International Journal of Disaster Risk Reduction 58 (2021) 102230

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: http://www.elsevier.com/locate/ijdrr

Review Article

Evolution of disaster nursing research in the past 30 years (1990–2019): A bibliometric and mapping analysis

Alex Molassiotis [a,*], Chunlan Guo [a], Hammoda Abu-Odah [a], Caryn West [b], Alice Yuen Loke [a]

[a] School of Nursing, The Hong Kong Polytechnic University, Hong Kong SAR, China
[b] College of Healthcare Sciences, James Cook University, Cairns, Australia

ARTICLE INFO

Keywords:
Disaster nursing
Mitigation
Preparedness
Response
Recovery
Bibliometric study
Temporal
Spatial

ABSTRACT

Background: Despite the development in disaster nursing and the increasing research and related publications, little efforts have been directed to map the global development and trends of disaster nursing literature, identify gaps and guide future research directions in the field.
Objectives: To generate a comprehensive picture of publications in disaster nursing over the past three decades and provide a discussion on the gaps and directions for future developments in disaster nursing-related research.
Methods: A bibliometric analysis was used. The Scopus database was utilized to retrieve disaster nursing publications for the period from 1990 to 2019.
Findings: A total of 1075 publications on disaster nursing were retrieved. The analysis indicated a rapid growth in publications from 2001 to 2014, followed by a plateau. Disaster nursing publications were geographically polarized within the Anglo-Saxon, European Union and Asian countries, with the United States, Australia, and the United Kingdom being the top three most productive countries. Both the number of publications by year and countries were significantly correlated with the number of total damages caused by disasters ($r = 0.42$, $p < 0.05$ and $r = 0.41$, $p < 0.001$ respectively). The analysis also highlighted that most of the impactful cooperation among different authors was found within the same countries only. The main keyword-based themes of the publications included disaster, nurses/emergency nurses/military nurses, preparedness, communication, and knowledge. The disaster phase of *response* received the most attention in disaster nursing followed by *preparedness*, while very few publications addressed *disaster mitigation* and *recovery*.
Conclusions: This study provides nursing leaders, educators, researchers, and practitioners a comprehensive map of the development of disaster nursing literature in the past three decades. However, the field of disaster nursing is still far from being mature. More empirical and theoretical research, especially in the full spectrum of disaster management, should be investigated to meet the global challenge of disasters. International collaboration should be a significant way in improving the quality of the related research.

1. Introduction

The frequency, magnitude, numbers of injured and deaths, and economic damages from disasters have increased significantly over the past three decades, and the trend is expected to continue [1], especially when climate change, unplanned urbanization, poverty, and environmental degradation are becoming more severe [2]. The continuing worldwide experience of disaster and emergency events confirm the need for nursing professionals to be prepared with comprehensive knowledge and skills in the whole spectrum of disaster management [3,4]. Nurses play pivotal and integral roles in disaster management [5,6] as they are leaders, educators, responders, policymakers, and researchers in disaster preparedness and response [7].

Despite growing interest and the vast amount of education and training programs on disaster nursing, little effort has been directed to comprehensively map the development of scientific literature related to disaster nursing. Previous attempts of review in this field have been narrow, focusing on specific events or areas such as hospital disaster response [8], disaster nursing competencies [9,10], and ethical considerations in disaster preparedness [11]. Moreover, there are four different phases in the disaster management continuum: prevention/mitigation, preparedness, response, and

* Corresponding author.
E-mail address: alex.molasiotis@polyu.edu.hk (A. Molassiotis).

https://doi.org/10.1016/j.ijdrr.2021.102230
Received 19 November 2020; Received in revised form 3 January 2021; Accepted 23 March 2021
Available online 30 March 2021

recovery/rehabilitation [12]. However, the existing reviews looked at one particular phase only such as preparedness [13]. In addition, previous studies reviewed a small number of papers and often limited their searches to specific countries, such as Australia [14], China [15], Japan [16], Iran [17], and the United States (US) [6]. No research has provided comprehensive mapping of disaster nursing scientific publications globally in order to understand the current research activity, limitations or knowledge gaps to assist in shaping future research direction.

This paper aims to fill this gap with a broad bibliometric analysis of the disaster nursing-related scientific research. The secondary aim is to construct a comprehensive representation of publications and progress generated in disaster nursing globally in the past 30 years. The outcome of this will provide directions for future developments in disaster nursing and related research and development of education/training programs.

Specifically, this study addresses the following themes: i) global growth rate of disaster nursing publications; ii) geographical distribution of the disaster nursing publications by country and the relationship with global disaster occurrences; iii) journal sources (including impact metrics) and highly cited articles in disaster nursing publications; vi) active authors and their cooperation at the institutional and country level; and v) the themes including type of disasters, phases of disaster management, study design, participants, and specific area of focus.

2. Methods

2.1. Bibliometric review and search strategies

A bibliometric and mapping analysis was adopted to construct a comprehensive representation of disaster nursing publications in the past 30 years from 1990 to 2019. Bibliometric analysis provides a useful means to collate existing publications, track research output, and summarize scholarly trends in particular fields [18,19]. This methodology has been increasingly used in health research [18,20,21] and nursing science [22–24]. Literature retrieval was conducted using the Scopus database on August 6, 2020. The use of Scopus only is common in such studies, acknowledging the challenges in merging different databases.

The search strategy used terms for nurse, including: registered nurse, healthcare professional and healthcare provider combined with terms for disaster including but not limited to natural disaster, manmade disaster, humanity rescue, extreme weather. The publication time of 1990–2019 was chosen because i) the severity and damages caused by the disasters were increased expressively in the past three decades [e.g. 1]; ii) it was a sufficient time series for studying the temporal trend of disaster nursing scientific literature; and iii) it could identify the changes before and after the September 11 terrorist attacks. The detailed search strategy used is presented in Appendix 1. The search strategies were validated and revised by manually testing the top 150 cited publications.

2.2. Data analysis and visualization

The bibliometric metadata extracted from Scopus included the year of publication, the number of citations, authors, institutions/affiliations, country, journal, and cited references, in addition to the title, abstract, and keywords of the articles. SPSS (version 25.0) was used to conduct a descriptive analysis of the disaster nursing publications. Correlation analyses were used to examine the relationship between the number of nursing publications and their temporal and spatial dimensions. Also, the top 20 journals and top 20 authors were identified by sorting the numbers of their publications of disaster nursing.

The disaster occurrence related data was retrieved from the Emergency Events Database (EM-DAT) maintained by the Centre for Research on the Epidemiology of Disasters (CRED), Brussels, Belgium [1]. We also collected the data of deaths, injured, homeless, affected people and total damages caused by disasters from EM-DAT for the review period. When studying the temporal trend of disaster nursing publications, exponential smoothing with Brown's linear trend was adopted to forecast of the number of publications per year for the next five years. When examining the spatial pattern, Esri's ArcGIS (version 10.4) was used to generate a distribution map of disaster nursing publications.

Network analysis [25] was adopted to map and measure the relationships among authors' cooperation at the organizational and country level as well as the keywords used. Network analysis examines how the information or social relationships travel through the network which is constructed by nodes and links [25]. Gephi (version 0.0.2) was used to conduct network analysis to establish three different networks of authors' organizations, countries, and keywords, in which each organization, country or keyword became a node. The importance and influence of a node was evaluated using the index of total link strength, degree centrality, and between centrality. Degree centrality is the number of direct links that a node has and indicates the importance of a node in the network [25]. The larger the degree centrality, the more important the node is and the more it could play the role of a "hub". By sorting the degree centrality, the importance of collaborations at both organizational and country level and authors' keywords could be determined and identified.

VOSviewer (version 1.6.13) was used to map the authors' keyword network in disaster nursing publications [26]. The number of minimum occurrences of keywords was limited to five based on multiple trials to generate a reliable, optimal, controllable, and producible network. Different colours represent different research themes, and nodes with a similar colour are representing a cluster of interrelated keywords. In addition, among publication records with sufficient data, the types of disasters, the phases of disaster management, study design, types of participants, and specific area of focus in the paper were explored through manual checking and thematic mapping analysis.

3. Findings

The search strategy identified 1077 publications. One duplicated record and one record with more than 75% missing data (including, author, affiliation, and abstract) were deleted, leaving, 1075 publications for inclusion in the bibliometric and mapping analysis of disaster nursing-related literature in the past 30 years. The publications consisted of: 865 research articles (80.5%), 82 reviews (7.6%), 45 notes (4.2%), 39 letters (3.6%), 25 editorials (2.3%), 13 short surveys (1.2%), and six conference papers (0.6%) according to the type of documents as defined by Scopus. Of this, 123 publications were open access (11.4%).

3.1. Temporal trends

There was an average of 19 publications related to disaster nursing per year from 1990 to 2001. There was a rapid growth of publications from 2002 to 2014 resulting in an average of 46 publications. After 2014, there was a stable growth of publications with an annual average of 52. A spike in publications occurred in 2014 with 68 publications (6.3%). Based on the trajectory of annual publications for the period assessed (1990–2019), the projection for the next 5 years (2020–2024) was 60 publications each year (Fig. 1).

When the number of publications per year was compared with the CRED data, the number of publications per year had significant correlation with homelessness caused by disasters ($r = -0.455$, $p < 0.05$), and the total damage caused by disasters ($r = 0.42$, $p < 0.05$). No significant correlation was found between the number of publications per year and the frequency of disasters per year ($r = 0.10$, $p = 0.59$), deaths caused by disasters ($r = -0.13$, $p = 0.50$), injured cases reported ($r = 0.15$, $p = 0.44$), and the affected population ($r = -0.16$, $p = 0.41$) by years.

