POLICY ANALYSIS

A Bibliometric Profile of Disaster Medicine Research from 2008 to 2017: A Scientometric Analysis

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ABSTRACT

This study analyzed and assessed publication trends in articles on "disaster medicine," using scientometric analysis. Data were obtained from the Web of Science Core Collection (WoSCC) of Thomson Reuters on March 27, 2017. A total of 564 publications on disaster medicine were identified. There was a mild increase in the number of articles on disaster medicine from 2008 (n = 55) to 2016 (n = 83). *Disaster Medicine and Public Health Preparedness* published the most articles, the majority of articles were published in the United States, and the leading institute was Tohoku University. F. Della Corte, M. D. Christian, and P. L. Ingrassia were the top authors on the topic, and the field of public health generated the most publications. Terms analysis indicated that *emergency medicine, public health, disaster preparedness, natural disasters, medicine,* and *management* were the research hotspots, whereas *Hurricane Katrina, mechanical ventilation, occupational medicine, intensive care,* and *European journals* represented the frontiers of disaster medicine research. Overall, our analysis revealed that disaster medicine studies are closely related to other medical fields and provides researchers and policy-makers in this area with new insight into the hotspots and dynamic directions. (*Disaster Med Public Health Preparedness*. 2019;13:165-172)

Key Words: citation analysis, CiteSpace, disaster medicine, scientometric analysis, visualization analysis

Natural disasters, biological terrorism, nuclear leakage, public health emergencies, epidemic diseases, and other disasters directly threaten the survival and development of mankind. Currently, a major disaster occurs almost daily in some part of the world.[1] Most population centers are concentrated in high-risk locales like metropolitan cities, which feature very frequent and multiple person-to-person contacts. High-risk occupations, international trade, and housing construction all increase the possibility of human exposure to disasters, leading to increased casualties after each disaster. The ever-increasing spiral of human populations, the rapid growth of technology, swift world-wide travel by millions of persons, and the exponential expansion of at-risk industries and residences combine to increase human exposure to disasters.[2]

In particular, the major casualties caused by the Wenchuan earthquake, the Nepal earthquake, and the Indian Ocean tsunami pose great challenges to disaster medicine.[3] The 2008 Wenchuan earthquake was one of the most devastating disasters in the past 10 years and caused more than 370,000 casualties; the main causes of death were trauma and crush syndrome. In addition, there was a significant increase in the number of respiratory infections, enteritis, and skin diseases in the week after the earthquake. Even a full year after the earthquake, some survivors began to suffer from posttraumatic stress disorder.[4]

Disaster medicine has attracted global attention gradually by implementing emergency medical treatment, disease prevention, and health care science under the conditions of disastrous damage. After the September 11 attacks, the United States made two major adjustments to the National Disaster Medical System (NDMS) to form a high-efficiency operating mechanism called the *national disaster medical rescue system*.[5] Japan has also established a national rescue medical center in Tachikawa City, Tokyo. As a data transmission and command center for disaster medical care, it features a disaster medical information system used to determine damage for medical institutions. In addition, Japan has enhanced its disaster emergency medical rescues by launching civil and community organizations.[6] After the outbreak of severe acute respiratory syndrome (SARS) in 2003, China likewise began to attach importance to the establishment of an emergency medical system. Then, after experiencing the Wenchuan, Lushan, and Yushu earthquakes, and observing the actual rescue experience, it built an emergency medical rescue system, including a rescue command center and a medical rescue scene and rescue information platform.[7]

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Disaster medicine scholars have published a substantial amount of original research based on care during disaster rescues, emergency medical treatment, and disease prevention. However, the bibliometric profile of disaster medicine in the literature is still unknown. Therefore, in this study, a scientometric analysis was conducted on disaster medicine to estimate the productivity of specific journals, countries, institutions, authors, and research areas, and to identify research hotspots and trends in this field.

