assessing the epidemiology of OHCA and analyzing the effectiveness of such systems 14, 15].

Accordingly, an important condition for the creation and further work of the OHCA registry is the use of standardized definitions, methods for collecting, analyzing and presenting information. The unified approach ensures consistency and comparability of registry materials and allows to compare epidemiological data and indicators of the functioning of first aid and medical assistance systems both between different geographic regions within a single register and between registries, including the ones of other countries, which opens up additional opportunities for improving quality of medical care at the prehospital stage and, consequently, improving the prognosis of OHCA [16].

In June 1990, the first international meeting of representatives of the resuscitation communities of the European Union, the USA, Canada and Australia was held in Utstein Abbey (Utstein), Norway, dedicated to the coordinated development of a common terminology and definitions for describing OHCA [10]. The result of the work of experts was the creation of recommendations for the unified reporting of information on OHCA (hereinafter Utstein recommendations). Revised in 2004 and 2013 as part of the meetings of the working group of International Liaison Committee on Resuscitation (ILCOR), the Utstein recommendations are currently the only internationally agreed document defining the glossary, procedure and reference report data on cases of OHCA [11, 17].

To describe the epidemiology of circulatory arrest, the structural organization and operation of the OHCA assistance system in the relevant region, it is proposed to use a specific set of Utstein data elements, which were divided into basic elements and additional elements based on expert judgment [11]. The main elements are data elements, which registration and reporting should be strived by all current registries. Registration and analysis of key elements are considered as the recommended minimum standard for quality control of OHCA assistance and evaluation of the effectiveness of measures aimed at optimizing assistance. Additional elements correspond to data, desirable but not necessary for registration and reporting, including elements which are more important for the achievement of scientific goals than for quality control [11].

All Utstein data elements are divided into five categories, each including the main and additional elements (Table 1) [11].

Table 1

Distribution of data items in Utstein recommendations by category

Category	Essential items	Additional Items
I. System	- The number of population supported by EMS; - The number of cases of OHCA assisted by EMS; - The number of resuscitation attempts undertaken by EMS;	- Additional description of the EMS system (the existence of laws defining the refusal to carry out resuscitation in special situations or groups of patients, the system of restriction/termination of prehospital

	Main elements	Additional elements
	- The number of cases of OHCA, when attempts at resuscitation were not undertaken; - The main description of the EMS system (the hierarchical model of assistance with OHCA, the competence of persons providing assistance, the number of calls, geographical coverage)	resuscitation, the rules for termination of resuscitation, the use of software by the dispatch service, the applied resuscitation algorithms, measures to ensure data quality, the capabilities of the system EMS for performing and interpreting of ECG in 12 leads)
II. Dispatching	- Confirmation of the OHCA by a dispatcher before the arrival of the SMP team; - Providing instructions for resuscitation by phone	
III . Patient	- Age; - Gender; - Development of OHCA in the presence of the EMS team, witnesses, or without witnesses; - Place of OHCA development; - Conduction of CPR by witnesses of OHCA; - Primary rhythm according to ECG; - Probable cause of OHCA	- A patient's need for third-party care in daily life; - Concomitant diseases; - A patient has a device for maintaining the function of the ventricles; - A patient has a cardioverter- defibrillator; - Presence of ECG signs of STEMI after RSC
IV . Process	Resuscitation - The time interval between the incoming call to the EMS and the EMS vehicle stop in the nearest place to the patient; - The time interval between the incoming call to the EMS and first defibrillation; - The time and conditions of the beginning of the purposeful regulation of body temperature; - Drugs administered Post-resuscitation care - Type and timing of coronary reperfusion	Resuscitation - The method of airway patency/protection; - The use of methods for assessing the quality of CPR during resuscitation; - The number of defibrillator discharges; - The time interval between incoming calling EMS and provision of vascular access and first administration of a drug; - The main way of drug administration; - The use of a device for mechanical CPR; - Targeted oxygenation and ventilation after RSC Post-resuscitation care - Extracorporeal methods of life support; - Intra-aortic balloon pump; - Primary pH after RSC; - Primary lactate concentration; - Conducting correction of glycemia to the target level after RSC; - The number and type of tests to determine the neurological prognosis; - The type of medical institution where the patient is hospitalized; - The number of OHCA cases, assisted at the medical institution annually; - ECG in 12 leads after RSC; - Conduction of targeted correction of blood pressure
V. Outcomes	- Survival (presence of spontaneous blood circulation at the time of transfer of the patient to the staff of the medical institution); - RSC at any time during resuscitation; - Survival in 30 days at the time of leaving the hospital; - Neurological status at the time of leaving the hospital	- Status of a patient (alive/died) 12 months after the circulatory arrest; - Transportation to a medical institution (whether a patient was transported); - The time of cessation of medical measures; - The official cause of death; - Donation of organs; - Outcome indicators reported by the patient; - Quality of life indicators