3.2. Geographical distribution and language of publications

Publications identified authors from 71 different countries (Fig. 2). The top 10 most productive countries included the Unites States of

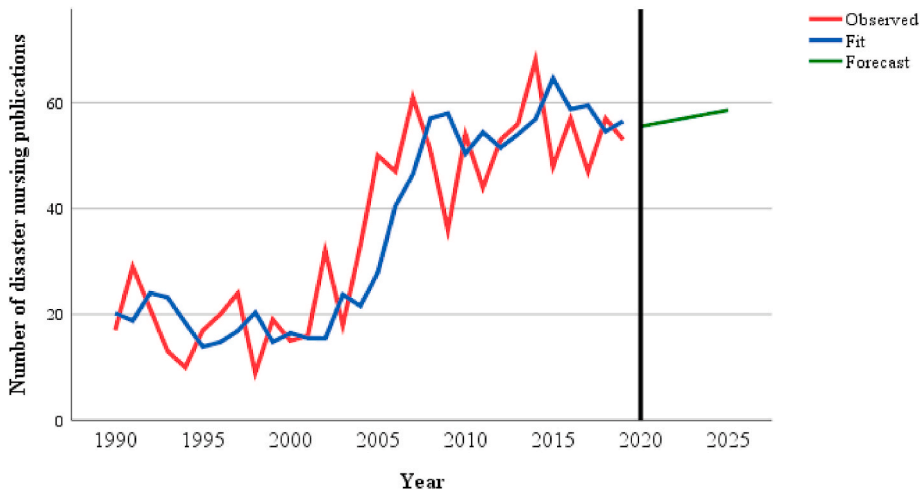

Fig. 1. Number of disaster nursing publications by years and forecast for the next five years. Note: Exponential smoothing with Brown's linear trend was adopted in the forecast; R-squared = 0.69.

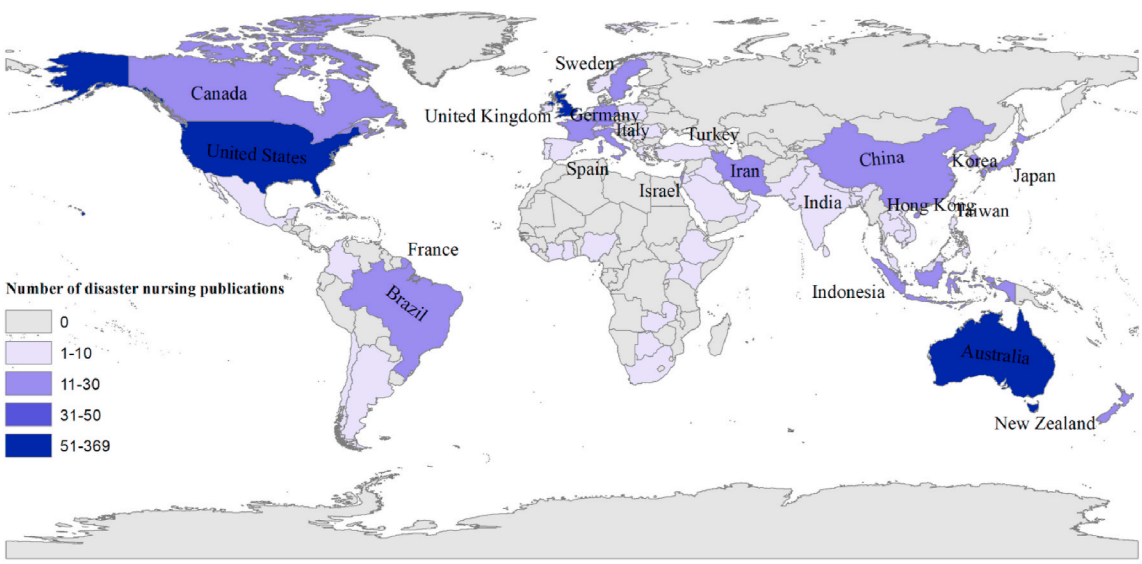

Fig. 2. Map showing the distributions of disaster nursing publications. Note: The top 20 productive countries are displayed on the map, created by using ArcGIS. Data source: Scopus.

America (369 publications), Australia (65 publications), the United Kingdom (52 publications), Japan (29 publications), Canada (28 publications), China (26 publications), France (23 publications), Iran (22 publications), Hong Kong SAR (17 publications), and Sweden (13 publications). The number of publications had significant and positive correlation with the occurrence of disasters ($r = 0.41$, $p < 0.001$) and total damage caused by disasters ($r = 0.85$, $p < 0.001$). The number of publications by countries did not show significant correlation with the number of deaths caused by disasters ($r = 0.03$, $p = 0.71$), injured cases ($r = 0.04$, $p = 0.58$), homeless cases caused by disasters ($r = 0.065$, $p = 0.35$), and the affected population from disasters ($r = 0.09$, $p = 0.19$).

Nineteen different languages were identified in the publications. In addition to the dominant language of English (947 publications, 88.1%), French (39, 3.6%), German (17, 1.6%), Italian (10, 0.9%), Japanese (10, 0.9%), Spanish (8, 0.7%), Danish (6, 0.6%), Chinese (5, 0.5%), Portuguese (5, 0.5%), Greek (4, 0.4%), and Norwegian (3, 0.3%) were the ten major languages used.

3.3. Journals and articles

The 1075 papers were published within 482 journals. The citation data of 315 of these journals could be identified from Scopus (missing/unavailable = 177), which included the total number of scholarly outputs, percentage of cites, CiteScore, Scimago Journal Rank (SJR), and Quartile. The mean CiteScore of the 315 journals was 2.42 (SD = 4.02) while the mean SJR was 0.66 (SD = 1.15). The mean Quartile was 2.34 (SD = 1.10).

The number of citations per publication ranged from 0 to 245. There was a mean of 9.8 citations (SD = 16.2) per publication. The percentage of the groups with 0 citations, 1–5 citations, 6–10 citations, 11–30 citations, and more than 30 citations was 37.8% (406 out of 1075), 33.9% (364 out of 1075), 11.9% (128 out of 1075), 12.3% (132 out of 1075), and 4.2% (45 out of 1075), respectively.

The top 20 journals, including their citation performance and impact metrics, are listed in Table 1. Half of the journals belong to the Scopus sub-subject area of general nursing; three in emergency nursing; three in public health, environmental, and occupational health; two in general medicine; one in emergency medicine; and one in health policy. The

Table 1
The top 20 journals most frequently publishing disaster nursing papers and their impact metrics.

Rank	Journal name	Publications n (%)	Scholarly output	Percent cited	CiteScore	SJR	Scopus Sub-Subject Area	Quartile
1st	Journal of Emergency Nursing	45(4.2%)	435	44.4	1.2	0.335	Emergency nursing	2
2nd	Military Medicine	23(2.1%)	254	25.2	0.5	0.196	Public health, environmental, and occupational health	4
3rd	American Journal of Nursing	21(2.0%)	745	25.6	0.7	0.228	General nursing	3
4th	Australasian Emergency Nursing Journal	17(1.6%)	93	67.7	2.2	0.623	Emergency nursing	1
5th	Disaster Medicine and Public Health Preparedness	16(1.5%)	492	56.5	1.8	0.420	Public health, environmental, and occupational health	3
5th	Soins	16(1.5%)	505	11.3	0.1	0.144	General nursing	4
6th	Nursing Standard	15(1.4%)	1810	12.9	0.3	0.135	General medicine	3
7th	Public Health Nursing	13(1.2%)	306	55.2	1.7	0.463	Public health, environmental, and occupational health	3
7th	Nursing Times	13(1.2%)	558	24.7	0.5	0.138	General nursing	3
7th	The American Nurse	13(1.2%)	146	15.1	0.2	0.105	General medicine	4
7th	Prehospital and Disaster Medicine	13(1.2%)	384	55.7	1.7	0.535	Emergency medicine	2
8th	Nurse Education Today	11(1.0%)	1053	77.9	4.6	1.178	General nursing	1
8th	Journal of Clinical Nursing	11(1.0%)	1773	71.5	3.1	0.809	General nursing	1
8th	Journal of Advanced Nursing	11(1.0%)	997	73.7	4.0	1.007	General nursing	1
8th	International Nursing Review	11(1.0%)	253	65.6	2.9	0.695	General nursing	1
9th	Journal of Nursing Scholarship	10(0.9%)	285	70.5	4.4	1.074	General nursing	1
9th	The American Journal of Nursing	10(0.9%)	745	25.6	0.7	0.228	General nursing	3
9th	International Emergency Nursing	9(0.8%)	239	71.5	2.9	0.705	Emergency nursing	1
9th	Nursing History Review	9(0.8%)	78	14.1	0.2	0.124	General nursing	4
9th	American Journal of Infection Control	9(0.8%)	1298	74.7	4.1	0.989	Health policy	1

Journal of Emergency Nursing (SJR = 0.335, Q2), published 45 articles (4.2%) Military Medicine (SJR = 0.196, Q4) 23 articles (2.1%) and the American Journal of Nursing (SJR = 0.228, Q3) 21 articles (2.0%).

