## Original Article
# Research progress of pre-hospital emergency during 2000-2020: a bibliometric analysis

Li Xu[1*], Fen Tang[2*], Yunyun Wang[3*], Qi Cai[4], Shuhui Tang[5], Demeng Xia[1], Xianghua Xu[6], Xiaoying Lu[7]

[1]Department of Emergency, Changhai Hospital, Naval Medical University, Shanghai, China; [2]Shanghai Key Lab of Tuberculosis, Shanghai Pulmonary Hospital, Tongji University School of Medicine, Shanghai, China; [3]Department of Emergency Intensive Care Unit, The Affiliated Hospital of Qingdao University, Qingdao, Shandong, China; [4]Department of Stomatology, Changhai Hospital, Naval Medical University, Shanghai, China; [5]Department of Oncology, Changhai Hospital, Naval Medical University, Shanghai, China; [6]Department of Respiratory Medicine, Northern Theater General Hospital, Liaoning, China; [7]Department of Nursing, Changhai Hospital, Naval Medical University, Shanghai, China. *Equal contributors.

Abstract: Background: The past decade has witnessed the preliminary development of pre-hospital emergency. We analyzed the scientific output related to pre-hospital emergency in the past two decades, aiming to evaluate the publication status of the literature related to pre-hospital emergency through bibliometrics analysis, and hope to provide enlightenment of trends and hotspots for the development of pre-hospital emergency. Method: By web of science, all literature on pre-hospital emergency from 2000 to 2 October 2020 was retrieved and screened by two researchers. Excel, Social Sciences Statistics Package (SPSS, version 24) and software GraphPad Prism 8 were used to analyze the publication trend in related fields. Besides, VOSviewer, Citespace were also applied to visualize the research trends and study the co-occurring keywords in pre-hospital emergency. Results: As of 2 October 2020, a total of 1839 pre-hospital emergency publications with total citation of 32800 times were identified. The United States accounted for the largest number of publications (36.7%) and the highest number of citations (12825), but its H-index was fourth (20.17). In the aspects of journals and articles, *Prehospital Emergency Care* is the most published journal in pre-hospital emergency (256), while the articles from Smith K presented the highest citation frequency (751). We can also obtain the information that the overall trend is upward, and developed countries contribute most. "Complications" is a hot research field in intensive care. In the identification research cluster, "acute ischemic stroke" was determined to be the hotspot, while "secondary outcome" was the new trend in the first-aid cluster. As for the management, "embase" was noted as new topics. Conclusion: In the past decade, researches on pre-hospital emergency has increased rapidly. However, the related articles were mainly published in developed countries, the United States has absolute advantages especially. Moreover, first-aid studies may become hotspots in the near future.

Keywords: Pre-hospital, emergency, citation, bibliometrics

## Introduction

As an emerging independent sub-specialty in medicine, pre-hospital emergency includes not only clinical nursing, but also logistics, rescue ability and field management skills [1]. In recent years, pre-hospital emergency plays an important role in saving the patient's life immediately. In Japan, the existence of pre-hospital emergency mode enables patients to receive professional medical assistance 4-7 minutes in advance [2]. Pre-hospital emergen-cy also shows unique advantages in the treatment of clinical emergencies such as cardiac arrest [3], stroke [4], respiratory failure [5] and so on. Especially in the process of inter-hospital transport of patients with severe COVID-19, pre-hospital emergency also plays a key role [6]. At present, the public's awareness of pre-hospital emergency is increasingly profound. For example, A lot of countries are popularizing cardiopulmonary resuscitation (CPR) training and providing automatic external defibrillators (AEDs) in public places [7]. The use of transport

technology also promoted the development of pre-hospital emergency. For example, the emergence of helicopter emergency medical service provided a new idea for pre-hospital emergency transport for severe trauma [8]. Therefore, both in terms of effectiveness and recognition, it is necessary to grasp the development trend and research hotspot of pre-hospital emergency.

Bibliometrics, as a scientific evaluation method, can evaluate the research effect of groups and individuals. Similarly, bibliometrics also provide supporting evidence for the development of future research hotspots [9]. Now the methods of bibliometrics has been widely used in kinds of important fields. Based on Web of Science (WOS), the purpose of our study is to comprehensively analyze the research progress of pre-hospital emergency field. We will use the method of bibliometric analysis to analyze the research trend related to pre-hospital emergency and predict the research hotspots in the future.

Although Richard et al. used bibliometrics to evaluate two decades of prehospital emergency publications worldwide, they focused on the authors of prehospital emergency journals [10], rather than publication trends and keywords. Therefore, our study will fill the gap of publishing trends and future hot spots in the field of pre-hospital emergency.

**Materials and methods**

*Data sources and search strategies*

Web of science is one of the largest and most comprehensive academic information resource in the world. Therefore, the publications we collected were obtained from online database Science Citation Index-Expanded (SCI-E) of Thomson Reuters' WOS. All of the search progresses were finished in October 2, 2020, in order to avoid bias introduced by rapid database renewal. The retrieval strategies were as follows: TS = (Emergency Medical Services OR Emergency Services) OR Emergency Service, Medical OR Medical Emergency Service OR Medical Emergency Services OR Service, Medical Emergency OR Services, Medical Emergency OR Medical Services, Emergency OR Emergency Medical Service OR Medical Service, Emergency OR Service, Emergency Medical

OR Services, Emergency Medical OR Prehospital Emergency Care OR Emergency Care, Prehospital OR Emergicenters OR Emergicenter OR Emergency Care OR Emergency. Health Services OR Emergency Health Service OR Health Service, Emergency OR Health Services, Emergency OR Service, Emergency Health OR Services, Emergency Health OR Emergency Medicine OR Medicine, Emergency OR Emergency OR Emergencies OR emergency Aid, First OR Aids, First OR emergencys AND Web of Science Categories = (Prehospital OR Prehospital) AND Language = English. Our data selected only standard peer-reviewed articles and reviews and excluded other types of studies. The specific collection process is shown in **Figure 1**.

*Data collation*

All the data were extracted by two searchers (LX and YYW), including titles, keywords, publication dates, authors, origin countries and regions, institutions, published journals, sum of citations, H-index and so on. The Microsoft Excel 2013 (Redmond, Washington, USA), statistical package for social sciences (SPSS, version 24, IBM Corporation, USA), GraphPad Prism 8 (GraphPad Prism Software Inc., San Diego, CA), VOSviewer version 1.6.12 (Leiden University, Leiden, the Netherlands), Citespace version 5.6.R5 64bit (Drexel University, Philadelphia, PA, USA), and the Online Analysis Platform of Literature Metrology (http://bibliometric.com/) were used for presenting, analyzing of data and description of figures. Meanwhile, the data regarding the gross domestic product (GDP) was retrieved according to the World Bank website.

*Bibliometric analysis*

Thomson Reuters' Web of Science (WoS) had a large collection of researches especially those focused on biomedicine, so we choosed the WOS to get the characteristics of all incorporated publications. The term relative research interest (RRI) was defined as the amount of publications in a particular research field divided by the total publications across all fields per year. While the impact factor (IF) was obtained from the information provided by the Journal Citation Reports (JCRs) published in 2020. As we all know, it has been widely accepted that H-index serves to reflect the scientific research
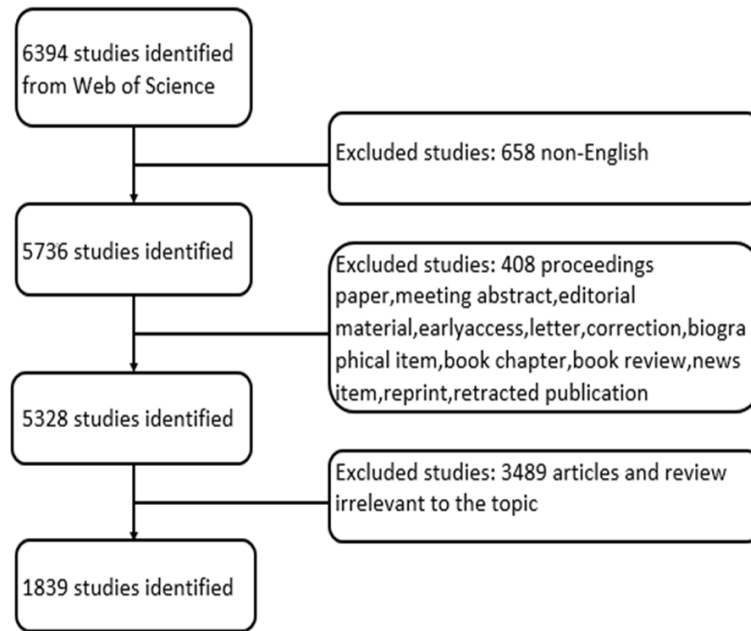
**Figure 1.** Flow diagram of the inclusion process. The detailed process of screening and enrollment.

word detection, etc) and visualization of nodes, connections and network structures, the hidden patterns and laws of knowledge structures in specific disciplines and fields were found. VOSviewer can generate a variety of bibliometrics-based maps, author or journal co-citation diagrams, keyword co-occurrence diagrams. Compared with other visualization software, its main feature is that the graphical display is rich and clear, which makes the analysis results of bibliometrics easy to explain. We also used Vosviewer to analyze keywords and academic institutions to get preliminary visual results.