METHODS

All of the data for this study were obtained from the Web of Science Core Collection (WoSCC) of Thomson Reuters on March 27, 2017 (incomplete data existed in 2017).[8] The WoSCC, which includes the Social Sciences Citation Index, Current Chemical Reactions, and Index Chemicus, is the most frequently used source of scientific information.[9] The search term "disaster medicine" was used to retrieve titles, keywords, author information, abstracts, and references published from 2008 to 2017. The following search string was used: (TS = (disaster medicine)) AND Languages: (English) AND document type: (Article OR Review). The impact factor of each journal was obtained from the 2016 Journal Citation Reports Science Edition, accessed on March 27, 2017.[10] CiteSpace III (64 bits)[8] was used to analyze publication outputs and construct knowledge maps, to analyze the extracted records for citation characteristics, and to visualize the patterns and trends in disaster medicine.[11–15]

RESULTS

General Data

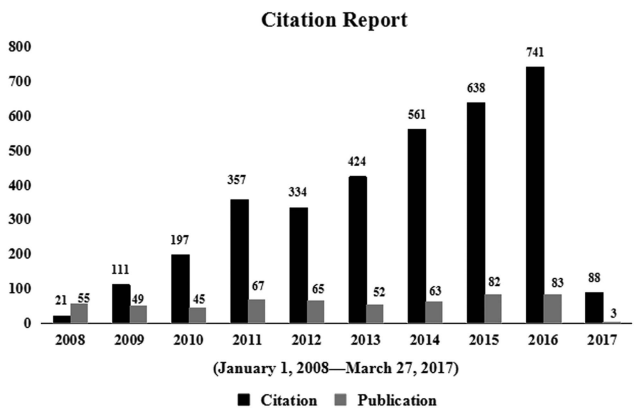
A total of 564 studies on disaster medicine, published from 2008 to 2017, were retrieved from the WoSCC (incomplete data existed in 2017). Of these, 497 (88.12%) were original articles. Although the number of publications increased only mildly from 2008 (n = 55) to 2016 (n = 83), the number of citations increased substantially from 2008 (n = 21) to 2016 (n = 741) (Figure 1). Of 564 studies, 403 (71.45%) were cited at least once, with an average of 6.12 citations per article for 3,452 total citations. Table 1 shows the 10 most frequently cited articles.[16–25] Among these 10 articles, the most common topic was disaster rescue and post-disaster health effects (9 of 10 [90%]). The top-ranking paper (73 citations) was published in *CHEST* and involved critical care treatment: "Definitive care for the critically ill during a disaster: A framework for allocation of scarce resources in mass critical care – From a Task Force for Mass Critical Care summit meeting, January 26-27, 2007, Chicago, IL."[16] The article provided 4 suggestions to perform triage while allocating scarce critical care resources during a disaster.

Journal Analysis

The studies were published in 102 different journals. The top-ranked journal, which published 65 papers, was *Disaster Medicine and Public Health Preparedness*, followed by two other journals with more than 10 papers each: *Academic Emergency Medicine* (n = 19) and *American Journal of Preventive Medicine* (n = 15). *Disaster Medicine and Public Health Preparedness* also had the greatest number of total citations (n = 151), again followed by *Academic Emergency Medicine* (n = 134) and *American Journal of Preventive Medicine* (n = 127) **(Table 1 in the online data supplement).**

FIGURE 1

The Number of Publications and Citations From 2008 to 2017.



Country and Institution Analysis

These research studies were published by 54 countries. The top 10 countries published 484 of the 564 studies, accounting for 85.82% of the total number of publications. The country with the greatest number of publications was the United States (n = 278), followed by Japan (n = 46) and China (n = 33) **(Table 2 in the online data supplement).** Similarly, among the 100 sponsoring institutions, the top 10 institutions published 142 literatures, accounting for 25.18% of the total number of publications. New York University had the most publications (n = 20), followed by the University of Washington (n = 17) and Johns Hopkins University (n = 16) (Table 2S).