Notes: CPR – cardiopulmonary resuscitation; ECG – electrocardiogram; EMS – emrgency medical services; OHCA – out-of-hospital cardiac arrest; RSC – return of spontaneous circulation; STEMI – myocardial infarction with ST segment elevation

I. The "System" describes the population covered by the emergency medical care system (emergency medical service; hereinafter referred to as EMS), organizational structure and key performance indicators of the EMS system.

II. "Dispatching" describes the participation of the dispatch service in the diagnosis of OHCA and the provision of instructions for CPR to witnesses OHCA.

III. The "Patient" includes the patient's demographic data, information about the alleged cause of circulatory arrest, the place of occurrence of OHCA, participation of witnesses in the provision of assistance, the primary manifestations of OHCA.

IV. The "Process" displays the actual assistance provided for OHCA, including the postresuscitation period.

V. "Outcomes" includes a description of the result of CPR and the status of the patient after certain periods of time after the event of OHCA.

The significant psychological stress and high intensity of the work of EMS specialists during resuscitation may make accurate recording of some data elements, such as indicators of time and intervals, difficult [17]. In addition, inaccuracy of data may be associated with the problem of time synchronization within the EMS system [11, 17]. Given the current trend towards incomplete description of cases of OHCA, in those circumstances where there is a possibility of partial or inaccurate data recording, it is recommended to limit the collection of information to the main elements of Utstein [17].

In order to provide a unified presentation of information about the epidemiology of circulatory arrest and the functioning of the first aid and medical aid system in a specific region, the data collected by the registry, represented by the main and additional elements of Utstein, is analyzed and summarized in an organized manner according to the recommended Utstein data message scheme [11]. The presentation of the results according to the Utstein scheme, on the one hand, allows us to consistently track the movement of patients with OHCA within the system, including the stage of assisting witnesses, the emergency medical system and the hospital stage, on the other hand,

provides key information about the structural organization, activities and performance of the system in a standardized format, which facilitates subsequent comparison in dynamics within the same system or external comparison with other similar systems [11].

At present, there are several dozens of large registries in the world describing the processes and results of providing assistance at OHCA [3, 12, 15, 18-20]. A modern OHCA registry is a well-coordinated, efficient mechanism for collecting, processing, storing, analyzing and communicating data, having internal quality assurance procedures and complying with current Utstein recommendations. A brief description of the individual registries is presented in Table 2.