Nurse Education Today obtained the highest CitationScore and SJR in 2019 (CiteScore = 4.6, SJR = 1.178, 11 papers) followed by the Journal of Nursing Scholarship (CiteScore = 4.4, SJR = 1.074, 10 papers) and the Journal of Advanced Nursing (CiteScore = 4.0, SJR = 1.007, 11 papers). The top 20 most cited articles in disaster nursing are listed in Table A1 of Appendix II. The number of citations of these articles ranged from 44 to 245, with publication years ranging from 2001 to 2016.

3.4. Authors and their collaborations

Table 2 displays the most frequently published disaster nursing authors. Of the 2491 authors identified, each of the top 20 authors had published four or above articles in disaster nursing in the past 30 years (1990–2019). Moreover, 2.8 authors were detected for each publication on average. The majority of these authors were from Australia (5 out of 20, 25%), the US (5 out of 20, 25%), and Hong Kong (3 out of 20, 15%).

Of 1445 institutions identified, 47 were linked with three or more disaster nursing publications. The top 20 most productive organizations in disaster nursing are listed in Table 3. It was found that few collaborative relationships were reported across international institutions in disaster nursing (Fig. 3). Cooperation was restricted only on institutions within the same counties: for example, i) Johns Hopkins University, Columbia University, Maryland University, and Hawaii University in the Unites States of America, ii) Flinders University, and Deakin University, University of Canberra, and the University of New England in Australia, and iii) Hong Kong Polytechnic University, the Chinese University of Hong Kong, Tung Wah College, and Sichuan University in China.

The cooperation was not strong as indicated by the thickness of the lines connecting the institutions, except for that of Flinders University and the University of Canberra. An international collaborative was

Table 2
The top 20 authors most frequently publishing on disaster nursing.

Rank	Author	Publications n (%)	Citations	H-index	Affiliation
1st	Paul Arbon	11(1.0%)	309	22	Flinders University, Australia
2nd	Jamie Ranse	9(0.8%)	146	13	University of Canberra, Australia
3rd	Elizabeth Scannell-Desch	8(0.7%)	98	8	Rutgers University–Camden, the US
4th	Tener Goodwin Veenema	7(0.7%)	133	11	Johns Hopkins University, the US
5th	Olivia Wai Man Fung	6(0.6%)	135	9	Hong Kong Polytechnic University, Hong Kong
6th	Alice Yuen Loke	5(0.5%)	105	26	Hong Kong Polytechnic University, Hong Kong
6th	Sue Turale	5(0.5%)	72	12	Chiang Mai University, Thailand
6th	Samantha M.C. Pang	5(0.5%)	52	22	Hong Kong Polytechnic University, Hong Kong
6th	Hugues Lefort	5(0.5%)	9	7	Legouest Teaching Military Hospital, France
6th	Susan Trossman	5(0.5%)	2	6	Silver Spring, the US
7th	Karen S. Hammad	4(0.4%)	100	7	Flinders University, Australia
7th	Mayumi Kako	4(0.4%)	80	7	Flinders University, Australia
7th	Kristine Gebbie	4(0.4%)	61	25	Flinders University, Australia
7th	Carol O'Boyle	4(0.4%)	61	10	The Joint Commission Resources/Joint Commission International, the US
7th	Roberta Proffit Lavin	4(0.4%)	50	7	Johns Hopkins University, the US
7th	Christine E Hallett	4(0.4%)	25	17	The University of Huddersfield, the UK
7th	Maria Sy Hung	4(0.4%)	22	5	Tung Wah College, Hong Kong
7th	Mohammadreza Firouzkouhi	4(0.4%)	12	4	University of Medical Sciences, Iran
7th	Ali Zargham-Boroujeni	4(0.4%)	12	6	Isfahan University of Medical Sciences, Iran
7th	Gertrudes Teixeira Lopes	4(0.4%)	11	4	State University of Rio de Janeiro, Brazil
7th	Bernard Marc	4(0.4%)	3	13	Centre hospitalier de Marne-la-Vallée, Jossigny, France

Table 3
The top 20 most productive organizations in disaster nursing.

Rank	Name of the organization	Number of publications	Citations	Total link strength	Degree centrality	Betweenness centrality
1st	Flinders University, Australia	16	272	18	18	133.0
2nd	Johns Hopkins School of Nursing, USA	11	93	18	18	306.5
3rd	University of Canberra, Australia	8	141	14	14	32.0
4th	The Hong Kong Polytechnic University, Hong Kong	7	58	8	8	30.0
5th	Karolinska Institutet, Sweden	6	38	3	3	0.0
5th	Harvard School of Public Health, the US	6	68	9	9	134.0
5th	Isfahan University of Medical Sciencesis, Iran	6	42	4	4	110.0
5th	University of Washington, the US	6	66	2	2	0.0
6th	Columbia University, the US	5	350	3	3	0.0
6th	Fukushima Medical University, Japan	5	66	1	1	0.0
6th	Tehran University of Medical Sciences, Iran	5	52	4	4	84.0
6th	Uniformed Services University of The Health Sciences, the US	5	26	4	4	58.5
7th	Ben Gurion University, Israel	4	66	1	4	0.0
7th	Newcastle University, Australia	4	35	2	2	234.0
7th	Tung Wah College, Hong Kong	4	20	5	5	0.0
7th	Universidade Federal Do Rio De Janeiro, Brazil	4	15	0	0	0.0
7th	University of California-San Francisco, the US	4	91	0	0	0.0
7th	University of Social Welfare and Rehabilitation Sciences, Iran	4	34	5	5	30.0
7th	Wuhan University, China	4	67	1	1	0.0
8th	James Cook University, Australia	3	26	3	3	5.0

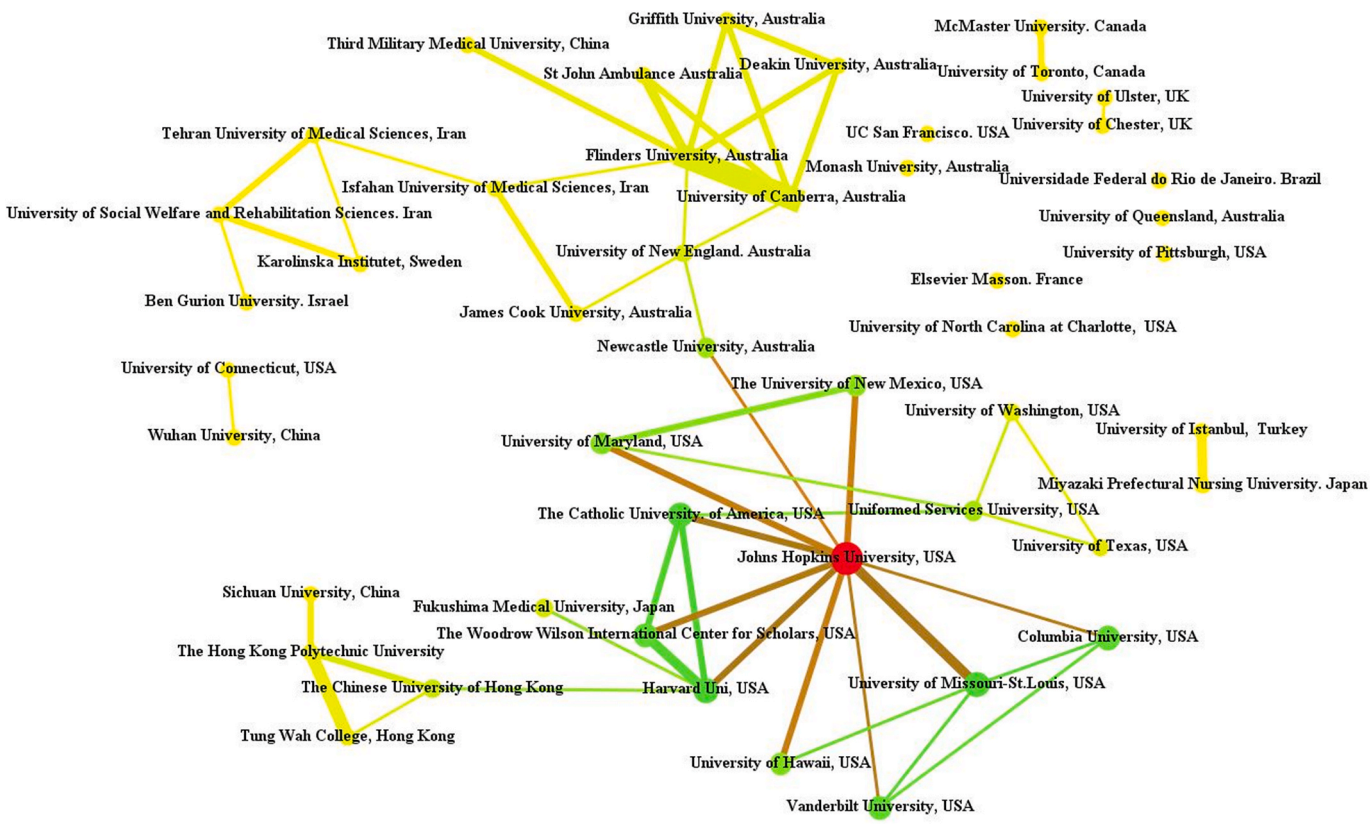

Fig. 3. Collaboration networks in disaster nursing research at the organizational level. Note: Nodes in the resultant network were recoloured and resized based on hyperlink-induced topic search value. Large nodes with red colour represent higher values that reflect more influential institutions, followed by nodes with green and yellow. The thickness of the line between the nodes represents the level of the collaborative relationship between institutions. The figure was created by using Gephi.

noted between the University of Istanbul in Turkey and Miyazaki Prefectural Nursing University in Japan and Iran (Tehran University of Medical Sciences, the University of Social Welfare and Rehabilitation Sciences, and Isfahan University of Medical Sciences), Sweden (Karolinska Institutet), and Israel (Ben Gurion University) (Fig. 3).

