SYSTEMATIC REVIEW

Factors Influencing Hospital Resilience

Afsaneh Khademi Jolgehnejad, MA; Reza Ahmadi Kahnali, PhD; ALi Heyrani, MD, PhD

ABSTRACT

This study aims at investigating the influencing factors on hospital resilience. For this purpose, a systematic review of the literature was conducted. Six databases, including Web of Science, Scopus, SAGE, EBSCO, Google Scholar, and PubMed were searched for articles published between 2000 and 2018. Sixteen studies were selected based on inclusion/exclusion criteria. Content analysis revealed 22 influencing factors were included in a framework with 2 dimensions: (1) phases of the hospital resilience process (preparation, response, and recovery/growth) and (2) the key components of the hospital (staff, infrastructure, management, and logistics). Considering the factors that emerged from this research, suggestions were made to improve hospital resilience. The results of this research will enable a hospital manager to develop better plans for hospital preparedness, as well as perform more effectively before, during, and after disasters.

Key Words: hospital resilience, influencing factors, systematic review

Hospitals have a pivotal role in providing effective health services during critical incidents; they are expected to manage extra admissions while continuing to provide care for existing patients.[1,2] Zhong et al. define hospital resilience as the ability to resist, absorb, and respond to disasters' consequences by providing additional services (eg, on-site rescue, prehospital care, emergency treatment, critical care, decontamination and isolation), and then to recover or to adapt to a new situation.[3]

Research on hospital resilience and its potential impact on risk reduction and community resilience have increased over the years.[4-6] Hospital resilience is as crucial as maintaining other lifeline services, such as water and electric power supply. It minimizes the impact of disasters on vulnerable populations.[7] A report published by the World Health Organization (WHO) showed the importance of applying a resilience approach in enhancing the capacity of health systems through "decreased vulnerability" and "improved choices and opportunities" in an unstable and changing climate.[8]

To achieve resilience in a hospital, it is essential to coordinate major related processes, resources, and technologies with the aim of managing expected and unexpected changes.[9,10] It is also important to consider the main factors that can affect hospital resilience, preparedness, adaptive capacity, and rapid response to an unexpected incident.[4,11,12]

Using concepts like preparedness and continuity, there have been a variety of studies conducted on the issue of coping strategies and resistance during disasters.[10,13,14] The issue has also been raised increasingly in hospital-related topics.[4,6,9,15] Although the WHO considers it an important issue and has published various reports on hospitals' infrastructure preparedness and safety, the organization has not provided a comprehensive framework for conceptualizing and measuring resilience in hospitals.

Many different factors affect hospital resilience with complex relationships. Therefore, it is essential to develop a general framework to address the issue. Elaborating on the concept and critical issues of hospital resilience, Zhong et al. have presented a framework along with an assessment tool.[16] The objective of the present study is to investigate the influencing factors on hospital resilience and consider the resilience process and the key components of hospitals.

METHODS

This systematic review of the existing literature followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[17] and the framework proposed by Xiao et al. and Jesson et al. for conducting systematic reviews.[18,19]

After clarifying the purpose of the study and formulating the research questions, proper key words and search strings were selected. In line with other systematic reviews on hospital resilience,[16] several key words were searched in online databases. The search strings were formulated by using the words "hospital" combined

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

TABLE 1

Search Protocol

Databases	Search Strings	Years
Web of Science	Topic (hospital) AND Title (resilien* OR preparedness OR risk mitigation OR continuity)	2000–2018
Scopus	(Title-Abstract-Keyword [hospital] AND Title [resilien* OR preparedness OR risk mitigation OR continuity])	2000–2018
SAGE	(Abstract hospital) AND (Title resilien*) OR (Title preparedness)	2000–2018
EBSCO	Title (hospital) AND title (resilien* OR preparedness OR risk mitigation OR continuity)	2000–2018
PubMed	(hospital [Title/Abstract]) AND (resilience OR preparedness OR risk mitigation OR continuity [Title])	2000–2018
Google Scholar	-	2000–2018

with "resilience," "resilient," "resiliency," "resilient*," "preparedness," "risk mitigation," and "continuity" by AND/OR connectors. The key words were searched in the titles and abstracts of published articles in Scopus, Web of Science, EBSCO, SAGE, Google Scholar, and PubMed. These databases are highly widespread and have been frequently used in the literature.[1,20] Table 1 shows more details of the search protocol.