Author and Research Area Analysis

A total of 103 authors contributed to these 564 studies; the top 10 authors accounted for 67 studies, 11.88% of the total. Three authors tied for first place, each with 9 publications: M. D. Christian, F. Della Corte, and P. L. Ingrassia **(Table 3 in the online data supplement).** A total of 73 research areas were represented, with the majority of articles focusing on public environmental/occupational health (n = 148), general internal medicine (n = 113), and emergency medicine (n = 98) (Table 3S).

TABLE 1

Top 10 Most Cited Articles in Disaster Medicine Field

Rank	First Author	Year	Paper	Journal	Impact Factor (2015)	Cited
1	DevereauxAV[16]	2008	Definitive care for the critically ill during a disaster: a framework for allocation of scarce resources in mass critical care – From a Task Force for Mass Critical Care summit meeting, January 26-27, 2007, Chicago, IL.	*Chest*	5.94	73
2	Leaning J[17]	2013	Natural disasters, armed conflict, and public health.	*New England Journal of Medicine*	59.56	64
3	Webber MP[18]	2009	Trends in respiratory symptoms of firefighters exposed to the World Trade Center disaster: 2001-2005.	*Environmental Health Perspectives*	8.44	58
4	North CS[19]	2013	Mental health response to community disasters: a systematic review.	*JAMA*	37.68	57
5	Weinberg ER[20]	2009	The use of simulation for pediatric training and assessment.	*Current Opinion Pediatrics*	2.20	55
6	Mulvey JM[21]	2008	Profile of injuries arising from the 2005 Kashmir earthquake: the first 72 h.	*Injury*	1.91	53
7	Heinrichs WL[22]	2008	Simulation for team training and assessment: case studies of online training with virtual worlds.	*World Journal of Surgery*	2.52	48
8	Devereaux A[23]	2008	Summary of suggestions from the Task Force for Mass Critical Care summit, January 26-27, 2007.	*Chest*	5.94	47
9	de la Hoz RE[24]	2008	Occupational toxicant inhalation injury: the World Trade Center (WTC) experience.	*International Archives of Occupational and Environmental Health*	2.06	41
10	Gordon JS[25]	2008	Treatment of posttraumatic stress disorder in postwar Kosovar adolescents using mind-body skills groups: a randomized controlled trial.	*Journal of Clinical Psychiatry*	5.41	38

Co-Citation Analysis

The visualization analysis for reference citations was conducted by CiteSpace III. The parameters in CiteSpace were as follows: time span = 10 years (2008–2017); time slicing = 1; term type = burst terms; selection criteria (c, cc, ccv) = (2, 2, 20) (4, 3, 20) (4, 3, 20). The top 50 most cited or occurring items from each slice were selected. The Pathfinder network method was used to streamline the network and to map the visualization analysis. The network revealed 244 nodes and 517 lines. In Figure 2, the thicker circle indicates a higher level of between-study centrality. In general, a study with a centrality value equal to or greater than 0.10 can be considered a key study; therefore, the key studies were [Subbarao I, 2008][26] (0.22), followed by [Einav S, 2006][27] (0.19) and [Gillett B, 2008][28] (0.16). In addition, the red circles represent burst studies which represent the frontier of a period[29]; Among them, the key burst studies were [Subbarao I, 2008][26] and [Walsh L, 2012],[30] which had the highest citation rates between 2014 and 2017.

Figure 3 presents the timeline view for hot keywords. The results show that the hotspots of disaster medicine during this period were *spinal cord injury*, *conceptual framework*, *health professional*, *occupational medicine*, *medical surge capacity*, *oleic acid*, *lifesaving intervention*, *terrorist bombing*, *developing country*, *workforce*, *professionalization* and *West Africa* (Figure 3). In addition, the research papers published in journals represent the frontiers of certain subjects, and the references cited in these papers provide the knowledge base of the papers.[31] In Figure 3, The nodes of clusters #3, #4, #5, #6, and #7 were mainly distributed before 2008 (the knowledge base), while the nodes of clusters #0, #1, #2, #8, #9, #10, and #11 were mainly distributed between 2008 and 2016 (the frontiers).