One hundred and seventeen unique country study settings were identified within the publications. With criteria of country occurrence within a publication of five or greater, 26 countries met the criterion (Fig. 4). Weighted degree and betweenness centrality values were calculated to identify and rank the top influential countries in disaster nursing (Table A2, Appendix II). The Unites States of America was the top-ranked country with respect to international collaborations in research on disaster nursing. The United Kingdom was the main centre in Europe. Australia and Japan were the key research centres in the Asia-Pacific region.

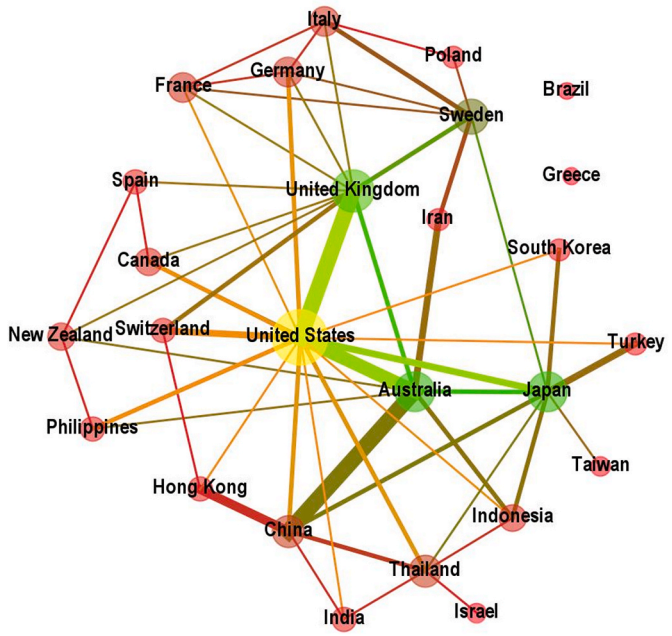

Fig. 4. Collaboration networks in disaster nursing research at the country level. Note: Nodes with yellow colour represented the highest degree values of influence in disaster nursing publications followed by green and red. The biggest nodes represented the highest cooperation in the country and others. The thick link between nodes represented strong cooperation across countries. The figure was created by using Gephi.

3.5. Keywords analysis

A total of 1130 different author keywords were extracted from Scopus. Forty-seven keywords met the criterion that the number of their occurrence should be five or above (Table 4). The final network comprised of 47 nodes with 261 relations (Fig. 5).

The 47 keywords were distributed into five clusters representing five main research themes:

(1) The first cluster (red) included 13 keywords and focused on the topics of children, deployment, First World War, history, military nursing, nurses, qualitative research, resilience, trauma, war, public health, recovery, and women.
(2) The second cluster (green) included 11 keywords and focused on the topics of influenza, disaster planning, disaster response, emergency preparedness, emergency response, nursing education, nursing students, pandemic influenza, pandemic preparedness, perception, and public health nurses.
(3) The third cluster (blue) included eight keywords and focused on the topics of disaster, disaster nursing, disaster education, disaster preparedness, disaster training, emergency department, and triage.
(4) The fourth cluster (yellow) included seven keywords and included attitudes, bioterrorism, competence, education, knowledge, policy, and preparedness.
(5) The last cluster (purple) comprised of seven keywords, including disaster management, earthquake, emergency, health care worker, hospital, natural disaster, and stress.

The findings of network analysis reveal the most common disaster nursing keywords were: nurses, disaster, emergency nurses, preparedness, military nurses, communication, and knowledge (Table 4).

Table 4
Rank of keywords in disaster nursing.

No.	Keywords	Total link strength	Degree centrality	Betweenness centrality
1	Nurses	200	37	238.4
2	Disaster	170	35	176.5
3	Emergency nurses	46	21	32.0
4	Preparedness	54	20	38.7
5	Military nursing	45	19	53.8
6	Knowledge	49	18	29.5
7	Disaster nursing	35	17	20.5
8	Emergency preparedness	39	17	26.4
9	Qualitative research	42	17	26.2
10	Education	33	16	27.5
11	Disaster preparedness	41	15	17.5
12	Disaster training	30	15	14.5
13	Disaster management	21	14	8.0
14	Disaster response	21	14	9.1
15	Emergency	36	14	12.7
16	Nursing education	31	14	11.9
17	Competencies	17	12	5.8
18	Emergency response	15	11	18.5
19	Perception	13	10	4.7
20	Earthquake	16	9	31.0
21	Nursing students	13	9	11.8
22	Resilience	15	9	4.5
23	War	15	9	5.8
24	Attitude	20	8	2.5
25	Children	10	8	2.2
26	Disaster education	14	8	1.3
27	Health care workers	10	8	24.0
28	Natural disasters	12	8	2.1
29	Policy	10	8	1.2
30	Public health nurses	10	8	3.0
31	Women	10	8	4.7
32	Bioterrorism	14	7	0.9
33	Emergency department	8	7	0.9
34	Pandemic influenza	7	7	8.9
35	Disaster planning	14	6	0.5
36	First world war	17	6	2.7
37	Hospital	11	6	3.5
38	Nursing student	6	6	7.9
39	Trauma	12	6	2.5
40	Triage	8	6	0.5
41	Deployment	8	5	0.0
42	Pandemic preparedness	7	5	4.8
43	Recovery	10	5	0.1
44	History	8	4	0.3
45	Influenza	5	4	7.1
46	Public health	6	4	1.4
47	Stress	2	2	0.6

3.6. Thematic mapping

Thematic mapping analysis was conducted on 721 publications. Publications were excluded (n = 354) due to missing abstract, not being data-based or missing necessary data for this analysis. Of the 721 included publications, approximately one third did not indicate any type of disaster in the study (249, 34.5%). The remaining publications focused on wars and military conflicts (196, 27.2%), infectious diseases (86, 11.9%), and earthquakes (53, 7.4%) (Table 5).

Two thirds of the publications addressed the disaster response (n = 484, 67.1%) and 12.1% focused on the disaster preparedness phase (n = 87). Fifty seven publications did not specify any disaster phase (7.9%) and 70 focused on more than one phase of disaster management (9.7%). Disaster mitigation (3, 0.4%) and recovery (15, 2.1%) had extremely

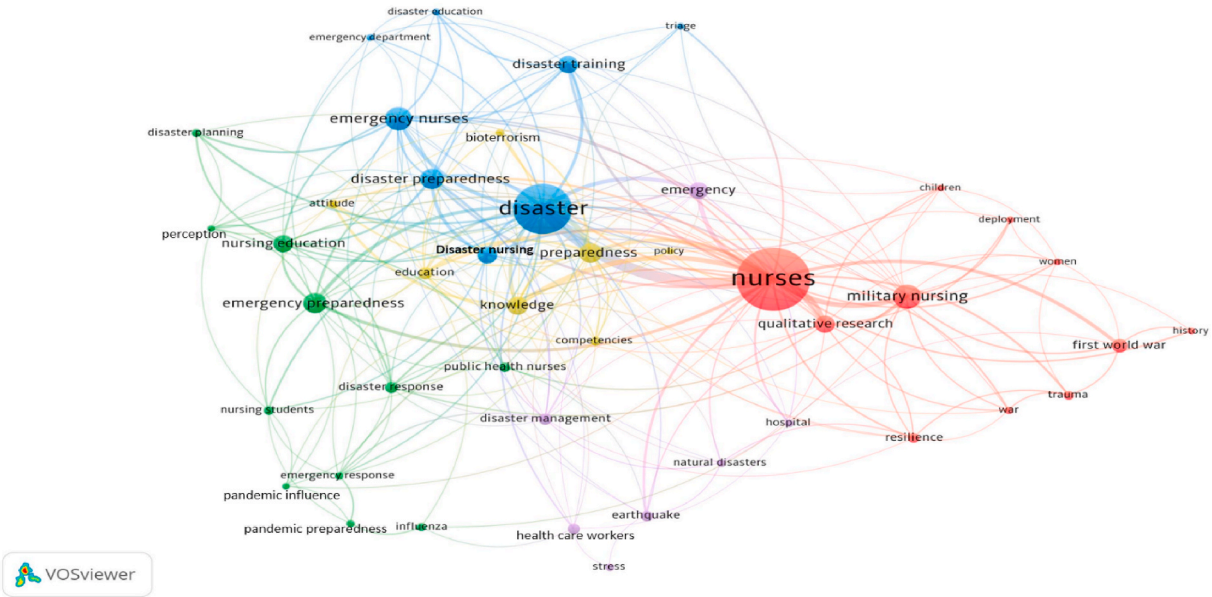

Fig. 5. Mapping of author's keywords network in disaster nursing.
Note: The five colours in the maps show five clusters representing five research themes. Nodes with similar colours represent a cluster of related terms. The figure was created by using VOSviewer.

Table 5
Types of disasters, phases of disaster management, study design, and types of participants identified in the disaster nursing publications.