The following inclusion criteria were used to select the related papers for the present study:

- The papers published in 2000–2018 were included because the issue of resilience has appeared in the related literature since 2000.
- The papers published in English were included because English is the dominant language of research in the field of resilience and hospital resilience.
- Different types of papers were included (eg, empirical, literature review, conceptual) to have a more comprehensive systematic literature review. Since this study intended to identify and synthesize various approaches to the factors that influence hospital resilience, all articles dealing with statistical analysis, documentation and qualitative composition, and hospital experiences from various disasters were examined disregarding their research methods.

Hence, articles on the resilience of nurses, doctors, patients, and hospital buildings, the ones examining patients' personal resilience in the face of illness or individual resilience of doctors and nurses in the face of patients were excluded. Furthermore, articles that investigated seismology due to geographical and geological specialization were excluded because they were outside the scope of the present study. Thus, only the studies that considered general hospital resilience with all of its components were selected to be analyzed

RESULTS

A total of 391 articles were retrieved through searching the key words in the selected online databases. In addition, 2 more papers were found by hand-searching and searching for cross-referencing citations. Duplicate papers (71) were removed from the results of the searches. Then, screening the titles of the papers, 213 were irrelevant because they investigated the resilience of nurses, doctors, patients, hospital buildings, and seismology, and thus they were excluded. Afterward, the abstracts of the remaining 109 articles were examined; 49 articles were selected to be reviewed. After that, 33 articles were excluded for the absence of eligible criteria for exclusion and inclusion. Finally, the selected articles were reviewed after applying the inclusion and exclusion criteria. According to the inclusion and exclusion criteria, these 16 articles (14 journal articles and 2 reports by the WHO) had dealt with factors that might have an influential role in hospital resilience (Figure 1). Moreover, the Critical Appraisal Skills Program (CASP) tools[21] were used to assess the quality of the selected articles. CASP tools present a number of questions that deal with some principles or assumptions of qualitative research. Figure 1 shows the strategy for searching and selecting the articles according to the PRISMA guidelines.

Details of each article and their special features, including authors, publication year, research method, and research population were evaluated. Table 2 provides the details of each article.

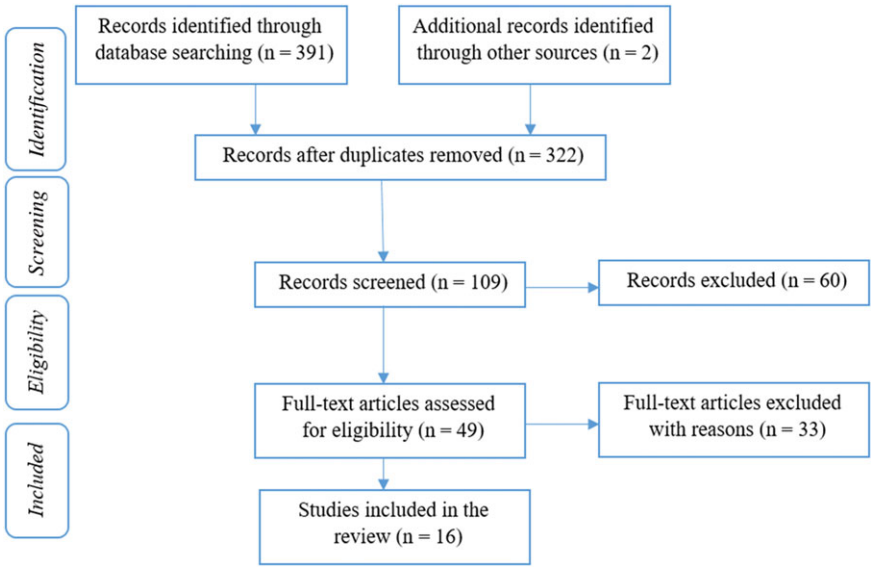
Data synthesis was performed through using content analysis to recognize what factors affect hospital resilience and how those factors might enhance and reduce hospital resilience. Content analysis describes some phenomena systematically and objectively and attempts to quantify phenomena.[22] In the present study, the theories from hospital resilience as well as resilience studies were used to codify and construct the primary framework. To achieve more reliability, 2 researchers independently read and coded the articles. Although the coding results were close to each other, they discussed the results and negotiated with each other about codes. Then, the articles were coded for the second round and the results improved. As coding proceeded, the primary framework was developed and refined; first, the emerging themes were identified, and then the factors influencing hospital resilience were specified based on the developed framework. Finally, the studies that described the challenges and drivers of hospital resilience were analyzed.

