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Trauma hospital preparedness against natural and man-made disasters: a cross-sectional study

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Abstract

Objective The purpose of this study is to investigate the trauma hospital preparedness in disasters of 2019.

Methods A cross-sectional study was conducted in two qualitative and quantitative phases. Data were collected retrospectively in the quantitative part through census and in the qualitative part through semi-structured interviews. Quantitative and qualitative data were analyzed using descriptive statistics and content analysis, respectively.

Results The Hazard of the trauma hospital in 2019 were divided into two categories: natural (floods) and man-made (floods, street riots, incidence of COVID-19). 93% of all hazards were attributed to the spread of COVID-19, 5.4% to disturbances and 1.6% to floods. In the quantitative part, from 227 extracted codes, two main themes were finally classified titled " Hospital's functional experience in response " and "Challenges and functional corrective solutions ".

Conclusions Due to the exhaustion of hospitals, the accident proneness of Iran and as well as insufficient attention to safety, it is essential that hospitals, especially trauma hospitals, have disaster preparedness plans. By using these comprehensive preparedness, managers can reduce the consequence of disasters and achieve proper preparation.

Keywords Disaster preparedness, Trauma hospital, Disaster management, Natural disasters, Man-made disasters

Introduction

Disaster, including floods, earthquakes, extreme weather events, and epidemics, are increasing worldwide [1], resulting in approximately 40,000 to 50,000 fatalities annually [2]. Iran is amongst the most vulnerable countries to accidents and disaster globally. Furthermore, nearly 90% of Iran's population faces exposure to the perils associated with earthquakes and floods [3].

Over the past few decades, there has been a substantial increase in the frequency, magnitude, and impact of natural disaster, causing immense destruction to both societies and infrastructure [4]. Unexpected events and disaster occur regardless of borders and the time of their occurrence is never known, so that the occurrence of disaster around the world has doubled and the number of people who have been injured has tripled in the last

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thirty years. Also, no person or country around the world is safe from their consequences [5].

At the international level, there is a significant emphasis on investing in disaster preparedness to mitigate the vulnerability of societies and enhance their capacity to respond and recovery phases of disaster cycle [6]. Because disaster increase people's need for health care; It's obvious, the role of healthcare centers is crucial for definitive care and rescue of the injured [7].

Healthcare facilities, particularly hospitals, play a critical role in disaster response by providing emergency treatment and trauma care. Healthcare facilities are expected to be available and working at their maximum capacity during and also after disaster [8]. However, healthcare infrastructures, especially in developing countries, are susceptible to the impacts of natural disaster. The structural vulnerability of hospitals often leads to a substantial disruption in the delivery of healthcare services [9].

The implementation of appropriate preparedness and policies, designing and building resilient hospitals, the assessment of hospital safety, training, protecting personnel and equipment, and strategic planning to respond in emergency situations are essential components for ensuring the provision of safe healthcare services [8]. Furthermore, the availability of a comprehensive and standardized practical guide for hospitals to follow during internal and external incidents significantly enhances their preparedness for natural disaster [10, 11]. Meeting the service needs of the hospital during unexpected events often depends on the whole system being ready for service not only within the hospital but also throughout the city [12].

The adoption of innovative approaches, such as fostering awareness of desired standards among hospital staff, equips the hospital with the essential readiness and expertise to respond efficiently to accidents and disaster, utilizing optimal diagnostic and operational capacities. Hospital staff's awareness of safety issues and the performance of technical systems will significantly increase their efficiency [13], which are fundamental factors in the preparation and prevention of emergencies and disasters [14].

Callaway (2020) emphasizes the significance of hospital preparedness for emergencies and disasters as a critical issue. The author highlights the necessity of adequately preparing both hospitals and pre-hospital emergency services to ensure an effective response to injured individuals [15].

Wei (2020) has highlighted the importance of hospitals' readiness to admit a significant number of psychologically affected patients during flood risk disaster. Furthermore, the occurrence of floods and the resulting damages contribute to a rise in the number of patients diagnosed with schizophrenia [16].

In developing countries, the insufficient allocation of funds for natural disaster has increased vulnerability in health-medical and social and economic fields [17]. Therefore, in order to save human lives and reduce damages caused by disasters, it is necessary to identify, calculate and express the factors and their impact in a very simple way for the general public, policy makers, managers, etc [18].