Types of disaster	N	%	Phases of disaster management	N	%	Types of study design	N	%	Types of participants	N	%
1. No specific type	249	34.5%	1. No specific phase	57	7.9%	1. Cross-sectional study	162	22.5%	1. Health care workers including nurses	75	10.4%
2. War and military conflicts	196	27.2%	2. Mitigation	3	0.4%	2. Historical study	91	12.6%	2. Military medical personnel including nurses	4	0.6%
3. Infectious diseases	86	11.9%	3. Preparedness	87	12.1%	3. Mixed method	8	1.1%	3. Military nurses	86	11.9%
4. Earthquake	53	7.4%	4. Preparedness and response	35	4.9%	4. Qualitative descriptive study	291	40.4%	4. Nurses#	508	70.5%
5. Hurricane	38	5.3%	5. Preparedness, response, and recovery	6	0.8%	5. Quasi-experimental study	17	2.4%	5. Nurses and nursing students	3	0.4%
6. Bioterrorism	25	3.5%	6. Response	484	67.1%	6. Review	40	5.5%	6. Nursing students	42	5.8%
7. Fire	17	2.3%	7. Response and recovery	29	4.0%	7. Unclear	112	15.5%	7. Vulnerable groups in disasters	3	0.4%
8. Chemical, biological, radiological and nuclear disaster	12	1.7%	8. Recovery	15	2.1%						
9. Terrorism	11	1.5%	9. All phases	5	0.7%						
10. Floods	9	1.2%									
11.Others#	25	3.5%									
Total	721	100.0%	Total	721	100.0%	Total	721	100.0%	Total	721	100.0%

Note: Other disasters include tsunami (8, 1.1%), tornado (5, 0.7%), human-made disaster (4, 0.6%), mass burn injuries (3, 0.4%), transport (2, 0.3%), blizzard (2, 0.3%), and drought (1, 0.1%). The types of nurses include nurses (general professional nurses; not specified in the publications, 396 out of 508, 78.0%), emergency nurses (23, 4.5%), public health nurses (13, 2.5%), school nurses (12, 2.4%), pediatric nurses (7, 1.4%), advanced practice nurses (6, 1.2%), nurse practitioners (6, 1.2%), mental health nurses (5, 1.0%), community nurses (4, 0.8%), nurse volunteers (3, 0.6%), occupational health nurses (3, 0.6%), and other types of nursing professionals (32, 6%).

low number of publications, as did publications addressing all phases of disasters (5, 0.7%).

The qualitative descriptive study was the most commonly adopted design in the disaster nursing research (291, 40.4%) (Table 5), followed by cross-sectional studies (162, 22.4%) and historical studies (91, 12.6%). More than 70% of the publications focused on nurses only (508, 70.5%). Of the total included publications, 266 reported the sample size of participants. The mean sample size was 390 (SD = 922, minimum = 10, maximum = 9211, median = 115, N = 263), after excluding 3 studies that significantly skewed the data, including the ones by Jacobson et al. (2012, N = 65,108) [27], Pryluka et al. (2013, N = 58, 902) [28], and Liao et al. (2019, N = 33,267) [29].

Manual review of the publications elicited a range of topics (Table 6). Integrated nursing experiences in disasters received the largest number of publications (163, 22.6%), followed by the historical studies of nursing experiences in wars (22.3%), disaster nursing education (82, 11.4%), assessment of disaster preparedness/readiness for disaster response (58, 8.0%), and mental health of nurses who participate in disaster response (40, 5.5%).

Table 6
Research topics identified in the disaster nursing publications.

Topics	N	%
1. Integrated nursing experience in disaster response	163	22.6%
2. Historical study of nursing experience in wars	161	22.3%
3. Disaster nursing education	82	11.4%
4. Assessment of disaster preparedness/readiness for disaster response	58	8.0%
5. Mental health of nurses who participate disaster response	40	5.5%
6. Knowledge and skills of nurses in disaster management	39	5.1%
7. Role of nurses in disaster management	37	5.1%
8. Guides for nurses in disaster management	27	3.7%
9. Occupational health especially occupational risk of infectious diseases	27	3.7%
10. Willingness to report for work during disasters	25	3.5%
11. Disaster nursing competencies	19	2.6%
12. Perception of nurses of disaster management	16	2.2%
13. Impact of disaster experience on nurses	7	1.0%
14. Nurses' participation in the planning/policy of disaster management	4	0.6%
15. Ethical decision making during disasters	3	0.4%
16. Technology in disaster management	3	0.4%
17. Vulnerable group in disaster management	3	0.4%
18. Disaster risk communication	2	0.3%
19. Leadership of nurses in disaster management	2	0.3%
20. Needs of nurses during disaster response	2	0.3%
21. Staffing in disaster response	1	0.1%
Total	721	100.0%

4. Discussion

We conducted a bibliometric study of disaster nursing publications during the past three decades available from Scopus. In addition to the temporal and spatial distribution patterns, various essential research indicators were described such as the language of publications, the most prominent authors, the most impactful articles, journals, institutions, and countries that have made the greatest contribution to the development of disaster nursing. The keywords and themes were also examined. The growth trend of publications indicated increased interest in disaster nursing, especially in the disaster phase of preparation and response.

The September 11 terrorist attacks on the United States of America (September 11, 2001) highlighted the need for nursing leaders and educators to enhance disaster nursing research and offer education and training for registered nurses and nursing students [12,30]. A dramatic increase in disaster nursing publications was witnessed immediately after the attacks in 2001 providing some recommendations for nursing practice, education, policy, and research. However, efforts to prepare and mobilize nurses for disaster response have been episodic and difficult to sustain [7], which is observed by the decrease in growth of disaster nursing publications after 2014. More efforts in disaster nursing research are needed to improve nurses' knowledge and skills of disaster management across the globe.

Disaster nursing publications were geographically polarized within the Anglo-Saxon, European Union, and East Asian countries. USA, Australia, and the United Kingdom were the most productive countries according to numbers of disaster nursing publications and degree of collaboration. USA was also the most productive country for disaster medicine research according to another bibliometric study of the publications between 2008 and 2017 [31].

This study indicates that the number of disaster nursing publications by years and by countries were significantly correlated with the number of total damage caused by disasters. However, the total damage caused by disasters is significantly correlated with socioeconomic measures, such as country population and per capital gross domestic product [32]. Therefore, disaster nursing research should be developed and advanced especially in the developing countries, such as the countries in Africa, Central and West Asia, Eastern Europe, and South America. It seems that disaster nursing research is not linked with the regions were disasters happen most commonly in the world, perhaps as a result of limited nursing research leadership or funding availability. International collaborations could enhance this situation so as studies can directly and positively affect those countries that need such research more.

The journals which published disaster nursing articles most frequently received slightly higher citations than radiology, nuclear medicine & medical imaging journals (CiteScore, 1.32; SJR, 0.53) [33]. However, their citation performance was similar to the wider nursing journals as identified in Scopus (N = 565, mean of CiteScore, 2.35; mean of SJR, 0.56) [34]. Hence, the impact of these publications, as is also the case in the wider nursing research, may be limited. Efforts should be directed in improving the quality of disaster nursing research by prioritizing research where gaps in knowledge exist, collaborating, carrying out larger studies with methodologically stronger designs, and focusing on the impact of such research.

There were about three authors on average in each disaster nursing publication. Most of the impactful cooperation among different authors at the institutional level was found within the same countries. There was little international cross-cultural comparative research in disaster nursing. This type of research is important for offering a global perspective for disaster nursing to advance nursing knowledge and skills especially when academia and decision makers are looking for global solutions [35]. However, more collaboration is required to strengthen disaster nursing research. International collaborations can also enhance the productivity of nursing researchers who seek to conduct studies with similar populations in different environments and who desire a larger impact based on the findings of their studies [36]. International collaborative teams have the potential to make important discoveries that affect the health of populations across the world. Therefore, developing and advancing international and cross-cultural research should be included in the research agenda of disaster nursing to improve evidence-based disaster nursing knowledge and skills.

This study illustrated that military conflict received the most focus in disaster nursing. Moreover, military medicine was the second most common journal publishing disaster nursing work. Military nursing was also listed as one of the main keywords under disaster nursing. Historical studies of nurses in World War I [37], Word World War II [38], and the Vietnam war [39], alongside more recent conflicts such as the Gulf War [40], Iran-Iraq wars [41,42] and Afghanistan conflict [43] became the major topics in the military nursing-focused publications. In addition, almost all those military nursing-focused publications emphasized emergency and war response, especially related to relief and transportation [44].

The existing disaster nursing publications stressed the nursing experience when responding to disasters such as wars, earthquakes, and bioterrorism. These types of publications described the experiences of nurses when they work in these environments during disasters, which could generate lessons learned from the experience, recommendations to enhance disaster nursing education and training, improvements in nursing knowledge, innovation, and manipulation of skills and technology in disaster nursing [45,46]. Increasing disaster nursing education and training to improve knowledge and enhance both comfort level and willingness to work in disaster management could also be observed from the thematic analysis [47]. Occupational health and the mental health of nurses during and after disaster response was another main theme, which included posttraumatic stress disorder (PTSD) symptoms [48], perceived coping, life satisfaction, meaning in life [49], and risk of infection during pandemics [50,51]. Nevertheless, a recent international survey has shown low levels of such psychological preparedness, limited training, and often self-directed learning, alongside a strong link between such preparedness and psychological outcomes (such as PTSD), highlighting the need for more substantive evidence in this area of disaster nursing in most effectively preparing nurses to work in disasters [52], and preparing health professionals with resilience on disaster response [53,54].