Review of the finally selected papers showed a steady growth of articles addressing hospital resilience, with a significant

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

FIGURE 1

Flow Diagram.



increase after the year 2013 (Figure 2). In addition, authors of the articles used the word *preparedness* more in the years before 2013 to convey the concept of hospital resilience. Moreover, when hospital resilience started to appear in the literature, the focus of the articles was on hospital preparedness; afterward, the focus shifted to measuring the general resilience and the lessons learned from hospital experiences. Preparedness relies exclusively on structural measures (eg, human, equipment) while it has little concern for hospital infrastructural safety and emergency services.[23] Hospital resilience includes structural components (eg, facility safety), non-structural components (eg, staff, medication, and equipment), emergency medical functions (eg, continuity of medical services) and disaster management capacity (eg, plan and procedure, crisis communication, community linkage).[16]

Regarding the methodologies used in the published papers, although some of them had used multiple methods (Figure 3), 4 major categories were identified: theorizing and conceptualization (7%), survey (43%), review (29%), and case study (21%). Our findings indicated that the survey method has received more attention, because this type of research describes the basic characteristics of the study population through investigating a sample and then generalizing the results to the whole population.[24] In addition, the survey is a good methodology to measure resilience in hospitals. The review method collects and submits documents through using a qualitative approach.[25] The review articles investigated hospital preparedness. Case study research is an inquiry that focuses on describing, understanding, predicting, and/or controlling an individual.[26] This type of article investigated hospital infrastructure.

The results also revealed that Southeast Asian countries had a special interest in hospitals' resilience compared with other countries. These countries are highly populated and they are highly exposed to disasters. In addition, according to the 2016 disaster report,[27] the countries reported to have the highest incidents are China, the United States, India, Indonesia, the Philippines, Vietnam, Japan, Pakistan, and Mexico. Therefore, it is justified why hospital resilience and preparedness are important to these mentioned countries. Table 2 provides more details on the special features of the reviewed articles, including author, publication year, research method, and research location.

To discuss the content of the existing literature on hospital resilience, the present study employed a comprehensive matrix as a conceptual framework. This matrix will help the readers get an overview of the study. A process perspective was observed in the literature on hospital resilience. The articles in the sample were clearly distributed according to the different process stages (ie, preparedness, response, and recovery and growth) and key components of hospital resilience (staff, infrastructure, management and logistics; Table 3). This framework can be used by hospital managers as a checklist of key factors that influence hospital resilience at different stages. It enables the hospital to keep providing health care services at the time of disaster.