**Results**

*Distribution of countries published*

From **Figure 2A** of the 1839 articles dated we retrieved from 2000 to 2020. The United States ranked the first in the number of publications at 675 (36.7 %), followed by England at 150 (8.1%) and Canada at 140 articles (7.6%). The United States has an absolute advantage in quantity and the number of citations, which is almost the same as the sum of citations in the second to sixth places. But America's H-index is fourth. By comparing the number of papers published per year, we found that the largest number of publications occurred in 2019, with 204 publications (11%) (**Figure 2A**). In addition, we found out, global interest in pre-hospital emergency research increased rapidly between 2009 and 2013, From 2014 to 2017, Starting again in 2018. The overall upward trend is clear. At RRI values, RRI values range from 0.00016 in 2009 to 0.00047 in 2018, Four times higher (**Figure 2B**). By comparing the GDP of economic parameters, the United States is clearly dominant, the rest are also developed countries. By visualizing the relationship between countries, the United States, as the most prolific country, is also most closely associated with other countries, particularly close to his neighbor, Canada (**Figure 3**).

impacts of a scholar or a country. The index of H means that a scholar/country has published H papers and each of them has been cited in other publications for at least H times, which is better than other indicators considered (total citation count, citations per paper, and total paper count) in predicting future scientific achievement. Thus H-index can provide a strong assessment of the impact of long-term cumulative research results by researchers.

We also used CiteSpace and VOSviewer to visualize the data we collected. Citespace will present the relevant laws and distribution by means of visualization. Firstly, the information units in the scientific literature (including references at the literature level, keywords at the subject level, subject words, disciplines, domain classifications, authors, institutions, countries, periodicals, etc.) were extracted, and then reconstructed according to the type and intensity of the information units to form a network structure of different meanings (keyword co-occurrence, author cooperation, document co-citation, etc), the nodes in the network represent the document information units, and the connections between nodes were represented (co-occurrence). Finally, through the measurement, statistical analysis (clustering, emergent
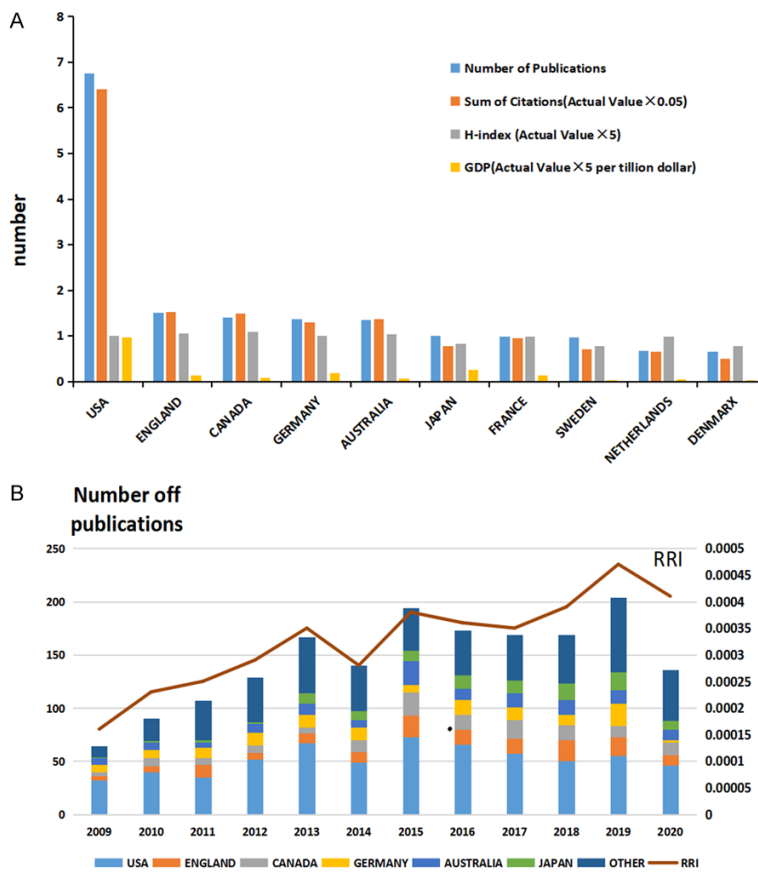
A



B

**Number off publications**



**Figure 2.** Contributions of different countries/regions to the research field regarding ultrasound in orthopedics researches. A. The number of publications, citation frequency (×0.05), H-index (×5) and GDP (×5, per trillion dollar) in the top 10 countries or regions; B. The number of publications worldwide and the time course of relative research interest of pre-hospital emergency.

frequency of 17.79 times per paper. 12825 (39.2%) were in the United States, Britain and Canada, 3040 (9.29%) and 2966 (9.06%), basically positive correlation with the total number of publications. In addition, although the number of publications from Australia ranked fifth, the citation frequency was 2,715 times with an H-index of 20.65, and thus ranked fourth and third among all considered countries and districts (**Figure 2A**).

*Journals with research publications on pre-hospital emergency*

Nearly a half of the papers in the filed were published in the top 10 journals (44.1%). The top two most published journals are *Prehospital Emergency Care* (IF=2.29), *Resuscitation* followed (IF=4.215). The two journals accounted for 19.7% of the total number of pre-hospital emergency papers. The top third magazine named *Scandinavian Journal of Trauma Resuscitation Emergency Medicine* published 96 articles (IF=2.37). Noticeably, the H-index of the American Journal of *Resuscitation* ranked first in the top 10 journals (39). And the IF factor is also at a high level. The top 10 journals with most publications on pre-hospital emergency were listed in **Table 1**.

*Institutions with research publications on pre-hospital emergency*

There were 2711 institutions involved in pre-hospital emergency related literature. Within the list of top 20 institutions in this field, American institutions and Canada account for more than half, with seven and four respectively, three were Australia institutions, two were in Norway, two were in Sweden, one was in South Korea, one was in France. The Univ Pittsburgh published the most (4.676%), followed by Univ Washington (2.991%), the

*Growth trends of publications*

The global cumulative publication numbers and the top 6 countries, as well as the corresponding model fitting curves were shown in **Figure 4**. It was found that the global research on pre-hospital emergency will continue to rise over the next decade, as will Britain, Canada, Germany and Australia (**Figure 4C-F**). For the United States and Japan, it was shown that while the development will rise in recently 3 or 4 years, then it will decline in the future (**Figure 4B** and **4G**). However, the number of publications in the United States will still have an absolute advantage in quantity.

*Citations and H-index analysis*

The total number of citations related to the pre-hospital emergency is 32705 (28773 times without self-citations), with an average citation
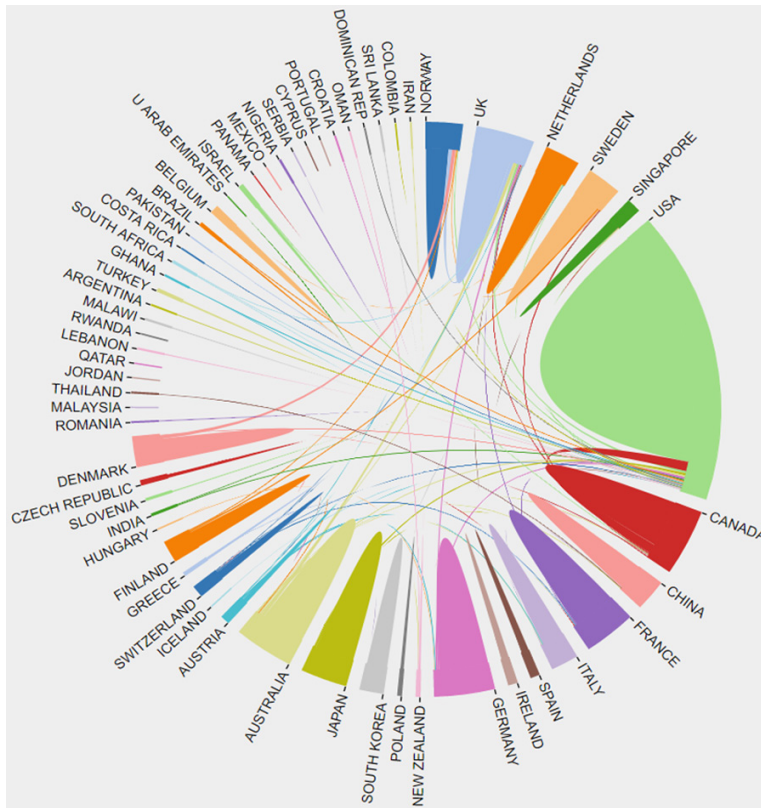
**Figure 3.** The cooperation networks of countries or regions in the field of pre-hospital emergency. The cooperative relations between countries/regions can be visualized.