Few of the existing disaster nursing publications explored any theory of disaster nursing. Moreover, usually a large-scale disaster requires

international disaster response work, such as responding to the 2004 Indian Ocean earthquake and tsunami [55], the 2010 Haiti earthquake [56], the 2014 Western Africa Ebola epidemic [57] and the most recent COVID-19 pandemic [58]. Disaster and health diplomacy become an important aspect of disaster management but few have focused in this area of disaster nursing [59]. Also, planning of nurses when they return to their home communities from deployment after disaster response was rarely discussed. When compared to the phases of preparedness and response, the number of disaster nursing publications on mitigation and recovery/long-term rehabilitation is extremely small. Ethics, leadership, communication, staffing, and needs of nurses during disaster response, and the role or use of technology in disaster management are other gaps in the literature. All of these specific topics are important in disaster nursing and should receive more attention in the future to foster the knowledge and skills of nurses in all phases of disaster management.

4.1. Limitations

To the best of the authors' knowledge, this study is the first to comprehensively describe the disaster nursing literature. Several limitations associated with this study must be acknowledged and considered when evaluating the results obtained. First, publications were only identified though Scopus because of the difficulties and challenges of merging data sets mentioned earlier, which database does not index all nursing and relevant journals. Additionally, Scopus includes only a very small number of publications in languages other than English, which may have limited the number of non-English publications identified through the search strategy. Future studies can extend the search to include other databases. Second, the term frequency method may not be robust because of the non-independence of the choice of topics for different papers. There may also be international differences in the term or terminology used for the same concept such as inconsistencies in disaster nomenclature. Thus, the existing terms might extract data from an incomplete list of disaster nursing publications. Third, the projection of the number of publications for the next five years was conducted by using a linear regression model based on the available data from 1990 to 2019. However, there might be a significant and dramatic growth of disaster nursing publications especially related to responses to pandemics in 2020 and the years following this because of the Coronavirus Disease 2019 (COVID-19) [58].

5. Conclusions

This study provides nursing leaders, educators, researchers, and practitioners a comprehensive map of the development of disaster nursing in the past three decades. It is clear that the field of disaster nursing is still far from being mature. More empirical and theoretical research, especially in the full spectrum of disaster management, is lacking and should be widely investigated to meet the global challenge of disasters. International collaboration should be a priority in improving the quality of the related research and add impactful research that can guide practice and education.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix I. Search strategies of disaster nursing in the past 30 years (1990–2019)

The search strategy and keywords for retrieving documents in disaster nursing using Scopus includes:

TITLE (nurse OR "registered nurse" OR "health care professional" OR "health care worker" OR "health care provider" OR "advanced practice nurs*" OR "nurse commander" OR "military nurs*" OR "response team nurs*" OR "nurse planner" Or "nursing student")

AND (TITLE ("natural disaster" OR "man* disaster" OR "tech* disaster" OR disaster* OR rescue OR "natural hazard" OR "disaster preparedness" OR "disaster response" OR "humanity rescue" OR "disaster recovery" OR "disaster manage*" OR "disaster plan*" OR relief OR "mass casualit*" OR deploy* OR earthquake OR tsunami OR volcan* OR drought OR bushfire OR "forest fire" OR fire OR storm OR windstorm OR "heat wave" OR "extreme weather" OR "cold wave" OR avalanche OR blizzard OR tornado OR cyclone OR hurricane OR typhoon OR storm OR flood OR landslide OR "rock fall" OR bioterrorism OR "environmental disaster" OR "chemical incident" OR "nuclear accident*" OR explosion OR "teeror* attack" OR war OR "infectious disease" OR pandemic) OR (TITLE (emergen*) AND TITLE-ABS-KEY ("natural disaster" OR "man* disaster" OR "tech* disaster" OR disaster* OR rescue OR "natural hazard" OR "disaster preparedness" OR "disaster response" OR "humanity rescue" OR "disaster recovery" OR "disaster manage*" OR "disaster plan*" OR relief OR "mass casualit*" OR deploy* OR earthquake OR tsunami OR volcan* OR drought OR bushfire OR "forest fire" OR fire OR storm OR windstorm OR "heat wave" OR "extreme weather" OR "cold wave" OR avalanche OR blizzard OR tornado OR cyclone OR hurricane OR typhoon OR storm OR flood OR landslide OR "rock fall" OR bioterrorism OR "environmental disaster" OR "chemical incident" OR "nuclear accident*" OR explosion OR "teeror* attack" OR war OR "infectious disease" OR pandemic))).

AND PUBYEAR >1989 AND PUBYEAR <2020.

AND NOT TITLE-ABS-KEY ("nursery fish" OR "tree seedling establishment" OR "nurse shrubs" OR "nurse trees" OR "nurse plant" OR "thymic nurse cell" OR "nursery period" OR "orange nursery trees" OR "violence against" OR "violence towards" OR "individual acts of violence" OR "nursing home" OR "nursing and residential homes" OR "container nursery regimes" OR "inpatient mortality" OR "pain relief" OR "agency-employed supplemental nurse" OR vaccine* OR "failure-to-rescue" OR "emotional labour")

AND (LIMIT-TO (SRCTYPE,"j")).

AND (EXCLUDE (DOCTYPE, "er"))

Appendix II

Table A1
The top 20 cited articles in disaster nursing

Rank	Authors	Title	Year	Source title	Cited by
1st	Qureshi K., Gershon R.R.M., Sherman M.F., Straub T., Gebbie E., McCollum M., Erwin M.J., Morse S·S [60].	Health care workers' ability and willingness to report to duty during catastrophic disasters	2005	Journal of Urban Health	245
2nd			2007	Military Medicine	103

(*continued on next page*)

Table A1 (*continued*)

Rank	Authors	Title	Year	Source title	Cited by
	Kolkow T.T., Spira J.L., Morse J.S., Grieger T.A [61].	Post-traumatic stress disorder and depression in health care providers returning from deployment to Iraq and Afghanistan			
3rd	Williams J., Nocera M., Casteel C [62].	The Effectiveness of Disaster Training for Health Care Workers: A Systematic Review	2008	Annals of Emergency Medicine	92
4th	Baack S., Alfred D [63].	Nurses' preparedness and perceived competence in managing disasters	2013	Journal of Nursing Scholarship	84
5th	McAlonan G.M., Lee A.M., Cheung V., Cheung C., Tsang K·W.T., Sham P·C., Chua S.E., Wong J.G.W·S [64].	Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers	2007	Canadian Journal of Psychiatry	81
6th	Olympia R.P., Wan E., Avner J.R [65].	The preparedness of schools to respond to emergencies in children: A national survey of school nurses	2005	Pediatrics	80
7th	Waeckerle J.F., Seamans S., Whiteside M., Pons P. T., White S., Burstein J.L., Murray R [66].	Executive summary: Developing objectives, content, and competencies for the training of emergency medical technicians, emergency physicians, and emergency nurses to care for casualties resulting from nuclear, biological, or chemical (NBC) incidents	2001	Annals of Emergency Medicine	74
8th	Schultz C·H., Koenig K.L., Whiteside M., Murray R [67].	Development of national standardized all-hazard disaster core competencies for acute care physicians, nurses, and EMS professionals	2012	Annals of Emergency Medicine	64
9th	Fung O·W.M., Loke A.Y., Lai C·K·Y [68].	Disaster preparedness among Hong Kong nurses	2008	Journal of Advanced Nursing	62
10th	Slepski L.A [69].	Emergency Preparedness and Professional Competency Among Health Care Providers During Hurricanes Katrina and Rita: Pilot Study Results	2007	Disaster Management and Response	60
10th	Chapman K., Arbon P [70].	Are nurses ready? Disaster preparedness in the acute setting	2008	Australasian Emergency Nursing Journal	60
11th	Al Khalaileh M.A., Bond E., Alasad J.A [71].	Jordanian nurses' perceptions of their preparedness for disaster management	2012	International Emergency Nursing	58
12th	Krichbaum K., Diemert C., Jacox L., Jones A., Koenig P., Mueller C., Disch J [72].	Complexity compression: nurses under fire.	2007	Nursing forum	57
12th	Seale H., Leask J.L., Po K., MacIntyre C.R [73].	Will they just pack up and leave? Attitudes and intended behaviour of hospital health care workers during an influenza pandemic	2009	BMC Health Services Research	57
13th	Lev-Wiesel R., Goldblatt H., Eisikovits Z., Admi H [74].	Growth in the shadow of war: The case of social workers and nurses working in a shared war reality	2009	British Journal of Social Work	55
14th	Wisniewski R., Dennik-Champion G., Peltier J.W [75].	Emergency preparedness competencies: Assessing nurses' educational needs	2004	Journal of Nursing Administration	51
15th	French E.D., Sole M.L., Byers J.F [76].	A comparison of nurses' needs/concerns and hospital disaster plans following Florida's hurricane Floyd	2002	Journal of Emergency Nursing	45
16th	Qureshi K.A., Merrill J.A., Gershon R.R.M., Calero-Breckheimer A [77].	Emergency preparedness training for public health nurses: A pilot study	2002	Journal of Urban Health	44
16th	Jennings-Sanders A., Frisch N., Wing S [78].	Nursing students' perceptions about disaster nursing	2005	Disaster Management and Response	44
16th	Arbon P., Ranse J., Cusack L., Considine J., Shaban R.Z., Woodman R.J., Bahnisch L., Kako M., Hammad K., Mitchell B [79].	Australasian emergency nurses' willingness to attend work in a disaster: A survey	2013	Australasian Emergency Nursing Journal	44
16th	Veenema T.G., Griffin A., Gable A.R., Macintyre L., Simons R.N., Couig M.P., Walsh J.J., Lavin R.P., Dobalian A., Larson E [80].	Nurses as Leaders in Disaster Preparedness and Response-A Call to Action	2016	Journal of Nursing Scholarship	44