Some papers showed that resilience consists of 3 stages[4,28] of preparedness, response, and recovery and growth. Through preparedness, the hospital maintains its function during disaster and provides predictions and awareness of the disturbances

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

TABLE 2

Data Extraction Sheet

Authors (year)	Journal	Purpose/Objectives	Research Method	Research Population
Adini et al., 2006	Prehospital and Disaster Medicine	Review the characteristics of contingency plans for mass-casualty incidents (MCIs) and models for assessing the emergency preparedness of hospitals	Review	Israel
McDaniels et al., 2008	Global Environmental Change	To explore applied decisions that can help make infrastructure systems more resilient to extreme events	Theoretical and Conceptual	Taiwan, Los Angeles, California, and Vancouver, British Columbia
Barbera et al., 2009	Disaster Medicine and Public Health Preparedness	Explores potential reasons for inconsistent emergency preparedness across the hospital industry	Review	United States
Sam et al., 2011	International Journal of Disaster Resilience in the Built Environment	To present a qualitative report on the implementation of activities aimed at reducing disaster risks through safer health facilities in the Western Pacific Region	Case study	Cambodia, Lao, the Philippines, and Vietnam
Djalali et al., 2013	Prehospital and Disaster Medicine	To compare hospital preparedness between Iran and Sweden, measured by functional capacity, using the WHO's hospital safety index.	Survey	Comparison between Iran and Sweden
Tang et al., 2014	Disaster Medicine and Public Health Preparedness	To identify from the literature common themes relating to the concept of hospital preparedness for emergencies to develop an agreed framework for evaluation	Review	–
Zhong et al., 2014a	Emergency Medicine	To define hospital resilience, build a preliminary conceptual framework, and highlight possible approaches to measurement	Review	–
Zhong et al., 2014b	BMC Health Services Research	To explore the status of resilience among tertiary hospitals in Shandong Province, China	Survey	China, Shandong Province
Achour et al., 2014	Disaster Management and Prevention	To explore major and potential challenges facing health care facilities operation, specifically those related to utility supplies; quantify the impact of utility supplies interruption on the operation of health care facilities through the development of an estimation model.	Case study	Japan
Chand and Loosemore, 2015	Construction Management and Economics	To explore the value of socio-ecological resilience theory in answering the research question of how hospital organizations can better learn from extreme weather events to improve the resilience of hospital infrastructure into the future	Case study	Sydney, Australia
Zhong et al., 2015	Journal of Health Services Researchand Policy	Develop a comprehensive framework of key indicators of hospital resilience	Survey	China
Jafar and Taneja, 2017	Public Health	To understand the status of business continuity planning (BCP) in hospitals in the National	Survey	India, Delhi

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

TABLE 2

Continued

Authors (year)	Journal	Purpose/Objectives	Research Method	Research Population
		Capital Territory (NCT) of Delhi. The article also focuses on the role played by hospitals during a disaster.		
Labarda et al., 2017	Disaster Prevention and Management: An International Journal	To describe the impact of Typhoon Haiyan on case hospitals delivery of services to meet the demand for emergency health services and medical care of survivors; and to draw out lessons on hospital resilience in disasters.	Survey	Philippines
Sumsuddin et al., 2018	Procedia Engineering	To investigate the hospital preparedness attributes and resilience indicators; to establish the relationship of preparedness attributes toward the hospital's resilience.	Survey	Malaysia

FIGURE 2

Number of Studies Based on the Published Year.

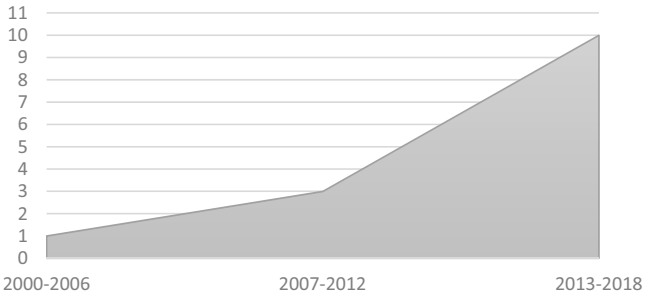
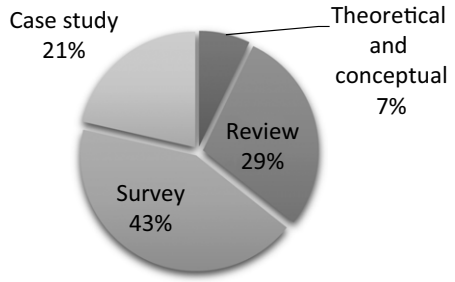