Second is the Callaway CW of American University of Pittsburgh Published 21 articles, even the total number of citations reached 1674, (34.3%) averaged 79. The United States occupies four of the top ten authors, Australia, Denmark, Korea, Canada, Norway, Sweden has one each (**Table 3**).

*Articles with research publications on pre-hospital emergency*

The most cited article in pre-hospital emergency is Part 8: Post-Cardiac Arrest Care 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Since its publication in 2015, it has been cited 695 times. This paper described and predicted the management of resuscitation in cardiac arrest, including cardiovascular care, temperature management, and respiratory care and so on. The second most cited article was written in 2014 by Kim F et al. on whether prehospital cooling improves outcomes after cardiac arrest and resuscitation in patients with ventricular fibrillation (VF) and non-VF. Besides, there are four the first five articles were on cardiac arrest, which partly explained the importance of the cardiac arrest study (**Table 4**).

*Analysis of keywords in publications of pre-hospital emergency*

We analyzed the keywords extracted from 1,839 publications using VOSviewer. As presented in **Figure 6A**, 118 keywords, defined as terms that occurred more than 45 times within titles and abstracts in all papers during the analysis process, were identified and classified into four clusters, namely, management, first-aid, identification, intensive care. Within the cluster of management, the following keywords were frequently mentioned: service 5573, management 288, review 236, pre-hospital care

Monash University ranked the third (2.936%) (**Table 2**).

In **Figure 5A**, the blue colour indicates that the articles belonging to the institution were published relatively early in the research stage, while the red colour indicates a more recent appearance. According to this, it was found that the most published Univ Pittsburgh in recent years are also more active by Citespace, and the Univ Calif San francisco has published more articles in recent years. In **Figure 5B**, the size of the ball represents the number of publications of the institutions, so the top three publications of the institutions are Univ Pittsburgh, Univ Washington, Monash University.

*Authors with research publications on pre-hospital emergency*

The authors who published the most articles was Smith K, from Monash University Australia Published 22 articles, the citation frequency up to 751, average 34 citations.

A

## GLOBAL

B

## USA

C

## ENGLAND

D

## GERMANY

E

## CANADA

F

## AUSTRALIA

G

## JAPAN

**Figure 4.** The model fitting curves of growth trends of publications associated with Pre-hospital emergency A. Global; B. USA; C. England; D. Canada; E. Germany; F. Australia; G. Japan.

149, process 123. Within the cluster of identification, diagnosis 195, confidence interval 241, survival 348. Within the cluster of the first aid, cardiac arrest 249, resuscitation 236, odds ratio 184, hospital cardiac arrest 330, spontaneous circulation 188. Within the cluster of intensive care, intubation 192, airway management 125, airway 123. Detailed consequences with respect to the cooccurrence analysis of all incorporated keywords are presented in **Figure 6A**, Supplementary Table 1.

As shown in **Figure 6B**, VOSviewer color all keywords according to the average time the key-

**Table 1.** The top 10 journals on ultrasound in Pre-hospital emergency

| SCR[a] | Journal | Contribution (%) | H-index | IF[b] |
|---|---|---|---|---|
| 1st | Prehospital Emergency Care | 215 (11.6) | 26 | 2.29 |
| 2nd | Resuscitation | 150 (8.1) | 39 | 4.215 |
| 3rd | Scandinavian Journal of Trauma Resucitation Emergency Medicine | 96 (5.2) | 21 | 2.37 |
| 4th | Emergency Medicine Journal | 76 (4.1) | 19 | 2.491 |
| 5th | Prehospital and Disaster Medicine | 69 (3.7) | 11 | 1.315 |
| 6th | American Journal of Emergency Medicine | 64 (3.4) | 15 | 4.529 |
| 7th | European Journal of Emergency Medicine | 62 (3.3) | 17 | 1.22 |
| 8th | Journal of Emergency Medicine | 45 (2.4) | 15 | 1.224 |
| 9th | Injury International Journal of the Care of the Injured | 44 (2.3) | 16 | 2.106 |
| 10th | Journal of Trauma and Acute Care Surgery | 39 (2.1) | 17 | 3.381 |

*SCR* standard competition ranking, *IF* impact factor, *OA* open access. [a]Equal journals have the same ranking number, and then a gap is left in the ranking numbers. [b]The impact factor was reported according to the journal citation reports (JCR) 2020.

**Table 2.** Top 20 institutes with most publications on Pre-hospital emergency

| Rank | Institution | Contribution (%) | Country |
|---|---|---|---|
| 1st | UNIV PITTSBURGH | 4.676 | USA |
| 2nd | UNIV WASHINGTON | 2.991 | USA |
| 3rd | MONASH UNIVERSITY | 2.936 | AUSTRALIA |
| 4th | UNIV TORONTO | 2.447 | CANADA |
| 5th | NORWEGIAN AIR AMBULANCE FDN | 2.121 | NORWAY |
| 6th | KAROLINSKA INST | 1.958 | SWEDEN |
| 7th | UNIV CALIF SAN FRANCISCO | 1.849 | USA |
| 8th | MED COLL WISCONSIN | 1.631 | USA |
| 9th | SEOUL NATL UNIV | 1.577 | SOUTH KOREA |
| 9th | UNIV HELSINKI | 1.577 | FRANCE |
| 11th | AMBULANCE VICTORIA | 1.468 | AUSTRALIA |
| 11th | UNIV BRITISH COLUMBIA | 1.468 | CANADA |
| 13th | OREGON HLTH SCI UNIV | 1.414 | USA |
| 13th | UNIV BORAS | 1.414 | SWEDEN |
| 15th | ALFRED HOSP | 1.305 | AUSTRALIA |
| 15th | ST MICHAELS HOSP | 1.305 | CANADA |
| 15th | UNIV OTTAWA | 1.305 | CANADA |
| 18th | UNIV BERGEN | 1.251 | NORWAY |
| 19th | CAROLINAS MED CTR | 1.196 | USA |
| 19th | UNIV CINCINNATI | 1.196 | USA |

words appear. Specifically, blue indicated that the word appears relatively early in the research phase, while yellow indicated late. For example, in the early stage of prehospital emergency, the AAY of the main topic complication (cluster 4) was 2014.8. At the first group, the latest word is embase (cluster 1), AAY is 2015.8. Acute ischemic stroke (cluster 2) is the most recent word in the second cluster, with a AAY of 2015.7 and 47 occurrences. More recently, research trends demonstrated that secondary outcome (cluster 3), with an AAY of 2016.5, may be a new target.

We can also obtain keyword information from **Figure 7** below. Ventilation was the most prominent key word and its strength is 9.3. From 2000 to 2014, it was most strengthened. Next is rapid sequence intubation, its strength was 8.2, and the level of research strengthened from 2008 to 2015. The keyword that has the longest heat is advanced life support, which last from 2000 to 2015.

## Discussion

### Research trends of pre-hospital emergency

Among all the countries, the United States ranked first in terms of the number of publications, accounting for about one third of the total publications (**Figure 2A**). Moreover, the countries ranked top in terms of the number of publications were all developed countries, which fully indicated that the economic strength and GDP index of a country influence the study of pre-hospital emergency (**Figure 2A**). And the volume of publications in this field will continue to increase in
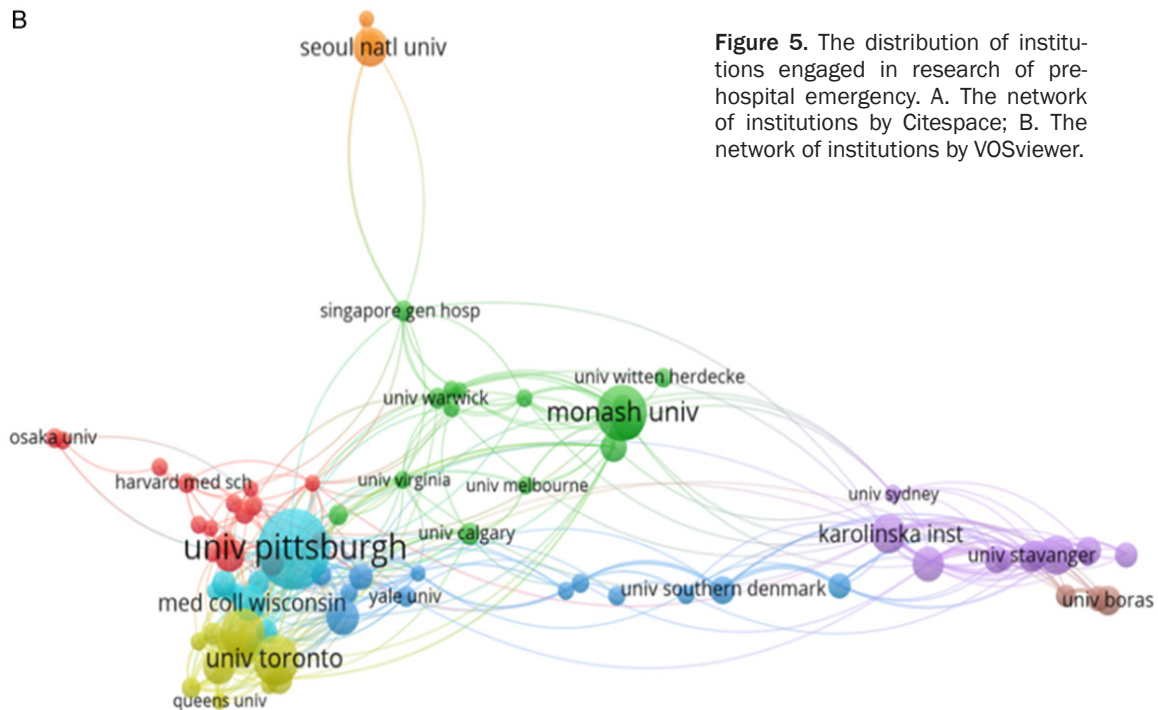
A