Table 2
The characterisrics of some actual registries

Name (link)	Year of establishment	Geographic coverage	Population Coverage	Inclusion Criteria
Swedish Cardiac Arrest Register (Strömsöe et al ., 2013) [21]	1990	Sweden (national register)	9,500,000	Cases of OHCA, assisted with resuscitation by the staff of EMS and (or) witnesses with or without defibrillation
Helsinki Cardiac Arrest Registry (Nishiyama et al., 2014) [15]	1994	Helsinki (Finland)	600,000	Cases of OHCA, assisted with assessment and/or resuscitation by the staff of EMS or defibrillation by witnesses
Cardiac Arrest Registry to Enhance Survival (McNally et al ., 2011) [12]	2005	USA (73 EMS systems and more than 340 hospitals in 23 states)	22,000,000	Cases of OHCA, assisted with resuscitation and (or) defibrillation, presumably caused by a cardiac disease
Resuscitation Outcomes Consortium Cardiac Arrest Epistry (Morrison et al ., 2008) [18]	2005	North America (264 EMS systems in 7 US states and 3 states in Canada)	24,000,000	Cases of OHCA, assisted with assessment and (or) compression by the staff of EMS, as well as defibrillation by EMS staff or witnesses
European registry of cardiac arrest (Gräsner et al ., 2016) [3]	2007	Countries of the European Union	not specified	Cases of OHCA, assisted with assessment and (or) resuscitation by the staff of EMS
Vienna Cardiac Arrest Registry (Nishiyama et al ., 2014) [15]	2009	Vienna (Austria)	1,700,000	Cases of OHCA, assisted with assessment and (or) resuscitation by the staff of EMS or defibrillation by witnesses
Pan Asian Resuscitation Outcomes Study (Ong et al ., 2011) [13]	2010	Australia, China, Korea, Malaysia, United Arab Emirates, Singapore, Taiwan, Thailand, Turkey, Japan	89,000,000	Cases of OHCA, assisted with intensive care
Australian Resuscitation Outcomes Consortium Epistry (Beck et al ., 2016) [19]	2014	Australia and New Zealand (4 Australian EMS systems and 2 New Zealand EMS systems)	19,300,000	Cases of OHCA, assisted with assessment and (or) resuscitation by the staff of EMS

Notes: EMS − emergency medical services; OHCA − out-of-hospital circulatory arrest

Existing registries differ in scale: from urban, such as the VICAR registry, Vienna (Austria) [15], to international, such as the PAROS registry covering 10 Asian countries [13], or the EURECA registry, which allowed to describe the epidemiology, medical assistance and outcomes of OHCA for 27 European countries [3].

A common practice in the formation of national and international OHCA registries is the initial creation of a municipal or regional registry with its subsequent expansion involving interested services and organizations from other regions. For example, the CARES registry was originally limited to the population of Atlanta (Georgia, USA), and today it covers the territory where more than 22 million Canadians and the United States citizens live [12]. An important stage on the way to the geographical expansion of a registry is preliminary testing, which allows to optimize collection, analisys and presentation of information and guarantee the effective functioning of the registry before its expansion [12].

The set of data elements that forms the pattern for collecting information on the case of OHCA is individual for each registry and is determined by the agreed opinion of the working group experts, taking into account the significance and objective possibilities for reliable registration of the relevant indicators [12, 13, 18, 19]. In order to ensure compliance with Utstein recommendations regarding the minimum set of basic data elements, collecting information on cases of OHCA may be required at several levels: at the dispatch service level (for example, initial treatment time, address), emergency care teams (possible cause of OHCA, treatment carried out) and hospital (information about the outcome, neurological status upon discharge) [12, 13, 19, 20].

The completed data collection form describing the case of OHCA should be checked for completeness and correctness, after which the case data is transferred to the main registry information using the electronic data recording system [12, 13]. In the interest of personal data security, all cases of OHCA included into the registry are identified by a unique code or are completely anonymized without the ability to identify a person [12, 13, 19].

To ensure the full coverage of OHCA cases, periodic (monthly, annual) monitoring is considered appropriate, where it is checked that the number of circulatory arrests included in the electronic database of the registry

corresponds to the number of cases of OHCA according to the primary medical records of the emergency medical service [12, 18]. Additional random checks can be performed for individual data elements or their combinations [18]. An important quality assurance measure is the training of EMS staff in the process of recording information on OHCA with explanation of terminology and data element definitions [18].

The data accumulated by the registry are subjected to detailed statistical analysis and described in the form of a report in accordance with the recommended Utstein data message scheme [19]. In addition to periodic reports, intermediate statistical analyzes can be performed, in particular, for a targeted assessment of changes under the influence of certain administrative changes in the EMS system or for conducting scientific research [3, 12, 22].

It is noteworthy that although the Utstein data reporting scheme is recognized as an international standard today, there is still a difference between the registries in the interpretation and implementation of recommendations. So, after analyzing the data of 13 OHCA registries from 13 countries, Nishiyama et al. (2014) found that they use different criteria for including cases of OHCA and reflect less than 62% of the recommended main elements of Utstein [15].