FIGURE 3

Research Method.



that will occur. In the response phase, the hospital's performance is at its lowest. The effective functioning of a hospital at this stage depends on its proper preparedness. After the disaster, the hospital should return to its original state and provide services to the patients (see Table 3).

In each stage, there are 4 areas of staff, infrastructure, management, and logistics, which constitute the Impact Factors Matrix (see Table 3). Each sheet of matrix shows the factors that influence hospital resilience. The following sections present these sheets.

PREPAREDNESS

Staff

Competency plays a significant role in the resilience and continuity of hospital services before, during, and after the occurrence of any disaster.[11,29] With competent staff, the provision of hospital services never stops.[29] Thus, it is important to ensure that staff are efficient because they have a positive effect on the preparedness of the hospital in emergency situations.[11] Staff training should focus on enabling them to manage patients' evacuation plans, to use activating alarms appropriately based on the type of incident, and to increase their responding speed.[11,14] These competencies should be built and improved by repeated emergency simulations and drills that involve a large group of staff, based on different natural and man-made scenarios.[12,14] Moreover, staff capacity building should encompass networking with different stakeholders, team working, and sharing experiences.[4,16,30]

Hospital Infrastructure

It includes different aspects like architectural, non-architectural (electrical systems, communication systems, emergency exit systems, etc.), and functional (access, internal circulation, security systems, utility systems, etc.).[10] According to the WHO, fostering standard protocols and operating procedures in hospitals is among the factors that have a great impact on

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

TABLE 3

Impact Factors Matrix.

Key Components	Process		
	Preparedness	Response	Recovery and Growth
Staff	• Training on roles and responsibilities[10,11,14,33] • Enough training and drills[1,3,4,8,9,11,14,16,33] • Risk perception[12,14,32]	• Workforce volunteerism[1,29]	• Learning from experiences[4,12,14,29,32]
Infrastructure	• Standard protocols or SOPs[3,4,9,10,12,14,29,30,32,34]	• Strategies for evacuation[4,11,16,33-34] • Access[4,10,14,29]	• Return equipment to pre-incident level[14,29]
Management	• Knowledge and skills in hospital disaster management[3,4,14,30] • Earmarked funds[8,11,12,14,29,33] • Disaster management planning[1,3,4,9-12,16,32,33] • Continuous surveillance and evaluation[1,3,8-11,14,16,30,33]	• Command system[1,16,29] • Communication system[4,10,14,29,33] • Continuity of medical care[1,9,16,33]	• Strategies for recovery and adaption[1,4,9-11,14,29,34]
Logistics	• Stockpiles management[3,4,9,11,12,14,30] • Surge capacity[1,4,9,11,12,14,16,33]	• Backup/duplicate systems[3,4,9,14,32,33,34] • Partnerships and collaborations[1,3,4,9,16,29,30]	• Support organizations and government for recovery [1,4,9,11,12,14,16,33]

resilience.[14,29] In addition, determining similar codes of signals in hospitals to communicate important messages can result in faster response and cooperation in case of a crisis involving an area.[14]

Management

In the preparedness phase, developing a plan for hospital disaster management by competent individuals has a great impact on hospital resilience.[14] Meanwhile, it is suggested to focus on the probable demands and capacity of available resources, as well as hospital in-crisis policies and procedures, and activation schemas in different anticipated scenarios.[30-32] In addition to the necessary planning, enough funds should be allocated for the training of human resources and maintaining essential equipment.[12] Fostering a knowledge and experience sharing system between managers at different levels of the hospital hierarchy is also of great value regarding hospital resilience.[4] Frequent assessment of the hospital emergency response plan[11] can develop warning and surveillance systems[1,3] and lead to more relevant response plans.[9]