B



**Figure 5.** The distribution of institutions engaged in research of pre-hospital emergency. A. The network of institutions by Citespace; B. The network of institutions by VOSviewer.

the future (**Figure 3G**), we believe that most of the contributions will also be made by developed countries. Similarly, we can also speculate that advanced science and technology can help the development of pre-hospital emergency. For example, in a clinical randomized controlled study, the emergence of extracorporeal membrane oxygenation, a medical device, increased the survival rate of patients with respiratory failure from 47% to 63% [11]. And the use of the latest defibrillators, the implantable cardioverter defibrillators, also reduces the likelihood of cardiac arrest in patients with arrhythmia, meanwhile these new technologies were often found in developed countries [12].

The most frequently cited published articles have a high academic impact in a particular

**Table 3.** Top 10 authors with most publications in research scope of Pre-hospital emergency

| Author | Country | Affiliation | No. of Publications | No. of Citations |
|---|---|---|---|---|
| Smith K | Australia | Monash University | 22 | 751 |
| Callaway CW | USA | University of Pittsburgh | 21 | 1674 |
| Martin-Gill C | USA | University of Pittsburgh | 21 | 129 |
| Herlitz J | Sweden | University of Boras | 19 | 306 |
| Guyette FX | USA | University of Pittsburgh | 18 | 265 |
| Lossius HM | Norway | Norwegian Air Ambulance Fdn | 18 | 552 |
| Morrison LJ | Canada | University of Toronto | 18 | 635 |
| Mikkelsen S | Denmark | Odense University Hospital | 17 | 132 |
| Shin SD | South Korea | Seoul National University | 16 | 262 |
| Wang HE | USA | University of Texas Austin | 16 | 174 |

field. We can obtain the detailed information on the top 10 most frequently cited publications in the field of pre-hospital emergency care (**Table 4**). Published on Circulation in 2015 as Part 8: The Guidelines for post-cardiac Arrest Care 2015 American Heart Association Guidelines Update for Cardiopulmonary Care [8] was one of the most influential literatures in pre-hospital emergency. What is worth mentioning is that, compared with the guideline issued in 2010 [13], the guideline pays more attention to the personalized treatment with cardiac arrest, which will be a major development trend of pre-hospital emergency and even the whole medicine. And overall, in the top five articles, there are four articles associated with cardiac arrest, and the other three articles associated with cardiac arrest respectively from low temperature induction [14], the survival rate for recovery [15], the use of epinephrine [16] research aspects such as the cardiac arrest, this suggests that cardiac arrest is a research direction has been attracting the attention of scholars.

So far, there have been some excellent articles (**Table 4**) and some high-IF journals (**Table 3**). However, in this field, RRI still presented a rapid rising trend (**Figure 3**). The reasons for the increase of interest may be inseparable from the following two points. On the one hand, with the acceleration of the pace of life, kinds of accidents occur more frequently. For example, the incidence of cardiac arrest [17] and drowning [18] are increasing year by year. According to statistics, the number of deaths caused by organophosphorus poisoning in the world has reached 200,000 [19], while the traffic injury rate has increased from 407/100,000 population in the 1990s to 92.9/100,000 population in 2010-2015 [20]. However, the death rate of traffic decreased from 19.9 per 100,000 populations in the 1990s to 9.3 per 100,000 population in 2010-2015 [20]. It is well-believed that the phenomenon is directly related to the development of pre-hospital emergency. On the other hand, as the medical work elaboration, the requirement of personalized treatment of critically ill patients also gradually be recognized, in the treatment of shock, such as allergic shock, hypotension shock and neurogenic shock, the treatment is different, and different age and gender groups also have different treatments [21], which promoted the research and the development of pre-hospital emergency.

For the top 20 published articles, the United States and Canada accounted for more than half (**Table 2**), and half of the top 10 published authors were from the United States and Canada (**Table 3**). We expect these phenomena to be associated with cooperation between countries. For example, the map based on WOS data shows that the United States has the strongest contact with many countries in this area, especially Canada (**Figure 3**), while other countries have few. So the number of products in other countries was lower than that in the United States and Canada. The phenomenon calls on scientists around the world to push boundaries and bring deeper cooperation. Only in this way, can help promote the development and application of pre-hospital emergency.

*Research focused on pre-hospital emergency*

Based on the mapping of bibliographic data obtained from the analysis of all keywords