OHCA IN RUSSIA

Currently, there is no organized system for recording cases of OHCA in the Russian Federation. The main source of data describing the epidemiology and assistance for OHCA are registration forms of the emergency medical service approved by the Order of the Ministry of Health and Social Development of the Russian Federation of December 2, 2009 No. 942 "On approval of the station's statistical instruments (departments), emergency medical services" Namely: registration form No. 109/u "Log book for Emergency Medical Service calls", No. 110/u "Emergency Medical Care Call Card" and No. 114/u, "Supporting list of an emergency medical station (department) and a voucher" [23]. Valid throughout the Russian Federation, these forms provide continuous registration and accumulation of information on cases of provision of emergency medical care, including cases of OHCA. However, the structure of the approved forms does not provide for the mandatory registration of many Utstein data elements, including such basic data elements as the development of OHCA in the presence of witnesses, CPR by witnesses, confirmation of OHCA by the dispatcher and providing instructions on CPR by phone, and information on the case of OHCA resuscitation events should be described in any form [23].

To standardize the description of CPR, the protocol may be used, which provides a detailed structured recording of all CPR manipulations performed by the EMS team at circulatory arrest [24]. Uniform requirements for CPR protocols are not currently approved at the legislative level, which opens up possibilities for adapting local protocols to existing international recommendations on the one hand, and prevents unified collection of information at the federal level on the other hand.

Thus, the current medical records do not allow for the collection of all data elements provided for the OHCA registry. To create an organized system for recording cases of OHCA in accordance with international recommendations, it is necessary to modify the existing registration forms to include the fields of mandatory registration of the main data elements of Utstein. In addition to the records of the EMS, to collect some key information about the outcomes (for example, data on the neurological status of the patientupon discharge) requires an analysis of medical records of medical institutions.

OHCA STUDIES IN RUSSIA

In order to review the available information on epidemiology and assistance with OHCA in Russia, we searched for scientific publications in bibliographic databases Russian Science Citation Index, Medline, Scopus, Science Direct and Google Scholar using the keywords presented in Table 3. The review included research data presented in the form of original articles, abstracts of papers and theses from December 1991 to December 2017 inclusive. The results of the initial search for the title, content of the summary and keywords identified publications corresponding to the topic of the review, and studied their full texts. An additional search was carried out in the lists of references of the included publications. Works representing the cumulative characteristic of deaths without distinguishing the epidemiological indicators of out-of-hospital and in-hospital death were excluded. Considering that the absolute majority of cases of forensic medical examination of corpses are cases of OHCA [25], studies based on the results of forensic medical examinations were considered as studies of OHCA.

Table 3

The list of terms used to search literature on the review topic

Search language	Bibliographic bases	Search terms
Russian	Russian scientific citation index, Google Scholar	Utstein sudden death clinical death circulatory arrest heart failure resuscitation heart death emergency CPR EMS

English*	Medline, Scopus, Science Direct, Google Scholar	cardiac arrest cardiac death circulatory arrest clinical death CPR emergency medical services EMS reanimation resuscitation sudden death Utstein

Notes: * For the purpose of geographical limitation of English search, the terms corresponding to the subject of the survey were combined with the logical operator "AND" with words "Russia" and "Russian". CPR — cardiopulmonary resuscitation; EMS — emergency medical services