Logistics

The hospital should prepare, store, maintain, and upgrade the required resources before an event occurs so that it can take care of many victims and continue service delivery.[12,31] Surge capacity for staff, equipment, pharmaceutical products, and physical space should also be considered in any disaster preparedness plan.[1,3,33]

RESPONSE

Staff

When an incident occurs, the hospital needs more staff to serve the growing number of victims. Therefore, organizing volunteer staffs or other eligible people in the response phase is crucial in hospital resilience.[29]

Infrastructure

Hospitals should be accessible from different directions during a disaster.[4,33] In addition, they should develop strategies for patients' protection and evacuation when necessary. Usually, emergency medical services performs patients' evacuation according to the priorities that have been set before.[3,4,11,16,33]

Management

The hospital must have an appropriate hierarchical command system, and the existence of a leader for the command system is essential to prevent chaos.[3,29] Establishing a communication system with other hospitals is required for the continuity of medical care or referring patients that need specific services. Moreover, communicating with other social and civic organizations (governmental or non-governmental), the hospital can help victims with other non-medical needs.[1,3,7]

Logistics

The performance of various supporting systems in a hospital (ie, water supply, electricity, and communication systems) is very influential in the process of service delivery.[32,34] A large

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

number of medical equipment, lighting, hospital information systems, and computers are dependent on electricity. Therefore, it must be determined whether the hospital has an emergency alternative for those supporting systems.[9] Other organizations and hospitals can facilitate medical services through networking and sharing equipment, staff, and other necessary resources.[29] A lack of proper interorganizational coordination will restrict the availability of sparse resources in a time-sensitive response to a disaster.[16]

RECOVERY

Staff

Hospital management can use lessons learned from past disasters to improve its resilience. They should incorporate the lessons in future staff training. In addition, such experiences can contribute to better planning for preparedness in future disasters.[12,32]

Infrastructure

It is important to check the hospital infrastructure as well as supplies and equipment in the recovery phase of an incident. Rapid replacement and maintenance of essential infrastructure, along with ensuring their efficacy, are crucial to restore hospital resilience.[7,29]

Management

The hospital should benefit from a rigorous recovery strategy to adapt to a new situation and be prepared as it was before.[4]

Logistics

Recovery needs time and sufficient resources. It is important for a crisis-hit hospital to gain the support of the government and other organizations. Hospitals need financial resources to return to their former optimal condition. Usually, government and the international community provide funds for the hospitals.[30] Moreover, the cooperation of other service-providing organizations can decrease the pressure on the hospital and provide the necessary time for the hospital to recover.[25]

DISCUSSION

This research has systematically reviewed the literature on the factors influencing hospital resilience. After reviewing the articles in detail, it became clear that recent articles have focused on all 3 resilience process phases (preparation, response, and recovery), whereas previous articles had only focused on hospital preparedness. It is indicated that, although the preparation phase is the most important phase of the resilience process, the response and recovery phases also need proper consideration. Focusing on factors that influence hospital resilience creates a pathway for hospitals to prevent disturbances and continue providing services during an event, and return to the pre-disaster situation as well. The degree to which a hospital considers those factors can affect the success or failure of the hospital resilience. Content analysis of the reviewed articles highlighted a lack of papers concerning each key component of hospitals that influence its resilience. The gap allowed us to present our framework that brings attention to 2 dimensions of hospital resilience: the resilience process phase (preparation, response, and recovery) and the key components of a hospital (staff, infrastructure, management, and logistics). By putting these 2 dimensions beside each other and identifying the factors that influence hospital resilience, we provided strategies for the development of hospital resilience. These strategies can be subsumed under the rubric of proactive, concurrent, and reactive strategies to manage hospital resilience. The presented framework will help readers get an overview of the study. In addition, it can be used by hospital managers as a checklist for key factors that influence hospital resilience in different phases; therefore, they can take actions to keep providing services in the time of disasters.