Terms Analysis

A total of 564 papers on disaster medicine research were included in this analysis. The visualization was generated by the Carrot system based on the first 100 results of a search on regenerative medicine. There were 69 results from the Lingo Clustering Algorithm; the first ranked cluster was Practices in Disaster (n = 112), followed by Hospital Disaster (n = 107), Disaster Events (n = 102), Disaster Setting (n = 92), and Earthquake Disaster (n = 78) (Figure 4). In addition, the time interval is depicted as a blue line, whereas the time period that represents a burst cited journal is depicted as a red line, indicating the beginning and the end of the time interval of each burst.[29] The top 3 burst references were *public health preparedness* (7.35), *Hurricane Katrina* (4.72), and *European journal* (3.75) (Table 2).

DISCUSSION

To the best of our knowledge, this is the first scientometric analysis on the topic of disaster medicine. The results indicated a significant increase in the number of publications

FIGURE 2

Reference Co-Citation Map of Papers Related to Disaster Medicine Research.

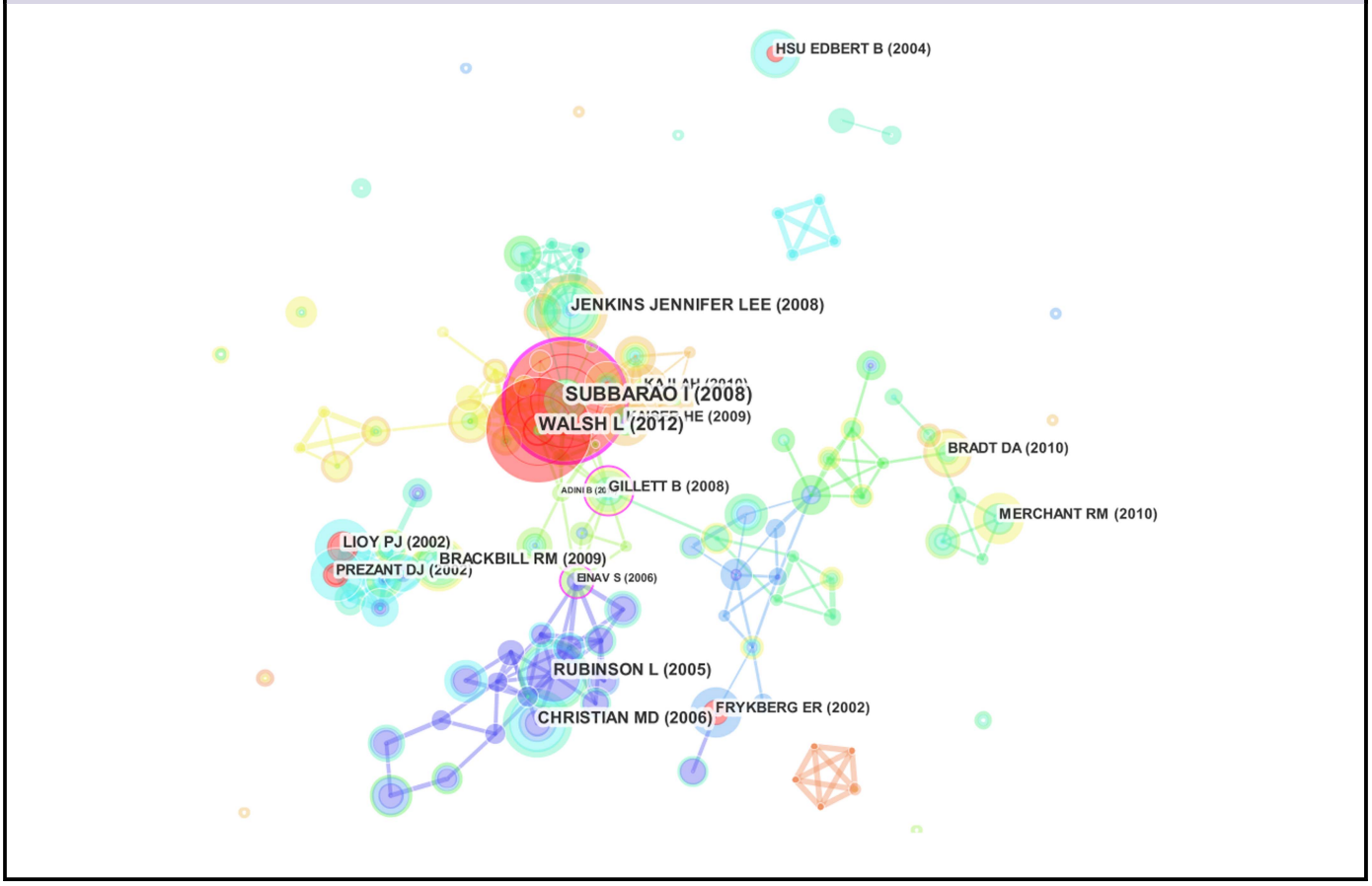


FIGURE 3

Reference Co-Citation Time-View Map of Papers Related to Disaster Medicine Research Published from 2008 to 2017.

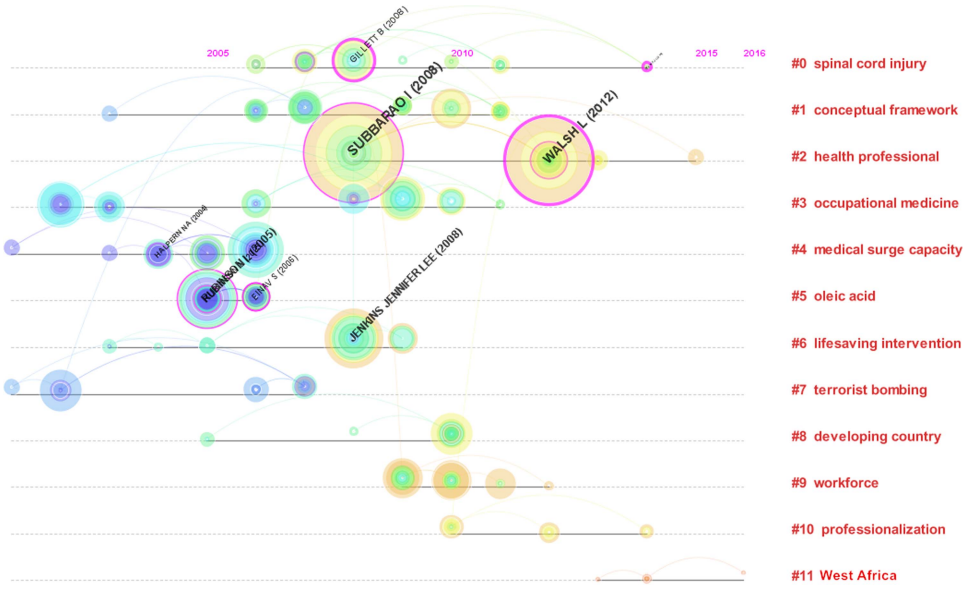


FIGURE 4

A Lightweight Map of Major Terms on Disaster Medicine.