The selection criteria were met by 24 publications describing the results of studies of the epidemiology of out-of-hospital death in the Russian Federation, three of which were excluded as duplicating the results of the same study. The scientific papers included in the analysis were thematically distributed as follows: studies of out-of-hospital death in general, including violent and non-violent death (48% of publications) [6, 24, 26–33], studies of sudden cardiac death as a sudden non-violent death with the exception of extracardiac causes (24 %) [34–38], studies of sudden death in general, i.e. deaths caused by both cardiac and extracardiac pathology (19%) [25, 39–41], and studies of the sudden death syndrome in children in the first year of life (9%) [42, 43]. The distribution of publications by year is presented in Fig. 2.
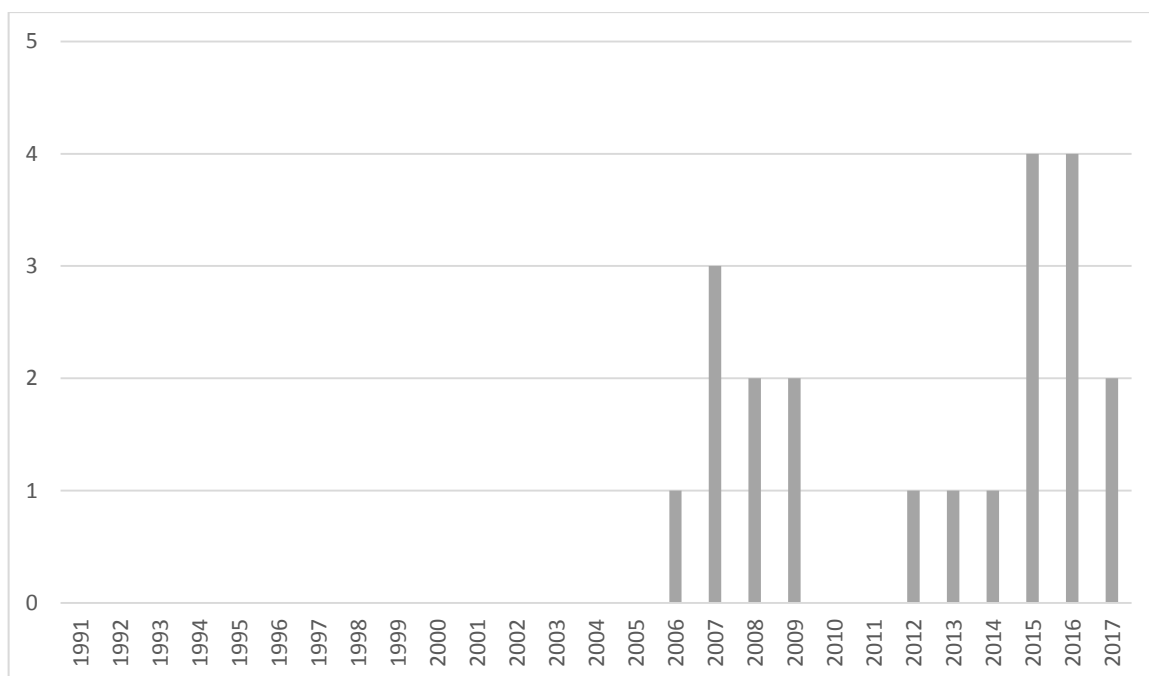

Fig. 2. Distribution of epidemiology studies of out-of-hospital circulatory arrest in Russia, depending on the year of publication.
Note. The authors of the review realize that some publications potentially meeting the selection criteria might not be included into the analysis due to limitations of the search methodology. In particular, this may concern studies published on paper without further conversion into the electronic format and inclusion into electronic databases

Studies differ significantly in the number and type of methods used: from a retrospective analysis of emergency call records [6] to a combination of forensic medical examination methods (sectional, anthropometric, pathological, histological, forensic) with a detailed analysis of medical outpatient records, medical histories, protocols of the pathoanatomical study) and interviews of relatives, witnesses of death, and medical workers in order to clarify the anamnesis [42].

The studied populations are diverse and include samples from the general population [6, 24, 26–31, 33–35, 41], people of separate age groups [25, 32, 36, 37, 39, 41–43], patients with ischemic heart disease [40] and patirnts with alcohol associated cardiomyopathy [38]. The geographical coverage of research varies from several districts of the city [37] to a region, territory or republic [25, 42, 43], the indicated population coverage ranges from 25,000 [40] to 13,400,000 inhabitants [41], the study period ranges from 6 months [35] to 10 years [25, 41, 42], the number of death observations is from 12 [33] to 206,639 cases [41].

The spectrum of epidemiological indicators describing out-of-hospital death includes the frequency of occurrence (19% of publications) [6, 37, 40, 42], the absolute number of cases in a certain population (62%) [6, 24–31, 37, 40, 41, 43], distribution by gender (67%) [6, 25–27, 31–37, 39, 41, 42], age (48%) [25, 29–31, 35, 37, 38, 41–

43], cause (81%), [6, 24–26, 28–32, 34–37, 39–41, 43], place of occurrence (19%) [6, 27, 35, 37], type of circulatory arrest according to ECG data (14%) [6, 28, 30], possible risk factors (38%) [25, 34–36, 40–43] and circumstances of death (including during witnesses / without witnesses; 14%) [34, 36, 41].