**Table 4.** Top 10 most-cited papers related to Pre-hospital emergency

| Title | Corresponding authors | Journal | Publication Year | Total Citations | Corresponding author's country |
|---|---|---|---|---|---|
| Part 8: Post-Cardiac Arrest Care 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care | | CIRCULATION | 2015 | 695 | |
| Effect of Prehospital Induction of Mild Hypothermia on Survival and Neurological Status Among Adults With Cardiac Arrest A Randomized Clinical Trial | Kim, F | JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION | 2014 | 367 | USA |
| Survival With Emergency Tourniquet Use to Stop Bleeding in Major Limb Trauma | Kragh, JF | ANNALS OF SURGERY | 2009 | 307 | USA |
| Recent Trends in Survival From Out-of-Hospital Cardiac Arrest in the United States | Chan, PS | CIRCULATION | 2014 | 269 | USA |
| Prehospital Epinephrine Use and Survival Among Patients With Out-of-Hospital Cardiac Arrest | Hagihara, A | JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION | 2012 | 277 | Japan |
| The out-of-hospital esophageal and endobronchial intubations performed by emergency physicians | Timmermann, A | ANESTHESIA AND ANALGESIA | 2007 | 240 | Germany |
| Association of Prehospital Advanced Airway Management With Neurologic Outcome and Survival in Patients With Out-of-Hospital Cardiac Arrest | Hasegawa, K | JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION | 2013 | 224 | USA |
| Induction of Therapeutic Hypothermia by Paramedics After Resuscitation From Out-of-Hospital Ventricular Fibrillation Cardiac Arrest A Randomized Controlled Trial | Bernard, SA | CIRCULATION | 2010 | 208 | Australia |
| Emergency Medical Services Intervals and Survival in Trauma: Assessment of the "Golden Hour" in a North American Prospective Cohort | Newgard, CD | ANNALS OF EMERGENCY MEDICINE | 2010 | 201 | USA |
| Design and Validation of a Prehospital Stroke Scale to Predict Large Arterial Occlusion The Rapid Arterial Occlusion Evaluation Scale | de la Ossa, NP | STROKE | 2014 | 188 | Spain |
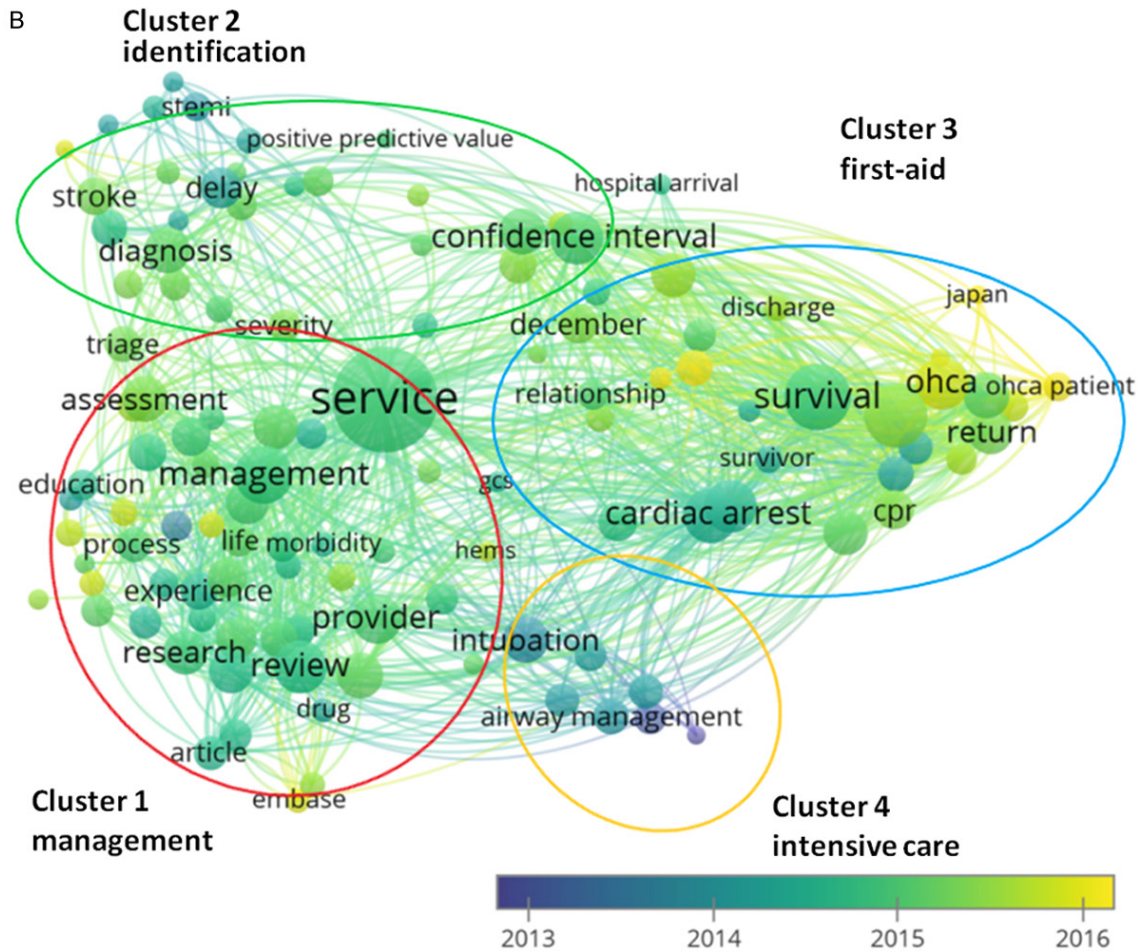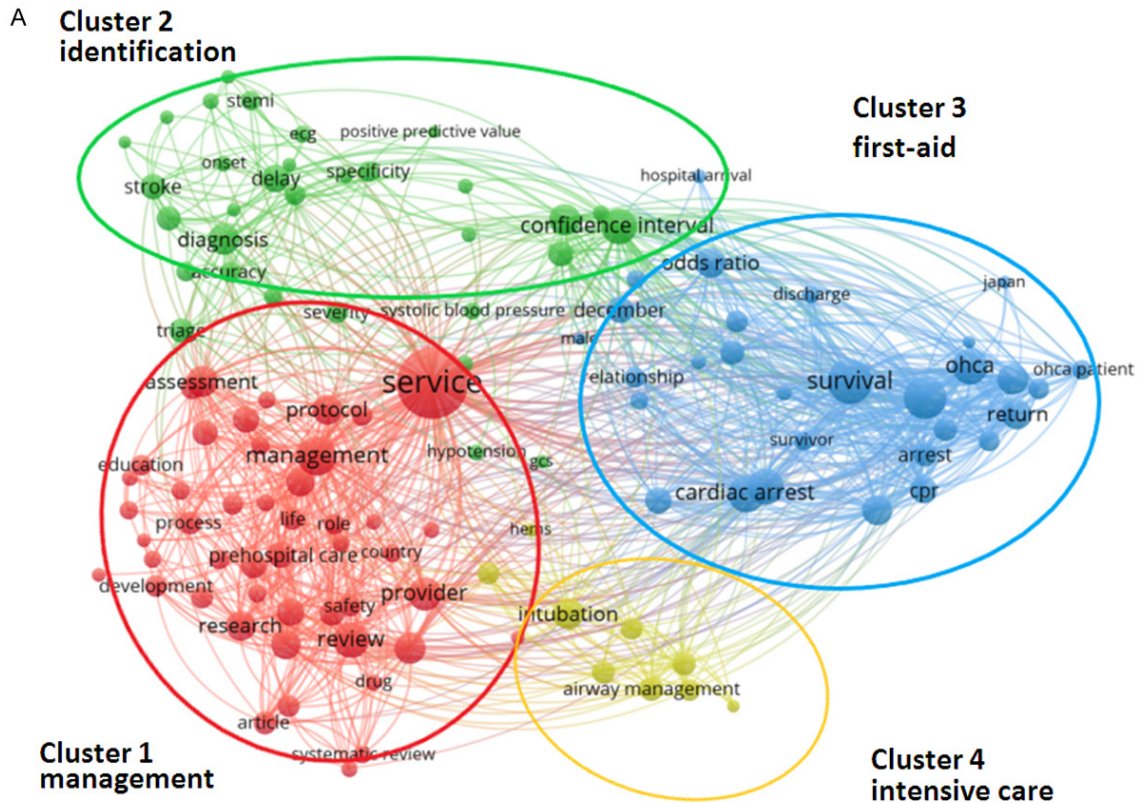
**Figure 6.** The co-occurrence analysis of all keywords in publications of pre-hospital emergency. A. Mapping of the keywords in the area of pre-hospital emergency. The words were divided into 4 clusters in accordance with different colors generated by default: "management" (left in red), "first-aid" (right in blue), and "identification" (up in green), "intensive care" (below in yellow). Size of the circle represented the frequency of keywords; B. Distribution of keywords were presented under occupation to the average time of application. The blue color represented early application and yellow color standing for late application. Two keywords were considered co-occurred if the same line in the corporate file. Smaller distance between 1 two keywords individually related higher co-occurrences of the keyword.

### Top 16 Keywords with the Strongest Citation Bursts

| Keywords | Year | Strength | Begin | End | 2000 - 2020 |
|---|---|---|---|---|---|
| ventricular fibrillation | 2000 | 6.7971 | 2000 | 2014 | |
| emergency medicine | 2000 | 3.6555 | 2000 | 2008 | |
| airway | 2000 | 5.9439 | 2000 | 2014 | |
| ventilation | 2000 | 9.3627 | 2000 | 2014 | |
| emergency | 2000 | 3.0943 | 2000 | 2009 | |
| experience | 2000 | 5.5177 | 2000 | 2014 | |
| delay | 2000 | 4.6661 | 2000 | 2014 | |
| advanced life support | 2000 | 5.2187 | 2000 | 2015 | |
| reperfusion | 2000 | 6.6721 | 2000 | 2010 | |
| traumatic brain injury | 2000 | 5.0397 | 2008 | 2014 | |
| rapid sequence intubation | 2000 | 8.2218 | 2008 | 2015 | |
| induction | 2000 | 5.0397 | 2008 | 2014 | |
| comatose survivor | 2000 | 5.0757 | 2009 | 2014 | |
| implementation | 2000 | 4.5668 | 2009 | 2014 | |
| diagnosis | 2000 | 4.5668 | 2009 | 2014 | |
| mild hypothermia | 2000 | 4.0581 | 2009 | 2014 | |

**Figure 7.** The top 16 keywords with the strongest citation bursts during 2000 to 2020. The red bars represent frequently cited keywords during this time period. The green bars represent infrequently cited keywords.

sures, the development of intensive care units has become increasingly mature. However, the on-site treatment of critically ill patients without adequate first-aid equipment becomes significant. At present, various countries focus their research on the on-site treatment. For example, in Belgium, different first-aid training plans were developed for each age group of children and incorporated into school curricula to respond to emergencies [23]. In Washington State, cardiopulmonary resuscitation (CPR) was compulsory for high school students [24]. Those measurements have greatly promoted the development of in the field of pre-hospital emergency.

(**Figure 6A**, **6B**), the keywords were divided into four groups, namely identification, management, first aid, and intensive care. The density of keywords generalizes the overall structure of the figure and focuses people's attention on the most important areas of pre-hospital emergency. However, the cluster of first-aid is relatively new in terms of publication date for the following potential reasons.