According to a review and meta-analysis conducted by Baziar (2020), the overall readiness of hospitals in Iran was found to be 53%. The specific readiness percentages in different areas were as follows: emergency (62%), communication (57%), security (54%), education (57%), logistics (65%), human resources (52%), management and command (64%), evacuation (44%), and non-structural (57%). These findings suggested that that to improve the performance of hospital preparedness against disasters, it is necessary to improve the performance of all fields [19].

Considering the need to strengthen and eliminate the deficiencies in the strength of hospitals and health services centers in most provinces of the country and due to the age of the structure, exhaustion and reduced safety, as well as the preparedness of hospitals against the disasters; current study shares the trauma hospital's experiences in dealing with the multiple disasters it faced in 2019. Also, this study examines the preparedness of Shahid Rajaei Hospital - which is the only trauma hospital in the south of the Iran country - against the disaster of 2019.

Method

The study was conducted in two phases, consisting of quantitative and qualitative research methods.

Quantitative phase

Research context

Shahid Rajaei Hospital, located in Shiraz, serves as a referral center for Multi-trauma patients. The hospital has a total infrastructure spanning 22,500 square meters.

The first phase comprises 8,500 square meters and consists of six floors dedicated to treatment departments, specialized clinics, Para clinical units, administrative units, laboratories, radiology, and physiotherapy.

The second phase covers 14,000 square meters and includes inpatient departments, intensive care units (ICU), CT SCAN facilities, operating rooms, clinics, laboratories, radiology services, as well as administrative units.

Data collection

Information from 3,617 patients was collected. Data collection for this study was conducted using a census approach, which involved all patients and injured

individuals who sought treatment at the trauma hospital's emergency department. This included individuals referred personally, transported via ambulances, or transferred from other healthcare facilities. Moreover, all patients that affected by both natural and man-made hazards in 2018 and recorded in the hospital's HSE (Health, Safety, Environment) management software were examined.

Quantitative data analysis was carried out utilizing the SPSS version 22 software. Descriptive statistics, such as frequency and percentage, were employed to analysis the data.

Qualitative phase

A total of 17 interviews were conducted between June and September 2019. In the qualitative phase of the study, purposive sampling was conducted to select experts and managers who held executive positions (planning, administrative-financial, operation, support, and command) in the Hospital Incident Command System (HICS). These individuals were also selected based on their involvement in responding to the risks of Shahid Rajaei Hospital (trauma) in 2019. The selection criteria included active participation in at least one operation related to the hospital's response to disasters. Data collection took place one year after hazards' event.

Table 1 Frequency of patients caused by natural and man-made hazards in trauma hospital in 2019

Variable Type	COVID-19	Disruptions	Floods
	N (%)	*N* (%)	*N* (%)
Gender:			
Male	2408	160	38
Female	955	36	20
Insurance Type:			
Health insurance	542	43	15
Social Security insurance	678	31	24
Armed Forces Social Security insurance	106	7	-
Traffics	873	-	-
Oil Company	12	2	-
Others	25	-	-
Free	1128	114	19
Age:			
< 20 years old	473	21	9
20–40 years old	1818	151	17
> 20 years old	1072	76	32
Nationality:			
Iranian	772	185	55
Non-Iranian	29	10	3
Unknown	2562	1	-
Admission Type:			
Outpatient	1210	102	43
Inpatient	2153	94	15

For the data collection method employed semi-structured interviews. After obtaining informed consent from the participants and coordinating with the secretary of the emergency and Disaster Committee of the hospital, the interviews were conducted individually in a suitable place. The purpose and the time of the interview were coordinated with the participants and they were assured that the principle of confidentiality was taken into account and they could withdraw at any stage of study if they did not want to.

To ensure consistency and minimize individual errors, an interview guide was developed. The guide included questions such as:

- What hazard or emergency situation did you have last year that changed the number of patients and ill patients referred to the trauma hospital?
- How was the hospital's performance in terms of weaknesses and strengths during that time?
- Please share your experiences regarding achievements, good performances, obstacles, and barriers to providing services after natural and man-made d in recent years at the trauma hospital.

All interviews were recorded with the participant's consent, and the full text of the interviews was transcribed verbatim.

Rigor

To confirm validity, according to the member review method, the transcripts of the interviews were returned to eight participants to prevent possible errors and allow participants to complete or correct their statements, and ultimately reach an agreement between the researchers and the participants. The use of the recorder and having the same researcher and note-taker in all the interviews helped to ensure dependability. All interviews were based on an interview guide. The content validity of guide questions was confirmed by five experts in the field of qualitative studies. The purposive sampling method was used to increase transferability.