Indicators describing the processes and effects of assistance in cases of OHCA include 7 (33%) of 21 publications [6, 24, 28–30, 33, 35]. Three of them describe the experience of introducing a set of measures aimed at increasing the effectiveness of medical care at OHCA in two cities of the Far Eastern Federal District [24, 28, 30].

In a study of 9,090 deaths, accompanied by calling the ambulance in Vladivostok from 1999 to 2004, and 2,517 cases in Yakutsk in 2004–2005, information is provided on the average annual proportion of cases of CPR in the total number of OHCA (resuscitation activity), the percentage of cases of circulatory restoration during resuscitation, causes of death, number of EMS vehicles, distribution of visits to cases of OHCA depending on the type of EMS brigade, time of arrival of EMS brigades in cases of OHCA, equipment of brigades with defibrillators and the time gap before the first defibrillation [24, 28]. The authors reported improved resuscitation activity indicators (from 13.0% in Vladivostok and 5.2% in Yakutsk to 26.8% and 12.5%, respectively), the arrival time of the EMS brigade for cases of OHCA (from 17.7 minutes in Vladivostok and 20.3 minutes in Yakutsk to 11.3 and 8.3 minutes, respectively), before the first discharge of the defibrillator is applied, the prevalence of cases of successful resuscitation (from 4.3% in Vladivostok and 0% in Yakutsk to 10.2% and 8.9%, respectively) as a result of introduction of the "system for improving the effectiveness of CPR" which is a set of measures, including the creation and continuous work of training centers for the emergency medical service personnel, the improvement of the material and technical base of the emergency service crews, the introduction of a system for examination of emergency call cards for cases of OHCA [24, 28]. Developed as part of the "system for increasing the effectiveness of CPR" and introduced in 2001, the CPR protocol includes a number of indicators that correspond to the key and additional data elements of the current Utstein recommendations: patient's age, primary rhythm according to ECG, drugs and their way of administration, method of ensuring patency/protection of the respiratory tract, the number of discharges of the defibrillator and the fact of the restoration of spontaneous circulation [24].

In the publication A.A. Ivanova et al. (2008) an additional analysis indicating further positive dynamics of aid effectiveness indicators at OHCA in Yakutsk from 2004 to 2007 is given, including a significant increase in the proportion of circulatory restoration during CPR (up to 27%) [30]. It is noteworthy that in both works of this group of authors [28, 30], resuscitation activity was calculated as the number of cases of resuscitation in relation to the number of cases of clinical death, rather than cases of OHCA as a whole, as suggested by the original formulation [24]. The result of this discrepancy is the significantly overestimated indicators of resuscitation activity (up to 100%) [28, 30].

In a recent study, based on a retrospective analysis of EMS call cards (form 110/u; n=67) for cases of circulatory arrest in Simferopol for 3 months, the definition of the Utstein data report [6] was used to describe the epidemiology of OHCA. The results indicate a high incidence of OHCA (674 cases per 100,000 population per year) with a low incidence of CPR (58 cases per 100,000 population per year) and, accordingly, low resuscitation activity (8.6%), as well as low prevalence of episodes of CPR performed by witnesses of circulatory arrest (2.3%) and the absence of cases of successful resuscitation. In addition, the proportion of cases of OHCA which developed in the presence of the EMS brigade (6.5%), the distribution of cases of OHCA depending on the alleged cause, the place of occurrence and the type of circulatory arrest according to the primary ECG [6] are reported.

In order to compare the effectiveness of the two extended resuscitation algorithms proposed by the American Heart Association in 2000 and 2005, an analysis of 172 out-of-hospital clinical deaths diagnosed by the intensive care team in Vladivostok in 2006 and 2007 was performed [29]. The author reports on the higher efficiency of the algorithm in 2005, provides information on the number and proportion of cases of successful resuscitation (10.8% and 17.3% when using the algorithms of 2000 and 2005, respectively), the duration of CPR, the distribution of cases of successful resuscitation depending on the age of patients and the causes of circulatory arrest [29].