First, over the past decade, research has shown a shift towards rapid aid of serious diseases, rather than just the usual in-hospital emergency treatment. The professionalism of on-site treatment directly determines the survival rate of patients. For example, Research results show that the survival rate of patients with cardiac arrest who receive timely professional treatment is significantly higher than those patients who do not receive timely treatment [22]. In addition, with the improvement of in-hospital intervention and evaluation mea-

In terms of the latest research hotspots, Embase from the management research cluster is the latest (cluster 1). As the main database of drugs, Embase has collected 17 million pieces of drug information (including more than 6 million pieces of information collected by Medicine), and the number is still increasing by 600,000 pieces every year [25]. This suggests that the discussion over the use of some medications in pre-hospital emergency care remains intense. For example, epinephrine, as a commonly used drug in cardiac arrest, has not been comprehensively evaluated in clinical practice now. The study of Gavin D, have shown that the use of epinephrine may have adverse effects on the brain and nervous system [26]. Similarly, in the treatment process of patients with arrhythmia, the use of common drugs amiodarone and lidocaine cannot improve the survival rate and prognosis of patients [27]. All these problems need to be discussed and studied. On the other hand, most of the information col-

lected in this database comes from Europe, which is a concentrated region of developed countries [25]. The important guidelines and consensus included consensus statement and practical guidance for pre-hospital management of Stroke [28], Recommendations on pre-hospital & Early hospital management of acute heart failure [29], which were formulated by Europe. Meanwhile the European Citation Council has also formulated a large number of guidelines for the treatment of the shock patients [30]. It also requires that the countries of the world should learn from and communicate with Europe in pre-hospital emergency.

Acute ischemic shock from the identification study cluster (cluster 2) is one of the terms found in the latest study. As a serious disease in the field of pre-hospital emergency, the early identification and diagnosis of acute ischemic shock plays an important role in improving the survival rate of patients. Studies have shown that, as a life-threatening disease, the onset of shock is secretive, especially the cardiogenic hemorrhagic shock with a high mortality [31]. At present, the evaluation of treatment options for ischemic shock remains controversial in the literature, for example, in particular the need for the management of key interventions, such as intubation, mechanical ventilation, or vascular access [32], which may account for the continued increase in interest among researchers in ischemic shock.

Keywords such as secondary results appeared most frequently in the latest study, and primary results ranked third (cluster 3). In our analysis, both of these words come from randomized controlled studies. This suggests that a randomized controlled study is more useful in the study of pre-hospital emergency, such as in the treatment of acute carbon monoxide poisoning, Lindell K used randomized controlled methods, and found in continuous hyperbaric oxygen therapy, could reduce the acute carbon monoxide poisoning cognitive sequelae after 6 weeks and 12 months of risk [19]. Similarly, in the emergency treatment of ankle sprain, Robert J et al. also randomly divided the patients into two groups, and finally concluded that the prognosis of the patients was not improved by adding physical therapy on the basis of conventional treatment [33]. This shows that researchers are also more rigorous and scientific about the study of first aid in the field.

In cluster 4, complications are the most frequently studied words. The survival chain of cardiac arrest consists mainly of early identification, early cardiopulmonary resuscitation, early defibrillation and advanced life support [34]. This means that in current emergency medicine, the early treatment of patients is only part of the treatment, however in intensive care, or advanced life support, it's also important to prevent the patient's complications, for example, the ischemia-reperfusion injury in patients with cardiac arrest is also important [35], and in the secondary prevention of recurrence of patients with cerebral embolism in the process of using dual antiplatelet therapy, can significantly improve the prognosis, reduce recrudescent possibility [36]. All require emergency medicine to pay more attention to the management of complications.

In **Figure 7**, the most popular and longest-lasting word is advanced life support, and new prominent keywords include mild hypothermia. Therefore, we speculate that the treatment of hypothermia in advanced life support will be a trend. Studies have shown that hypothermia therapy after cardiac arrest can reduce the mortality of patients and the probability of nervous system injury [37]. The development of hypothermia like treatment concepts over the past two decades has accelerated advances in advanced life support and pre-hospital emergency care.

This bibliometrics collection collects publications extracted from the Web of Science database. Despite our efforts to make the data objective and reliable. But there will still be shortcomings. Our inclusion criteria limited the content of our study to English articles, while some important but non-English studies on pre-hospital care were ignored. In addition, the database is still constantly updated, so our results may be biased to some extent.

### Conclusion

The United States was the most productive country for research on pre-hospital emergency, and global publications will continue to rise and developed countries have contributed more. The focus of keywords gradually shifted to first aid research. It was also recommended to focus on promising research hotspots, such as Embase, acute ischemic shock secondary

results and complications. Our study provided profound insights into the research history and current status of pre-hospital emergency, which may indicate its future trend.

## Disclosure of conflict of interest

None.

**Address correspondence to:** Demeng Xia, Department of Emergency, Changhai Hospital, The Naval Medical University, Shanghai, China. Tel: +86-21-3116-2631; Fax: +86-21-5522-6616; E-mail: demengxia@163.com; Xianghua Xu, Department of Respiratory Medicine, Northern Theater General Hospital, Liaoning, China. E-mail: ccrysy@sina.com; Xiaoying Lu, Department of Nursing, Changhai Hospital, Naval Medical University, Shanghai, China. E-mail: luxiaoyingjoy@163.com

## References

[1] Andruszkow H, Frink M, Zeckey C, Krettek C, Hildebrand F and Mommsen P. Merits and capabilities of helicopter emergency medical service (HEMS) in traumatized patients. Technol Health Care 2012; 20: 435-444.

[2] Higashi H, Takaku R, Yamaoka A, Lefor AK and Shiga T. The dedicated emergency physician model of emergency care is associated with reduced pre-hospital transportation time: a retrospective study with a nationwide database in Japan. PLoS One 2019; 14: e0215231.

[3] Singer B, Reynolds JC, Lockey DJ and O'Brien B. Pre-hospital extra-corporeal cardiopulmonary resuscitation. Scand J Trauma Resusc Emerg Med 2018; 26: 21.

[4] Lima FO, Mont'Alverne FJA, Bandeira D and Nogueira RG. Pre-hospital assessment of large vessel occlusion strokes: implications for modeling and planning stroke systems of care. Front Neurol 2019; 10: 955.

[5] Lichtenstein DA. BLUE-protocol and FALLS-protocol: two applications of lung ultrasound in the critically ill. Chest 2015; 147: 1659-1670.

[6] Hilbert-Carius P, Braun J, Abu-Zidan F, Adler J, Knapp J, Dandrifosse D, Braun D, Pietsch U, Adamczuk P, Rognås L and Albrecht R. Prehospital care & interfacility transport of 385 COVID-19 emergency patients: an air ambulance perspective. Scand J Trauma Resusc Emerg Med 2020; 28: 94.

[7] Emery MS and Kovacs RJ. Sudden cardiac death in athletes. JACC Heart Fail 2018; 6: 30-40.

[8] Callaway CW, Donnino MW, Fink EL, Geocadin RG, Golan E, Kern KB, Leary M, Meurer WJ, Peberdy MA, Thompson TM and Zimmerman JL. Part 8: post-cardiac arrest care: 2015 American heart association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2015; 132: S465-482.

[9] Avcu G, Sahbudak Bal Z, Duyu M, Akkus E, Karapinar B and Vardar F. Thanks to trauma: a delayed diagnosis of pott disease. Pediatr Emerg Care 2015; 31: e17-18.

[10] Lammers R, Simunich T and Ashurst J. Authorship trends of emergency medicine publications over the last two decades. West J Emerg Med 2016; 17: 367-371.

[11] Peek GJ, Mugford M, Tiruvoipati R, Wilson A, Allen E, Thalanany MM, Hibbert CL, Truesdale A, Clemens F, Cooper N, Firmin RK and Elbourne D. Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. Lancet 2009; 374: 1351-1363.

[12] Varma N, Schaerf R, Kalbfleisch S, Pimentel R, Kroll MW and Oza A. Defibrillation thresholds with right pectoral implantable cardioverter defibrillators and impact of waveform tuning (the Tilt and Tune trial). Europace 2017; 19: 1810-1817.

[13] Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, Samson RA, Kattwinkel J, Berg RA, Bhanji F, Cave DM, Jauch EC, Kudenchuk PJ, Neumar RW, Peberdy MA, Perlman JM, Sinz E, Travers AH, Berg MD, Billi JE, Eigel B, Hickey RW, Kleinman ME, Link MS, Morrison LJ, O'Connor RE, Shuster M, Callaway CW, Cucchiara B, Ferguson JD, Rea TD and Vanden Hoek TL. Part 1: executive summary: 2010 American heart association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2010; 122: S640-656.

[14] Kim F, Nichol G, Maynard C, Hallstrom A, Kudenchuk PJ, Rea T, Copass MK, Carlbom D,

Deem S, Longstreth WT Jr, Olsufka M and Cobb LA. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest: a randomized clinical trial. JAMA 2014; 311: 45-52.

[15] Chan PS, McNally B, Tang F and Kellermann A. Recent trends in survival from out-of-hospital cardiac arrest in the United States. Circulation 2014; 130: 1876-1882.