Qualitative data analysis was performed using the content analysis method and through the MAXQDA version 10 software. Codes and categories were adjusted, compared, and the relationships between categories and sub-categories were identified and included in a table. Additionally, to complete the qualitative part, the minutes of the disaster committee during the last year were also analyzed.

Findings

Table 1 Displays the frequency distribution of patients affected by natural and man-made disasters at the trauma hospital in 2019, categorized by demographic

characteristics such as age, gender, type of admission, type of insurance coverage, and nationality. Technological and man-made hazards with a score of 52.38 and geological hazards with a score of 19.05 had the lowest probability of an event among the groups of hazards in the hospital. From the aspect of evaluating non-structural safety of the hospital according to location, electrical systems and water supply system with the highest score of 75, and office equipment and furniture and storage; medical gas systems; infrastructure protection, access and physical security had the lowest score with 50 points. Among the various areas of emergency and disaster management, patient care and support services with a score of 83.33 and information and communication management with 50 points scored the highest and lowest scores, respectively.

Qualitative phase

A total of 17 interviews were conducted between June and September 2019. The duration of the interviews was between 45 and 120 min. Out of the interviewees, 14 held executive positions and had responsibilities within the incident command system, including roles such as Hospital Inccident Commander (Hospital Head), First Deputy Commander (Hospital Director), Chief of Safety, Public Relations, Technical, Coordination, Head of Operations and their first and second deputies, Chief and First Deputy of Support, Chief of Planning, Chief of Finance, and Head of Administration. Additionally, 10 individuals from the operation department, consisting of 4 doctors and 6 nurses, were also included in the interviews. The demographic characteristics of the participants displayed in Table 2.

As a result of the content analysis, 227 initial codes and finally two main themes were classified under the title "Rajai Hospital's functional experience in response to disasters" and "Challenges and functional corrective solutions of trauma hospitals' preparedness for disasters" (Supplementary Material Tables 1, 2 and 3).

Table 2 Demographic characteristics of the participants in the qualitative phase

Demographic Characteristics		Number (%)
Gender	Female	7 (41.2)
	Male	10 (58.8)
Education Level	Bachelor's	9 (55)
	Postgraduate	7 (43)
	Post-doctorate	1 (2)
Age	40 – 25 years old	9 (52.9)
	55 – 40 years old	4 (23.5)
	70 – 55 years old	4 (23.5)

Discussion

In the present study, the preparedness of the trauma hospital in facing natural and man-made disasters in 2019, which coincided with the onset of the COVID – 19 disease, was investigated. The results obtained from all the patients of the hospital in 2019 showed that although the COVID disease appeared at the end of the year (the last month of the year), the largest number of patients was attributed to COVID 19, and more than half of them were men. In terms of type of admission and nationality, the highest percentage of clients were Iranian and were hospitalized. Also, the age group of 20 to 40 years old had the highest percentage.

Among the injured from the riots, the majority were men, 77% of whom were in the age group of 20–40 years old, and about half of them were admitted as outpatients. This shows that young people are interested in emotional movements and street disturbances are more for the youth group, street conflicts can cause a significant amount of active human resources in the society to be disturbed and even irreparable injuries.

In April 2019, there were two floods, and more than half of the patients were men, and most of them were outpatients. The age group older than 40 years old were the most clients. In all three types of accidents and disasters, social security was the most type of insurance coverage, which indicates the variety of commitments and its high service coverage.

It is inevitable to prepare hospitals as vital centers when disasters occur. During the first 24 to 48 h after emergency and disasters, the greatest need for health care is felt, with 85 to 95% of survivors requiring aid and health care in the first 24 h. Therefore, all hospitals must be prepared to manage and provide services so that they can provide timely health services to affected patients in order to reduce the death rate and increase the number of survivors [19].

It was recommended to implement trial and training programs for hospital staff, proper management of resources and training in the field of optimal use of existing equipment to improve the performance of personnel and better preparedness of Iranian hospitals to deal with disasters [20].

As our findings also showed that the optimal management of available resources including physical, human and equipment resources in the field of hospital services is effective in improving the preparedness of hospitals against disasters.

In the present study, there was no mention of disaster and disaster management training programs and the role of personnel training in the occurrence of emergencies. While in a descriptive study, the results showed that hospital managers should train their personnel in disaster management by preparing educational programs; By increasing their knowledge and skills regarding the

incident command system, their role and position at the time of incidents to ensure their active participation and effective response [21].