The results also show that proper training and drills directed to empower hospital staff have gained the most attention in many papers. Developing standard policies and procedures for maintaining hospital infrastructure in the preparedness phase has also been shown to be of great interest. Proactive disaster management planning has been underlined in many studies. Moreover, advancing surge capacity by providing rapid access to necessary resources has been considered in the logistics section.

There are some limitations to this study. Exclusion criteria were focused on the overall resilience of the hospital; while obtaining more precise results, some other factors such as the resilience of individuals, structural resilience, and so forth, were to be considered. Since the concept of resilience has been taken from the management field, it was not used to search for online medical databases. This limits the scope of this search.

CONCLUSIONS

This study presents a conceptual framework for understanding hospital resilience. The framework links different phases of the resilience process (preparedness, response, and recovery) with different dimensions of hospitals (staff, infrastructure, management, and logistics) to mention the factors influencing hospital resilience. The findings will have implications for hospital managers. While in recent years, disruptive events (of domestic or foreign origin) have significantly been increased, the framework can be used to create a comprehensive plan for promoting hospital resilience. In addition, the present authors suggest that future research can address the social determinants influencing the resilience of the hospital (eg, economics, politics, and culture), as well as the hospital supply chain.

About the Authors

Industrial Management, Management Faculty, University of Hormozgan, Bandar Abbas, Iran (Ms Khademi Jolgehnejad); Department of Industrial Management,

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press

Management Faculty, University of Hormozgan, Bandar Abbas, Iran (Dr Ahmadi Kahnali); and Social Determinants in Health Promotion Research Center, Hormozgan Health Institute, Hormozgan University of Medical Sciences, Bandar Abbas, Iran (Dr Heyrani).

Correspondence and reprint requests to Reza Ahmadi Kahnali, Department of Industrial Management, Management Faculty, University of Hormozgan, Bandar Abbas, Iran (e-mail: rahmadi.hormozgan@gmail.com).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