[16] Hagihara A, Hasegawa M, Abe T, Nagata T, Wakata Y and Miyazaki S. Prehospital epinephrine use and survival among patients with out-of-hospital cardiac arrest. JAMA 2012; 307: 1161-1168.

[17] Porzer M, Mrazkova E, Homza M and Janout V. Out-of-hospital cardiac arrest. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 2017; 161: 348-353.

[18] Denny SA, Quan L, Gilchrist J, McCallin T, Shenoi R, Yusuf S, Hoffman B and Weiss J. Prevention of drowning. Pediatrics 2019; 143: 1-11.

[19] Eddleston M, Buckley NA, Eyer P and Dawson AH. Management of acute organophosphorus pesticide poisoning. Lancet 2008; 371: 597-607.

[20] Adeloye D, Thompson JY, Akanbi MA, Azuh D, Samuel V, Omoregbe N and Ayo CK. The burden of road traffic crashes, injuries and deaths in Africa: a systematic review and meta-analysis. Bull World Health Organ 2016; 94: 510-521A.

[21] Kislitsina ON, Rich JD, Wilcox JE, Pham DT, Churyla A, Vorovich EB, Ghafourian K and Yancy CW. Shock - classification and pathophysiological principles of therapeutics. Curr Cardiol Rev 2019; 15: 102-113.

[22] Bakran K, Šribar A, Šerić M, Antić-Šego G, Božić MA, Prijić A, Lacković T and Peršec J. Cardiopulmonary resuscitation performed by trained providers and shorter time to emergency medical team arrival increased patients' survival rates in Istra County, Croatia: a retrospective study. Croat Med J 2019; 60: 325-332.

[23] De Buck E, Van Remoortel H, Dieltjens T, Verstraeten H, Clarysse M, Moens O and Vandekerckhove P. Evidence-based educational pathway for the integration of first aid training in school curricula. Resuscitation 2015; 94: 8-22.

[24] Salvatierra GG, Palazzo SJ and Emery A. High school CPR/AED training in Washington state. Public Health Nurs 2017; 34: 238-244.

[25] Lam MT, De Longhi C, Turnbull J, Lam HR and Besa R. Has Embase replaced MEDLINE since coverage expansion? J Med Libr Assoc 2018; 106: 227-234.

[26] Perkins GD, Quinn T, Deakin CD, Nolan JP, Lall R, Slowther AM, Cooke M, Lamb SE, Petrou S, Achana F, Finn J, Jacobs IG, Carson A, Smyth M, Han K, Byers S, Rees N, Whitfield R, Moore F, Fothergill R, Stallard N, Long J, Hennings S, Horton J, Kaye C and Gates S. Pre-hospital assessment of the role of adrenaline: measuring the Effectiveness of drug administration in cardiac arrest (PARAMEDIC-2): trial protocol. Resuscitation 2016; 108: 75-81.

[27] Kudenchuk PJ, Brown SP, Daya M, Rea T, Nichol G, Morrison LJ, Leroux B, Vaillancourt C, Wittwer L, Callaway CW, Christenson J, Egan D, Ornato JP, Weisfeldt ML, Stiell IG, Idris AH, Aufderheide TP, Dunford JV, Colella MR, Vilke GM, Brienza AM, Desvigne-Nickens P, Gray PC, Gray R, Seals N, Straight R and Dorian P. Amiodarone, lidocaine, or placebo in out-of-hospital cardiac arrest. N Engl J Med 2016; 374: 1711-1722.

[28] Kobayashi A, Czlonkowska A, Ford GA, Fonseca AC, Luijckx GJ, Korv J, de la Ossa NP, Price C, Russell D, Tsiskaridze A, Messmer-Wullen M and De Keyser J. European academy of neurology and european stroke organization consensus statement and practical guidance for pre-hospital management of stroke. Eur J Neurol 2018; 25: 425-433.

[29] Mebazaa A, Yilmaz MB, Levy P, Ponikowski P, Peacock WF, Laribi S, Ristic AD, Lambrinou E, Masip J, Riley JP, McDonagh T, Mueller C, deFilippi C, Harjola VP, Thiele H, Piepoli MF, Metra M, Maggioni A, McMurray J, Dickstein K, Damman K, Seferovic PM, Ruschitzka F, Leite-Moreira AF, Bellou A, Anker SD and Filippatos G. Recommendations on pre-hospital & early hospital management of acute heart failure: a consensus paper from the Heart Failure Association of the European Society of Cardiology, the European Society of Emergency Medicine and the Society of Academic Emergency Medicine. Eur J Heart Fail 2015; 17: 544-558.

[30] Smereka J, Kaminska H, Wieczorek W, Dąbrowski M, Ładny JR, Ruetzler K, Szarpak Ł, Robak O and Frass M. Which position should we take during newborn resuscitation? A prospective, randomised, multicentre simulation trial. Kardiol Pol 2018; 76: 980-986.

[31] Sánchez Marteles M and Urrutia A. Acute heart failure: acute cardiogenic pulmonary edema and cardiogenic shock. Med Clin (Barc) 2014; 142 Suppl 1: 14-19.

[32] Richards JB and Wilcox SR. Diagnosis and management of shock in the emergency department. Emerg Med Pract 2014; 16: 1-22; quiz 22-23.

[33] Brison RJ, Day AG, Pelland L, Pickett W, Johnson AP, Aiken A, Pichora DR and Brouwer B. Effect of early supervised physiotherapy on recovery from acute ankle sprain: randomised controlled trial. BMJ 2016; 355: i5650.

[34] Gullo A. Cardiac arrest, chain of survival and Utstein style. Eur J Anaesthesiol 2002; 19: 624-633.

[35] Kloner RA, Shi J, Dai W, Carreno J and Zhao L. Remote ischemic conditioning in acute myocardial infarction and shock states. J Cardiovasc Pharmacol Ther 2020; 25: 103-109.

[36] Powers WJ, Derdeyn CP, Biller J, Coffey CS, Hoh BL, Jauch EC, Johnston KC, Johnston SC, Khalessi AA, Kidwell CS, Meschia JF, Ovbiagele B and Yavagal DR. 2015 American Heart Association/American Stroke Association Focused Update of the 2013 Guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke 2015; 46: 3020-3035.

[37] Schenone AL, Cohen A, Patarroyo G, Harper L, Wang X, Shishehbor MH, Menon V and Duggal A. Therapeutic hypothermia after cardiac arrest: a systematic review/meta-analysis exploring the impact of expanded criteria and targeted temperature. Resuscitation 2016; 108: 102-110.

**Supplementary Table 1.** The analytic consequence of 117 keywords with at least 45 occurrence times

| No. | Label | Cluster | Links | Occurrences | Average appearing years (AAY) | Average citations |
|---|---|---|---|---|---|---|
| 1 | emergency medicine | 1 | 654 | 97 | 2013.6289 | 13.3299 |
| 2 | question | 1 | 560 | 67 | 2014.1194 | 18.0149 |
| 3 | drug | 1 | 502 | 67 | 2014.1493 | 21.5672 |
| 4 | survey | 1 | 769 | 107 | 2014.4393 | 13.0841 |
| 5 | emergency physician | 1 | 761 | 102 | 2014.4412 | 16.4118 |
| 6 | experience | 1 | 1021 | 136 | 2014.4485 | 13.6912 |
| 7 | lack | 1 | 755 | 94 | 2014.5106 | 14.7553 |
| 8 | morbidity | 1 | 498 | 64 | 2014.5312 | 18.6094 |
| 9 | education | 1 | 755 | 99 | 2014.5556 | 16.5657 |
| 10 | article | 1 | 1035 | 114 | 2014.5614 | 19.3158 |
| 11 | training | 1 | 1492 | 185 | 2014.6 | 14.1892 |
| 12 | literature | 1 | 946 | 113 | 2014.6018 | 20.5752 |
| 13 | medication | 1 | 577 | 78 | 2014.6026 | 14.3077 |
| 14 | recommendation | 1 | 695 | 81 | 2014.6667 | 22.2963 |
| 15 | safety | 1 | 793 | 106 | 2014.6698 | 18.0094 |
| 16 | review | 1 | 1852 | 236 | 2014.7161 | 15.9195 |
| 17 | emergency | 1 | 1067 | 141 | 2014.7447 | 13.1915 |
| 18 | role | 1 | 792 | 96 | 2014.7812 | 12.8333 |
| 19 | management | 1 | 2230 | 288 | 2014.8368 | 15.6424 |
| 20 | research | 1 | 1415 | 177 | 2014.8588 | 13.8757 |
| 21 | pain | 1 | 517 | 78 | 2014.8718 | 11.6795 |
| 22 | service | 1 | 5573 | 749 | 2014.8812 | 15.9092 |
| 23 | information | 1 | 1211 | 147 | 2014.8912 | 12.6395 |
| 24 | ems provider | 1 | 548 | 63 | 2014.9048 | 15.4603 |
| 25 | process | 1 | 939 | 123 | 2014.9431 | 13.748 |
| 26 | condition | 1 | 1249 | 171 | 2014.9591 | 12.2573 |
| 27 | quality | 1 | 1188 | 142 | 2014.9718 | 15 |
| 28 | provider | 1 | 1762 | 222 | 2014.973 | 14.0721 |
| 29 | practice | 1 | 1246 | 162 | 2015.0309 | 12.5 |
| 30 | prehospital care | 1 | 1109 | 149 | 2015.0805 | 13.4497 |
| 31 | development | 1 | 876 | 110 | 2015.0818 | 15.9545 |
| 32 | protocol | 1 | 1415 | 182 | 2015.0879 | 12.989 |
| 33 | life | 1 | 840 | 109 | 2015.0917 | 18.422 |
| 34 | pediatric patient | 1 | 373 | 49 | 2015.102 | 16.1633 |
| 35 | paper | 1 | 464 | 55 | 2015.1091 | 13.1636 |
| 36 | order | 1 | 631 | 80 | 2015.1125 | 12.35 |
| 37 | evidence | 1 | 1669 | 196 | 2015.1276 | 16.898 |
| 38 | assessment | 1 | 1478 | 191 | 2015.2618 | 14.199 |
| 39 | systematic review | 1 | 700 | 73 | 2015.411 | 21.726 |
| 40 | prehospital emergency care | 1 | 357 | 52 | 2015.4231 | 8.9615 |
| 41 | country | 1 | 680 | 80 | 2015.425 | 14.875 |
| 42 | decision | 1 | 927 | 120 | 2015.4583 | 11.525 |
| 43 | knowledge | 1 | 684 | 83 | 2015.6386 | 11.0482 |
| 44 | nurse | 1 | 594 | 83 | 2015.7229 | 10.2289 |
| 45 | challenge | 1 | 579 | 75 | 2015.7333 | 13.44 |