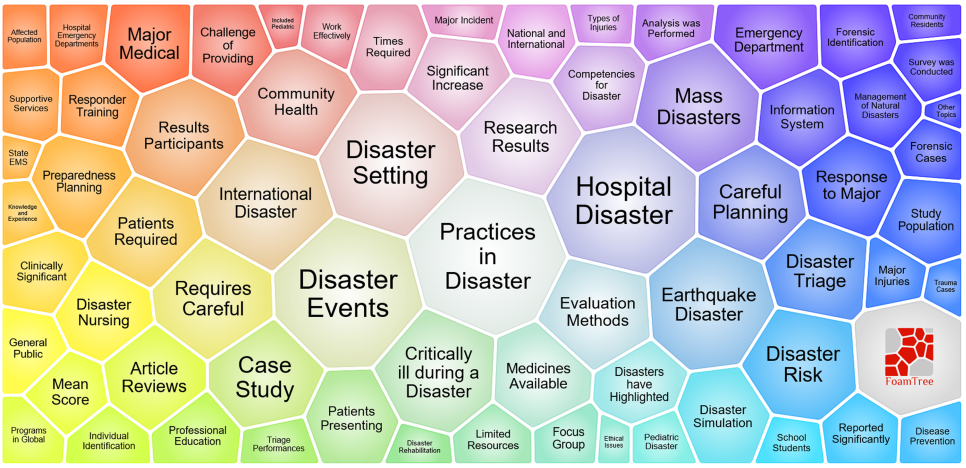


TABLE 2

Top 12 Terms With Strongest Citation Bursts

Terms	Frequency	Burst Strength	Centrality	The Burst Year
Hurricane Katrina	25	4.72	0.08	
Mechanical ventilation	8	2.58	0.00	
Occupational medicine	11	2.42	0.00	
Intensive care	12	2.44	0.00	
European Journal	13	3.75	0.03	
Vertical bar Lippincott Williams	12	3.46	0.02	
China	7	2.57	0.00	
Nuclear power plant	10	3.00	0.00	
Great East Japan earthquake	21	3.09	0.03	
Impact	14	2.84	0.00	
Public health preparedness	44	7.35	0.08	
Public health emergency	10	2.62	0.01	

Burst strength: representing the intensity of the frequency of a key word suddenly increasing over a short period of time. The burst-detection algorithm can be adapted for detecting sharp increases of interest in a specialty. In CiteSpace III, a current research front is identified based on such burst terms extracted from titles, abstracts, descriptors, and identifiers of bibliographic records. Burst-detection algorithms can identify emergent terms; Centrality: evaluating the parameter of the number of lines on a certain node, the larger the value, the more the number of lines, that is, the importance of the node in the whole network.

: 2008-2017.

: the burst year.

worldwide on this topic; the publications and citations in 2011 (67 and 357) were significantly higher than in 2010 (45 and 197). This increase may be due to several major disasters. The year 2011 was the first year after the Haiti earthquake, and much of the related research focused on the implementation and development of international medical rescue.[32–33] It was also the third year after the Wenchuan earthquake, research on which mainly focused on disease classification and patient management of the patients.[34–35] Finally, 2011 was the 10th anniversary of the 9/11 attacks; the relevant research mainly focused on post-disaster effects, including respiratory and mental health problems, among survivors and rescuers.[36–37] The United States, Japan, and China published the most research on disaster medicine. This may be because the frequent occurrence of disasters in these countries has caused serious casualties and property losses.[35,38–40] Likewise, these countries have participated in international humanitarian relief efforts many times, so they have a wealth of medical rescue experience.[41–43] The top 10 studies (by number of citations) all emphasized 2

categories of disaster medicine, except for [Leaning J, 2007],[17] which summarizes the challenges and pressures posed by natural disasters to public health. These categories are disaster rescue[16, 20–23] and post-disaster health effects.[18–19, 24–25]

Overall, the most cited article was "Definitive care for the critically ill during a disaster: A framework for allocation of scarce resources in mass critical care – From a Task Force for Mass Critical Care summit meeting, January 26-27, 2007, Chicago, IL," which offers guidance for allocating scarce critical care resources, drawn from a task force on mass critical care. This task force provided several suggestions for managing the triage process when medical systems are overwhelmed.[16] In addition, [Devereaux AV, 2008][16] was sponsored by New York University, which sponsored the greatest number of disaster medicine publications from 2008 to 2017. Among the authors, F. Della Corte, M. D. Christian, and P. L. Ingrassia were the most productive. In their papers, the most cited articles were all associated with the "Task Force for Mass Critical Care." [16, 44–45] Among the studies of post-disaster health effects, the most cited article was "Trends in respiratory symptoms of firefighters exposed to the World Trade Center disaster: 2001-2005," which described trends in post-911 respiratory and gastroesophageal reflux disease symptoms in WTC-exposed fire fighters.[46] This study also contributed to the literature on public environmental/occupational health, the discipline that produced the most disaster medicine studies from 2008 to 2017.