In a paper describing 31 cases of forensic medical examination of sudden cardiac death, it was reported that in 2 cases resuscitation was undertaken: a closed heart massage (2 cases), artificial respiration (1), electrical defibrillation (1) and medication administration (2) [35].

M.V. Smirnov et al. (2017) describe 12 cases of prehospital resuscitation using a device for automated mechanical CPR [33]. They report number of cases with tracheal intubation (8), peripheral catheterization (12) or central vein (4), drug therapy (12), defibrillation (4). The proportion of cases of successful resuscitation was 50%, and the duration of resuscitation was average [33].

The lack of a single methodological approach to collecting, analyzing and presenting data during epidemiological studies of blood circulation makes the effective generalization and comparison of the registered indicators difficult. However, the results of individual scientific studies indicate a high incidence of OHCA in the general population, low resuscitation activity and, in particular, low incidence of resuscitation performed by witnesses of circulatory arrest, low prevalence of successful resuscitation cases, and also demonstrate the possibility of improving the effectiveness of resuscitation care as a result of introducing a set of administrative measures to improve equipment, training, algorithms and administrative monitoring of EMS activities.

In general, the analysis of publications included in the review showed a significant thematic and methodological heterogeneity of scientific studies describing the epidemiology of OHCA in the Russian Federation. Many works

characterize varieties of circulatory arrest (for example, sudden cardiac death) or are limited to analysis in subpopulations, whereas studies of the epidemiology of the whole OHCA (sudden and expected, violent and non-violent death) in the general population are few and do not provide a complete epidemiological situation of OHCA in Russia, due to the small geographical and population coverage as well. In some publications describing the processes and results of first aid and medical care for OHCA, there is no significant part of the key data elements included in the recommendations of Utstein, which is explained by the imperfection of the existing systems for recording cases of out-of-hospital death.

CONCLUSION

The need to create a registry of OHCA may be shortly described by the well-known statement of the British physicist William Thomson: "You cannot improve what you cannot measure."

Adaptation of the positive experience of other countries and the EMS system is an important way to increase the survival of patients with OHCA. However, in conditions of limited health resources, administrative decisions on the implementation of measures to improve the first aid and medical care systems require a preliminary comparative analysis, which should show the applicability of the proposed changes to the existing conditions in the relevant region [15].

Such a preliminary analysis of the reasonability, as well as an assessment of the effectiveness of the measures implemented, is possible only if there is reliable information about the local epidemiology of OHCA, the structure and function of a specific first aid system, and this information for comparison between systems should meet the same principles of collection, analysis and presentation of data.

Given the high prevalence of circulatory arrest and the low survival rate of patients with OHCA in the Russian Federation, it is necessary to take urgent measures to improve the effectiveness of care for OHCA. The creation of the OHCA registry, corresponding to the current Utstein recommendations on the unified reporting of information about cases of circulatory arrest, and the subsequent geographical expansion of this register will allow:

1) to accumulate and analyze detailed and objective data on the epidemiology of OHCA, including information on the incidence, risk factors and outcomes of circulatory arrest, as well as the organizational structure and performance of individual components of the first-aid system and medical care for OHCA;

2) to carry out a comparative analysis of the epidemiological indicators and indicators of the functioning of the first aid system and medical assistance for OHCA within the same registry or between registries;

3) to identify priority areas for improving the system of first aid and medical care for OHCA;

4) to reliably assess the effectiveness of the measures being implemented.

FINDINGS

1. The available information about the epidemiology of out-of-hospital circulatory arrests in Russia is limited. However, the published data indicate a high incidence of OHCA, low resuscitation activity and a small number of cases of successful resuscitation.

2. For a rational organization and evaluation of the effectiveness of administrative interventions to improve the survival of patients with OHCA, a registry is necessary to collect and periodically analyze epidemiological data and information about the structure and function of the first aid system and medical care in the relevant region.

3. To ensure the reliability and comparability of data, the registry should be developed and operated in accordance with the approved Utstein international recommendations for a unified report of information about OHCA.

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