REFERENCES

1. Tang R, Fitzgerald G, Hou XY, et al. Building an evaluation instrument for China's hospital emergency preparedness: a systematic review of preparedness instruments. *Disaster Med Public Health Prep*. 2014;8:101-109.
2. Vugrin ED, Verzi SJ, Finley PD, et al. Modeling hospitals' adaptive capacity during a loss of infrastructure services. *J Healthc Eng*. 2015;6:85-120.
3. Zhong S, Hou XY, Clark M, et al. Disaster resilience in tertiary hospitals: a cross-sectional survey in Shandong Province, China. *BMC Health Serv Res*. 2014;14:135-145.
4. Chand AM, Loosemore M. A socio-ecological analysis of hospital resilience to extreme weather events. *Constr Manag Econ*. 2015;33:907-920.
5. Low SP, Gao S, Wong GQE. Resilience of hospital facilities in Singapore's healthcare industry: a pilot study. *Int J Disaster Resil Built Environ*. 2017;8:537-554.
6. Cimellaro GP, Malavisi M, Mahin S. Factor analysis to evaluate hospital resilience. *J Struct Eng*. 2018;4:04018002.
7. Bruneau M, Chang SE, Eguchi RT, et al. A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthq Spectra*. 2003;19:733-752.
8. World Health Organization (WHO). *Operational framework for building climate resilient health systems*. Geneva: WHO; 2015.
9. Zhong S, Clark M, Hou XY, et al. Development of key indicators of hospital resilience: a modified Delphi study. *J Health Serv Res Policy*. 2015;20:74-82.
10. Samsuddin NM, Takim R, Nawawi AH, et al. Disaster preparedness attributes and hospital's resilience in Malaysia. *Procedia Eng*. 2018;212:371-378.
11. Adini B, Goldberg A, Laor D, et al. Assessing levels of hospital emergency preparedness. *Prehosp Disaster Med*. 2006;21:451-457.
12. Barbera JA, Yeatts DJ, Macintyre AG. Challenge of hospital emergency preparedness: analysis and recommendations. *Disaster Med Public Health Prep*. 2009;3:74-82.
13. Schreiber S, Yoeli N, Paz G, et al. Hospital preparedness for possible nonconventional casualties: an Israeli experience. *Gen Hospital Psychiatry*. 2004;26:359-366.
14. Jafar E, Taneja U. Business continuity planning – a survey of hospitals in Delhi. *J Public Health*. 2017;25:699-709.
15. Takim R, Samsuddin NM, Nawawi AH. Assessing the content validity of hospital disaster resilience assessment instrument. *Jurnal Teknologi*. 2016;78:35-42.
16. Zhong S, Clark M, Hou XY, et al. Development of hospital disaster resilience: conceptual framework and potential measurement. *Emerg Med J*. 2014;31:930-938.
17. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6:e1000097.
18. Xiao Y, Watson M. Guidance on conducting a systematic literature review. *J Plan Educ Res*. 2019;39:93-112.
19. Jesson J, Matheson L, Lacey FM. *Doing your literature review: traditional and systematic techniques*. London: Sage; 2011.
20. Tukamuhabwa BR, Stevenson M, Busby J, et al. Supply chain resilience: definition, review and theoretical foundations for further study. *Int J Prod Res*. 2015;53:5592-5623.
21. Critical Appraisal Skills Programme. CASP qualitative checklist. 2019. https://casp-uk.net/wp-content/uploads/2018/01/CASP-Qualitative-Checklist-2018.pdf. Accessed April 25, 2019.
22. Evans D, FitzGerald M. Reasons for physically restraining patients and residents: a systematic review and content analysis. *Int J Nurs Stud*. 2002;39:735-743.
23. Nelson C, Lurie N, Wasserman J, et al. Conceptualizing and defining public health emergency preparedness. *Am J Public Health*. 2007;97:9-11.
24. Fowler FJ Jr. *Survey research methods*. London: Sage; 2013.
25. Barrett E, Bolt B, eds. *Practice as research: approaches to creative arts enquiry*. London: IB Tauris; 2014.
26. Woodside AG. *Case study research: theory, methods and practice*. Boston: Emerald Group; 2010.
27. Guha-Sapir D, Hoyois P, Wallemacq P, et al. *Annual disaster statistical review 2016: numbers and trends*. Brussels: Centre for Research on the Epidemiology of Disasters; 2016.
28. Sheffi Y, Rice JB Jr. A supply chain view of the resilient enterprise. *MIT Sloan Manag Rev*. 2005;47:41-49.
29. Labarda C, Labarda MDP, Lamberte EE. Hospital resilience in the aftermath of Typhoon Haiyan in the Philippines. *Disaster Prev Manag*. 2017;26:424-436.
30. Sam A, Geroy L, Pesigan AM. Disaster risk reduction for health facilities in the Western Pacific Region. *Int J Disaster Resil Built Environ*. 2011;2:268-277.
31. Cristian B. Hospital resilience: a recent concept in disaster preparedness. *J Crit Care Med*. 2018;4:81.
32. McDaniels T, Chang S, Cole D, et al. Fostering resilience to extreme events within infrastructure systems: characterizing decision contexts for mitigation and adaptation. *Glob Environ Change*. 2008;18:310-318.
33. Djalali A, Castren M, Khankeh H, et al. Hospital disaster preparedness as measured by functional capacity: a comparison between Iran and Sweden. *Prehosp Disaster Med*. 2013;28:454-461.
34. Achour N, Miyajima M, Pascale F, et al. Hospital resilience to natural hazards: classification and performance of utilities. *Disaster Prev Manag*. 2014;23:40-52.

https://doi.org/10.1017/dmp.2020.112 Published online by Cambridge University Press