Based on the co-citation analysis, "A consensus-based educational framework and competency set for the discipline of disaster medicine and public health preparedness" had the highest centrality; it developed a new educational framework for disaster medicine and public health preparedness, based on consensus identification from an expert working group in the American Medical Association.[27] A time-view map of the co-citation activities appears to the left of the column with the clusters' labels.[45] New clusters include cluster #0 on spinal cord injury, #1 on conceptual framework, and #2 on health professionals; the landmark publications include [Subbarao I, 2008][26] and [Walsh L, 2012].[30] They were also the newest burst strength publications, which suggests that "public health preparedness" will become a hot topic in disaster medicine.

Terms analysis provides a reasonable description of research hotspots (areas of focused attention by a number of scientific researchers, addressing a set of related research problems and concepts), whereas burst words represent new research frontiers (emerging trends and abrupt changes that occur in a timely manner).[47] As shown in Figure 4, The top 5 hotspots of disaster medicine research were:

(1) "Practices in disasters." These papers focus on the practical elements of disaster medicine, including the treatment of wounded, effect evaluation, first aid, and disaster medical education.[48–52]
(2) "Hospital disasters." These papers also focus on practical elements of disaster medicine, including modular management, humanitarian relief, first aid management processes, and disaster emergency departments.[53–55, 56]
(3) "Disaster events." These papers summarize the casualties of disasters and their impact on public health.[57–60]
(4) "Disaster settings." These papers focus on the medical needs of the disaster, including medical personnel, medical equipment, and medical technology.[61–64]
(5) "Earthquake disasters." These papers focus on medical rescues during an earthquake, including the medical decision-making, the rescue process, and the treatment of the special population.[65–68]

In addition, several burst terms were detected by Cite Space III and are considered indicators of research frontiers over time. In the results, the time interval is shown as a blue line, and the time period that represents a burst term category is shown as a red line, indicating the beginning and the end of the time interval of each burst. Therefore, the three newest frontiers were:

(1) "Impact." These papers focus on post-disaster effects on the physiology and mental health of survivors, including their daily behaviors, physiological indicators, and mental states.[69–70, 63]
(2) "Public health preparedness." These papers focus on the establishment, evaluation, and management of medical rescue systems.[71–75]
(3) "Public health emergencies." These papers focus on the training of emergency personnel, the promotion of emergency technology, and the management of emergency procedures.[72, 76–77]

LIMITATION

In this study, although the noise data can be reduced by setting up the requisite statistical parameters in CiteSpace III, the source of data is limited by a generic search term strategy, which is likely to lead to some noise in the selection of articles.

CONCLUSION

The major findings of the present scientometric study are helpful for all those involved in worldwide disaster medicine research. Indeed, this study can help researchers better understand disaster medicine research worldwide and be useful, for example, in choosing appropriate journals for publication and collaborations. Fellows choosing an institution for advanced work may also be interested in such an analysis. Journals can determine where they stand in relation to other journals in publishing articles related to disaster medicine. Governments and policy-makers can also ascertain the most effective countries and institutions in the world in this field, and this analysis may assist them to apprehend and predict the hotspots and dynamic directions of disaster

medicine research and to target resources so that further developments can be encouraged, supported, and monitored.

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LZ and PZ conceived and designed the paper. LZ, NX, and SL wrote the article. ZZ, LF, ST, KH, LZ, and PZ collected and analyzed the data. SL provided critical revisions. All authors approved the final version of the paper.

Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/dmp.2018.11

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