| 46 | incident | 1 | 481 | 71 | 2015.7887 | 8.2113 |
|----|----------|---|-----|-----|-----------|--------|
| 47 | embase | 1 | 624 | 63 | 2015.8254 | 18.3333 |
| 48 | stemi | 2 | 624 | 91 | 2013.956 | 16.7143 |
| 49 | symptom onset | 2 | 337 | 50 | 2014.1 | 20.88 |
| 50 | delay | 2 | 1187 | 158 | 2014.1456 | 20.4684 |
| 51 | st segment elevation myocardial infarction | 2 | 354 | 50 | 2014.16 | 18.08 |
| 52 | acute coronary syndrome | 2 | 376 | 54 | 2014.2222 | 21.3704 |
| 53 | ecg | 2 | 581 | 76 | 2014.25 | 18 |
| 54 | door | 2 | 435 | 64 | 2014.4219 | 16.8438 |
| 55 | gcs | 2 | 386 | 54 | 2014.4259 | 12.3519 |
| 56 | systolic blood pressure | 2 | 532 | 75 | 2014.64 | 19.5067 |
| 57 | consecutive patient | 2 | 376 | 49 | 2014.6531 | 27.5306 |
| 58 | symptom | 2 | 893 | 126 | 2014.6825 | 16.9444 |
| 59 | trauma center | 2 | 378 | 64 | 2014.7656 | 14.2656 |
| 60 | positive predictive value | 2 | 391 | 45 | 2014.8889 | 24.4444 |
| 61 | confidence interval | 2 | 2112 | 241 | 2014.9253 | 20.7593 |
| 62 | ability | 2 | 610 | 83 | 2014.988 | 10.0602 |
| 63 | min | 2 | 1601 | 196 | 2015.0153 | 18.5051 |
| 64 | hospital mortality | 2 | 432 | 60 | 2015.0667 | 16.6333 |
| 65 | chest pain | 2 | 390 | 53 | 2015.0755 | 8.0943 |
| 66 | diagnosis | 2 | 1412 | 195 | 2015.0821 | 12.6974 |
| 67 | specificity | 2 | 881 | 101 | 2015.1089 | 18.6634 |
| 68 | sensitivity | 2 | 845 | 101 | 2015.1485 | 17.4851 |
| 69 | onset | 2 | 506 | 67 | 2015.1493 | 23.4627 |
| 70 | accuracy | 2 | 730 | 100 | 2015.21 | 15.98 |
| 71 | triage | 2 | 911 | 124 | 2015.2258 | 15.5565 |
| 72 | hypotension | 2 | 434 | 65 | 2015.2308 | 15.8 |
| 73 | stroke | 2 | 965 | 141 | 2015.234 | 21.0284 |
| 74 | severity | 2 | 716 | 106 | 2015.283 | 17.2075 |
| 75 | identification | 2 | 724 | 90 | 2015.2889 | 11.8222 |
| 76 | predictor | 2 | 1123 | 137 | 2015.3577 | 13.4745 |
| 77 | interquartile range | 2 | 446 | 60 | 2015.3833 | 15.5 |
| 78 | adjustment | 2 | 497 | 64 | 2015.5625 | 20.7656 |
| 79 | acute ischemic stroke | 2 | 321 | 47 | 2015.7872 | 16.6596 |
| 80 | arrest | 3 | 1358 | 129 | 2014.1628 | 23.7442 |
| 81 | hospital discharge | 3 | 1306 | 118 | 2014.2288 | 31.1695 |
| 82 | survivor | 3 | 779 | 79 | 2014.2532 | 30.6962 |
| 83 | bystander | 3 | 527 | 57 | 2014.4386 | 19.8246 |
| 84 | cardiac arrest | 3 | 2252 | 249 | 2014.4498 | 20.9558 |
| 85 | resuscitation | 3 | 2149 | 236 | 2014.4661 | 24.572 |
| 86 | hospital arrival | 3 | 518 | 52 | 2014.6923 | 36.4808 |
| 87 | adult | 3 | 1370 | 145 | 2014.7724 | 24.069 |
| 88 | hospital admission | 3 | 777 | 85 | 2014.8353 | 20.2824 |
| 89 | survival | 3 | 3370 | 348 | 2014.8391 | 26.0718 |
| 90 | relationship | 3 | 869 | 101 | 2014.9604 | 16.505 |
| 91 | logistic regression | 3 | 992 | 113 | 2015.0265 | 20.4336 |
| 92 | cardiopulmonary resuscitation | 3 | 1876 | 177 | 2015.0847 | 26.4068 |
| 93 | spontaneous circulation | 3 | 2148 | 188 | 2015.0904 | 21.6117 |
| 94 | return | 3 | 2118 | 187 | 2015.2246 | 22.2781 |

| 95 | male | 3 | 390 | 46 | 2015.2609 | 11.0652 |
| 96 | december | 3 | 1223 | 149 | 2015.2886 | 21.7785 |
| 97 | cpr | 3 | 1654 | 149 | 2015.2953 | 15.4228 |
| 98 | hospital cardiac arrest | 3 | 3439 | 330 | 2015.3303 | 20.6515 |
| 99 | duration | 3 | 769 | 85 | 2015.3412 | 20.0471 |
| 100 | odds ratio | 3 | 1673 | 184 | 2015.4457 | 19.0272 |
| 101 | discharge | 3 | 783 | 78 | 2015.4744 | 25.5256 |
| 102 | neurological outcome | 3 | 1101 | 100 | 2015.5 | 23.49 |
| 103 | rosc | 3 | 1279 | 104 | 2015.6635 | 15.6923 |
| 104 | hospital cardiac arrest patient | 3 | 535 | 47 | 2015.766 | 19.9362 |
| 105 | ohca | 3 | 2539 | 237 | 2015.7722 | 17.6624 |
| 106 | ohca patient | 3 | 1025 | 87 | 2015.954 | 17.092 |
| 107 | primary outcome | 3 | 1251 | 127 | 2016.3937 | 18.7717 |
| 108 | japan | 3 | 447 | 48 | 2016.4375 | 23 |
| 109 | secondary outcome | 3 | 558 | 57 | 2016.5789 | 12.8421 |
| 110 | eti | 4 | 491 | 47 | 2012.9149 | 28.5532 |
| 111 | endotracheal intubation | 4 | 931 | 107 | 2013.215 | 24.4486 |
| 112 | intubation | 4 | 1453 | 192 | 2013.8073 | 21.7552 |
| 113 | airway management | 4 | 1115 | 125 | 2014.008 | 25.872 |
| 114 | attempt | 4 | 975 | 120 | 2014.025 | 17.4333 |
| 115 | airway | 4 | 1034 | 123 | 2014.1301 | 24.2764 |
| 116 | ventilation | 4 | 951 | 112 | 2014.1696 | 23.1429 |
| 117 | complication | 4 | 796 | 111 | 2014.8288 | 15.4865 |