Table A2
The top 20 countries that have collaborations in disaster nursing

Rank	Label	Degree centrality	Betweenness centrality
1st	United States	15	97.1
2nd	United Kingdom	10	39.0
3rd	Japan	9	47.3
4th	Australia	9	31.9
5th	Sweden	7	28.2
6th	Thailand	6	23.7
7th	China	6	7.4
8th	Italy	6	5.3
9th	Germany	5	4.1
9th	France	5	4.1
10th	Canada	4	5.4
11th	New Zealand	4	3.1
12th	Indonesia	4	1.2
13th	Switzerland	3	1.6
13th	Philippines	3	1.6
14th	Hong Kong	3	0.5
15th	India	3	0.0
16h	Iran	2	0.8
17th	Turkey	2	0
17th	South Korea	2	0

References

[1] CRED, The international disasters database, in: C.f.R.o.t.E.o.D. CRED (Ed.), CRED, Centre for Research on the Epidemiology of Disasters, 2020.
[2] UNDRR, Sendai framework for disaster risk reduction 2015-2030, in: UNDRR, UN, Geneva, 2015.
[3] A.Y. Loke, O.W.M. Fung, Nurses' competencies in disaster nursing: implications for curriculum development and public health, Int. J. Environ. Res. Publ. Health 11 (2014) 3289–3303.
[4] T.G. Veenema, Disaster Nursing and Emergency Preparedness for Chemical, Biological, and Radiological Terrorism and Other Hazards, fourth ed., Springer, New York, 2019.
[5] O.W.M. Fung, A.Y. Loke, C.K.Y. Lai, Disaster preparedness among Hong Kong nurses, J. Adv. Nurs. 62 (2008) 698–703.
[6] T.G. Veenema, R.P. Lavin, A. Griffin, A.R. Gable, M.P. Couig, A. Dobalian, Call to action: the case for advancing disaster nursing education in the United States, J. Nurs. Scholarsh. 49 (2017) 688–696.
[7] T.G. Veenema, A. Griffin, A.R. Gable, L. Macintyre, R.N. Simons, M.P. Couig, J. J. Walsh, R.P. Lavin, A. Dobalian, E. Larson, Nurses as leaders in disaster preparedness and response-A call to action, J. Nurs. Scholarsh. 48 (2016) 187–200.
[8] K.S. Hammad, P. Arbon, K. Gebbie, A. Hutton, Nursing in the emergency department (ED) during a disaster: a review of the current literature, Australas. Emerg. Nurs. J. 15 (2012) 235–244.
[9] A. Hutton, T.G. Veenema, K. Gebbie, Review of the international council of nurses (ICN) framework of disaster nursing competencies, Prehospital Disaster Med. 31 (2016) 680–683.
[10] A. Al Thobaity, V. Plummer, B. Williams, What are the most common domains of the core competencies of disaster nursing? A scoping review, Int. Emerg. Nurs. 31 (2017) 64–71.
[11] M.J. Johnstone, S. Turale, Nurses' experiences of ethical preparedness for public health emergencies and healthcare disasters: a systematic review of qualitative evidence, Nurs. Health Sci. 16 (2014) 67–77.
[12] ICN, WHO, ICN Framework of Disaster Nursing Competencies, ICN & WHO, Geneva, 2009.
[13] S.K.K. Lam, E.W.Y. Kwong, M.S.Y. Hung, S.M.C. Pang, V.C.L. Chiang, Nurses' preparedness for infectious disease outbreaks: a literature review and narrative synthesis of qualitative evidence, J. Clin. Nurs. 27 (2018) e1244–e1255.
[14] P. Rokkas, V. Cornell, M. Steenkamp, Disaster preparedness and response: challenges for Australian public health nurses - a literature review, Nurs. Health Sci. 16 (2014) 60–66.
[15] Y.Y. Zhang, L.L. Zhu, Y. Sheng, X.H. Li, X.H. Xu, Q.Y. Wang, Disaster nursing development in China and other countries: a bibliometric study, J. Nurs. Scholarsh. 50 (2018) 567–576.
[16] M. Kako, S. Mitani, P. Arbon, Literature review of disaster health research in Japan: focusing on disaster nursing education, Prehospital Disaster Med. 27 (2012) 178–183.
[17] K. Yousefi, H.A. Larijani, M. Golitaleb, A. Sahebi, Knowledge, attitude and performance associated with disaster preparedness in Iranian nurses: a systematic review and meta-analysis, Adv. J. Emerg. Med . 3 (2019) e42.
[18] W.M. Sweileh, A bibliometric analysis of health-related literature on natural disasters from 1900 to 2017, Health Res. Pol. Syst. 17 (2019) 11.
[19] C.R. Sugimoto, Y.Y. Ahn, E. Smith, B. Macaluso, V. Lariviere, Factors affecting sex-related reporting in medical research: a cross-disciplinary bibliometric analysis, Lancet 393 (2019) 550–559.
[20] A. Mainwaring, N. Bullock, T. Ellul, O. Hughes, J. Featherstone, The top 100 most cited manuscripts in bladder cancer: a bibliometric analysis (review article), Int. J. Surg. 75 (2020) 130–138.
[21] S.X. Chen, Q. Lu, J.B. Bai, C.Y. Deng, Y.G. Wang, Y. Zhao, Global publications on stigma between 1998-2018: a bibliometric analysis, J. Affect. Disord. 274 (2020) 363–371.
[22] J.Y. Dong, W.Q. Wei, C.F. Wang, Y. Fu, Y. Li, J.X. Li, X. Peng, Research trends and hotspots in caregiver studies: a bibliometric and scientometric analysis of nursing journals, J. Adv. Nurs. (2020) 16, https://doi.org/10.1111/jan.14489.
[23] H. Carter-Templeton, R.M. Frazier, L. Wu, T.H. Wyatt, Robotics in nursing: a bibliometric analysis, J. Nurs. Scholarsh. 50 (2018) 582–589.
[24] P. Kokol, D. Zeleznik, J. Zavrsnik, H.B. Vosner, Nursing research literature production in terms of the scope of country and health determinants: a bibliometric study, J. Nurs. Scholarsh. 51 (2019) 590–598.
[25] S. Wasserman, K. Faust, Social Network Analysis : Methods and Applications, Cambridge University Press, Cambridge, 1994.
[26] N.J. van Eck, L. Waltman, Software survey: VOSviewer, a computer program for bibliometric mapping, Scientometrics 84 (2010) 523–538.
[27] I.G. Jacobson, J.L. Horton, C.A. Leardmann, M.A. Ryan, E.J. Boyko, T.S. Wells, B. Smith, T.C. Smith, Posttraumatic stress disorder and depression among U.S. military health care professionals deployed in support of operations in Iraq and Afghanistan, J. Trauma Stress 25 (2012) 616–623.
[28] D. Pryluka, G. Lopardo, L. Daciuk, D. Stecher, P. Bonvehi, Severe acute respiratory disease in health-care workers during the influenza H1N1 pandemic in Argentina, J. Infect. Dev. Ctries. 7 (2013) 36–40.
[29] K.L. Liao, Y.T. Huang, S.H. Kuo, W.T. Lin, F.H. Chou, P.L. Chou, Registered nurses are at increased risk of hospitalization for infectious diseases and perinatal complications: a population-based observational study, Int. J. Nurs. Stud. 91 (2019) 70–76.
[30] T.G. Veenema, Expanding educational opportunities in disaster response and emergency preparedness for nurses, Nurs. Educ. Perspect. 27 (2006) 93–99.
[31] L. Zhou, P. Zhang, Z. Zhang, L. Fan, S. Tang, K. Hu, N. Xiao, S. Li, A bibliometric profile of disaster medicine research from 2008 to 2017: a scientometric analysis, Disaster Med. Public Health Prep. 13 (2019) 165–172.
[32] G. Shen, L. Zhou, Y. Wu, Z. Cai, A global expected risk analysis of fatalities, injuries, and damages by natural disasters, Sustainability 10 (7) (2018) 2573.
[33] M. Villaseñor-Almaraz, J. Islas-Serrano, C. Murata, E. Roldan-Valadez, Impact factor correlations with Scimago journal rank, source normalized impact per paper, eigenfactor score, and the CiteScore in radiology, nuclear medicine & medical imaging journals, La radiologia medica 124 (2019) 495–504.
[34] Scopus, Source Search, 2020.
[35] W. Rosa, One mind, one health, one planet- A pledge to planetary citizenship, in: W. Rosa (Ed.), A New Era in Global Health: Nursing and the United Nation 2030 Agenda for Sustainable Development, Springer, New York, 2017, pp. 517–520.
[36] L.C. O'Keefe, K.H. Frith, E. Barnby, Nurse faculty as international research collaborators, Nurs. Health Sci. 19 (2017) 119–125.
[37] J.F. Irwin, Beyond versailles: recovering the voices of nurses in post-world war I U. S.-European relations, Nurs. Hist. Rev. 24 (2016) 12–40.
[38] S.S. Dittmar, M.P. Stanton, M.A. Jezewski, S.S. Dickerson, Images and sensations of war: a common theme in the history of military nursing, Health Care Women Int. 17 (1996) 69–80.
[39] E.A. Scannell-Desch, The lived experience of women military nurses in Vietnam during the Vietnam war, J. Nurs. Scholarsh. 28 (1996) 119–124.
[40] H. Worthington, S. Titus, A nurse's role in Operation Desert Storm. Psychosocial nursing in a war, J. Psychosoc. Nurs. Ment. Health Serv. 29 (1991) 29–34.
[41] P.W. Kelley, D. Kenny, R. Donley, Experiences of vulnerability and uncertainty during the Iraq and Afghanistan wars: stories of wounded service members and the nurses who cared for them, Nurs. Outlook 65 (2017) S71–S80.
[42] Z. Farsi, N.D. Nayeri, Pain and suffering: experiences of health care professionals in the Iran-Iraq War-A content analysis study, J. Mil. Med. 19 (2017) 222–233.
[43] A. Finnegan, S. Finnegan, D. Bates, D. Ritsperis, K. McCourt, M. Thomas, Preparing British Military nurses to deliver nursing care on deployment: an Afghanistan study, Nurse Educ. Today 35 (2015) 104–112.
[44] H. Gholami, H. Mahmoudi, S.T. Moradian, Relief and transportation of victims on the battlefield from the viewpoint of military nurses: a qualitative study, J. Mil. Med. 21 (2019) 585–595.
[45] J. Brooks, Nurses as therapeutic agents in the extreme environment of the desert war, 1940-44, J. Adv. Nurs. 71 (2015) 2520–2528.
[46] H. Yin, H. He, P. Arbon, J. Zhu, A survey of the practice of nurses' skills in Wenchuan earthquake disaster sites: implications for disaster training, J. Adv. Nurs. 67 (2011) 2231–2238.
[47] J.C. Langan, R. Lavin, K.A. Wolgast, T.G. Veenema, Education for developing and sustaining a health care workforce for disaster readiness, Nurs. Adm. Q. 41 (2017) 118–127.
[48] E.D. Battles, An exploration of post-traumatic stress disorder in emergency nurses following hurricane katrina, J. Emerg. Nurs. 33 (2007) 314–318.
[49] M. Ben-Ezra, Y. Palgi, Y. Hamama-Raz, Y. Soffer, A. Shrira, Reactions to the 2011 Tōhoku earthquake and tsunami: a preliminary matching study comparing nurses and civilians, J. Nerv. Ment. Dis. 201 (2013) 534–536.
[50] Y. Koh, D. Hegney, V. Drury, Nurses' perceptions of risk from emerging respiratory infectious diseases: a Singapore study, Int. J. Nurs. Pract. 18 (2012) 195–204.
[51] Y.S. Ahn, H.S. Lim, Occupational infectious diseases among Korean health care workers compensated with industrial accident compensation insurance from 1998 to 2004, Ind. Health 46 (2008) 448–454.
[52] N.B. Said, A. Molassiotis, V.C.L. Chiang, Psychological preparedness for disasters among nurses with disaster field experience: an international online survey, Int. J. Disaster Risk Reduct. 46 (2020) 101533.
[53] X. Mao, A.Y. Loke, O.W.M. Fung, X. Hu, What it takes to be resilient: the views of disaster healthcare rescuers, Int. J. Disaster Risk Reduct. 36 (2019) 101112.
[54] X. Mao, O.W. Fung, X. Hu, A.Y. Loke, Characteristics of resilience among disaster rescue workers: A systematic review, Disaster Med. Public Health Prep. (3 Nov 2020) 1–10, https://doi.org/10.1017/dmp.2020.192. In press.
[55] P. Arbon, C. Bobrowski, K. Zeitz, C. Hooper, J. Williams, J. Thitchener, Australian nurses volunteering for the Sumatra-Andaman earthquake and tsunami of 2004: a review of experience and analysis of data collected by the Tsunami Volunteer Hotline, Australas. Emerg. Nurs. J. 9 (2006) 171–178.
[56] K. Ketchie, E. Breuilly, Our experience in earthquake-ravaged Haiti: two nurses deployed with a disaster medical assistance team, J. Emerg. Nurs. 36 (2010) 492–496.
[57] V. Wiwanitkit, Critical guidelines for health care workers who deploy to west Africa for the Ebola response, Disaster Med. Public Health Prep. 10 (2016) 187.
[58] WHO, Coronavirus Disease (COVID-19) Pandemic, 2020.
[59] T. Pryor, Health diplomacy through collaboration and a story of hope in tsunami-ravaged Banda Aceh, Indonesia: a U.S. public health service nurse officer perspective, Mil. Med. 171 (2006) 44–47.
[60] K. Qureshi, R.R.M. Gershon, M.F. Sherman, T. Straub, E. Gebbie, M. McCollum, M. J. Erwin, S.S. Morse, Health care workers' ability and willingness to report to duty during catastrophic disasters, J. Urban Health 82 (2005) 378–388.

[61] T.T. Kolkow, J.L. Spira, J.S. Morse, T.A. Grieger, Post-traumatic stress disorder and depression in health care providers returning from deployment to Iraq and Afghanistan, Mil. Med. 172 (2007) 451–455.
[62] J. Williams, M. Nocera, C. Casteel, The effectiveness of disaster training for health care workers: a systematic review, Ann. Emerg. Med. 52 (2008) 211–222, 222. e211-212.
[63] S. Baack, D. Alfred, Nurses' preparedness and perceived competence in managing disasters, J. Nurs. Scholarsh. 45 (2013) 281–287.
[64] G.M. McAlonan, A.M. Lee, V. Cheung, C. Cheung, K.W. Tsang, P.C. Sham, S. E. Chua, J.G. Wong, Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers, Can. J. Psychiatr. 52 (2007) 241–247.
[65] R.P. Olympia, E. Wan, J.R. Avner, The preparedness of schools to respond to emergencies in children: a national survey of school nurses, Pediatrics 116 (2005) e738–745.
[66] J.F. Waeckerle, S. Seamans, M. Whiteside, P.T. Pons, S. White, J.L. Burstein, R. Murray, Executive summary: developing objectives, content, and competencies for the training of emergency medical technicians, emergency physicians, and emergency nurses to care for casualties resulting from nuclear, biological, or chemical incidents, Ann. Emerg. Med. 37 (2001) 587–601.
[67] C.H. Schultz, K.L. Koenig, M. Whiteside, R. Murray, Development of national standardized all-hazard disaster core competencies for acute care physicians, nurses, and EMS professionals, Ann. Emerg. Med. 59 (2012) 196–208.
[68] O.W. Fung, A.Y. Loke, C.K. Lai, Disaster preparedness among Hong Kong nurses, J. Adv. Nurs. 62 (2008) 698–703.
[69] L.A. Slepski, Emergency preparedness and professional competency among health care providers during hurricanes Katrina and Rita: pilot study results, Disaster Manag. Response 5 (2007) 99–110.
[70] K. Chapman, P. Arbon, Are nurses ready?: disaster preparedness in the acute setting, Australas. Emerg. Nurs. J. 11 (2008) 135–144.
[71] M.A. Al Khalaileh, E. Bond, J.A. Alasad, Jordanian nurses' perceptions of their preparedness for disaster management, Int Emerg Nurs 20 (2012) 14–23.
[72] K. Krichbaum, C. Diemert, L. Jacox, A. Jones, P. Koenig, C. Mueller, J. Disch, Complexity compression: nurses under fire, Nurs. Forum 42 (2007) 86–94.
[73] H. Seale, J. Leask, K. Po, C.R. MacIntyre, Will they just pack up and leave?" - attitudes and intended behaviour of hospital health care workers during an influenza pandemic, BMC Health Serv. Res. 9 (2009) 30.
[74] R. Lev-Wiesel, H. Goldblatt, Z. Eisikovits, H. Admi, Growth in the shadow of war: the case of social workers and nurses working in a shared war reality, Br. J. Soc. Work 39 (2009) 1154–1174.
[75] R. Wisniewski, G. Dennik-Champion, J.W. Peltier, Emergency preparedness competencies: assessing nurses' educational needs, J. Nurs. Adm. 34 (2004) 475–480.
[76] E.D. French, M.L. Sole, J.F. Byers, A comparison of nurses' needs/concerns and hospital disaster plans following Florida's Hurricane Floyd, J. Emerg. Nurs. 28 (2002) 111–117.
[77] K.A. Qureshi, J.A. Merrill, R.R.M. Gershon, A. Calero-Breckheimer, Emergency preparedness training for public health nurses: a pilot study, J. Urban Health 79 (2002) 413–416.
[78] A. Jennings-Sanders, N. Frisch, S. Wing, Nursing students' perceptions about disaster nursing, Disaster Manag. Response 3 (2005) 80–85.
[79] P. Arbon, J. Ranse, L. Cusack, J. Considine, R.Z. Shaban, R.J. Woodman, L. Bahnisch, M. Kako, K. Hammad, B. Mitchell, Australasian emergency nurses' willingness to attend work in a disaster: a survey, Australas. Emerg. Nurs. J. 16 (2013) 52–57.
[80] T.G. Veenema, A. Griffin, A.R. Gable, L. MacIntyre, R.N. Simons, M.P. Couig, J. J. Walsh Jr., R.P. Lavin, A. Dobalian, E. Larson, Nurses as leaders in disaster preparedness and response–A call to action, J. Nurs. Scholarsh. 48 (2016) 187–200.