Examining disaster response capability and preparedness of 41 hospitals in Iran shows simply having a program without skill enhancement, change of attitude and knowledge cannot help in dealing with the problems caused by emergencies and disasters [22].; This study shows that As in the present study, patients, personnel and information sources were affected by the direct and indirect consequences of the 2019 disasters.

Studies have shown that many organizations and countries use a specific model for dealing with radiation incidents, which includes an intertwined network of six elements: Manpower, equipment, physical space, structure, processes and instructions and coordination inside and outside the hospital [23].

In the current study, these six areas were regularly mentioned by the interviewees under the headings of challenges during incidents and above: "Lack of intersectoral cooperation and coordination", "issues related to hospital processes", "lack of human resources", "lack of facilities and equipment" and "inappropriate physical space".

In the study of hospitals of Isfahan University of Medical Sciences, the state of disaster preparedness and limitations were reported at a favorable level, and only the lack of new technologies in disaster conditions was recorded as a limitation. Therefore, the hospital should not only invest more to provide and maintain new technologies but also to use them in the conditions of emergencies and disasters, but also provide arrangements for training and empowering hospital employees to use these technologies [24].

Iran is one of the ten Vulnerable country countries in the world and ranks fourth in Asia after India, Bangladesh and China. The need for hospitals to be prepared to deal with disasters reveals the necessity of designing a basic plan to deal with expected and unexpected disasters in hospitals. Designing a specific plan with scientific and accurate management in all stages (before, during and after) of disasters through preventive measures and formation of specialized management groups and committees, training and familiarization of employees and conducting periodical maneuvers to prepare and face against disasters were suggested [25].

Over the past years, the number of disasters around the world has doubled and the amount of damages and personal injuries caused by them has increased three times. Therefore, the preparation of hospitals plays a vital role in reducing injuries. Disaster management programs should be among the priorities of medical centers and have an active and dynamic organizational structure for the preparation of units, facilities and human resources [26].

The interviewees in our study pointed out the importance of providing facilities and having capable human resources more than the necessity of disaster management programs.

The findings showed that the lack of competent human resources was one of the problems faced by the studied hospital in recent one-year disasters of the studied hospital. This reveals the role of hospital staff training.

It is very important that hospitals are well prepared to deal with disasters in order to minimize its adverse effects. The lack of emergency plans and insufficient availability of resources were identified as factors influencing the level of preparedness. Three other critical factors that affect the level of preparedness of hospitals against disasters are the lack of knowledge of personnel about emergency management and operational methods of emergency in hospitals, lack of experience and lack of training programs for hospital staff [27].

In the current study, the strengthening of the functional support system was proposed as one of the functional corrective solutions in the field of hospital preparedness for natural and man-made hazards, which included six areas: Providing welfare and motivational facilities, strengthening the morale of personnel, providing and developing the required physical space, facilitating physical access to the hospital, providing access to facilities and equipment, and strengthening the information system.

The challenges faced by hospitals during the outbreak of an epidemic such as COVID-19 indicate the lack of proper preparation of hospitals for emerging and re-emerging risks. Tehran hospitals need to have enough medical equipment and supplies to prevent disappointment in providing services and support needed by COVID-19 patients Also, the functional readiness of Tehran hospitals mainly revolves around four indicators including medical equipment, emergency medicine, sufficient space for beds and advanced medical information system [28].

Since the effects of disasters are disproportionate, there is a need for effective pre-, during- and post-event planning. Effective disaster management requires a multidisciplinary team to address medical needs; mental health and rehabilitation; disaster management training; shelter and essential supplies; adhering to the principles of health and nutrition during relief activities. Disasters usually disrupt the uninterrupted flow of medical and pharmaceutical supplies and hence require a competent logistics manager [29].

According to the opinions of the interviewees, provision and access to facilities and equipment, cooperation and coordination between personnel were functional corrective measures in the field of hospital preparedness for emergencies and disasters. During the COVID-19 era,

control and coping measures, including protective measures and ensuring the welfare of personnel, were carried out. This was while the hospital was facing problems such as personnel training issues, involvement of officials in non-executive work, facing shortages and limitations, and personnel protection, welfare and security problems.

Conclusion

The analysis of the preparedness of the studied hospital against the emergencies and disasters that occurred in 2019 showed that disaster management programs should be part of the priority actions of hospitals, especially trauma centers. The analysis of the preparedness of the studied hospital against the emergencies and disasters that occurred in 2018 showed that emergency and disaster management programs should be part of the priority actions of hospitals, especially trauma centers.

The risks of the hospital are different according to the geographical location of each hospital, and since the number of dangerous disasters are large, it is not possible to plan for all of them. Fortunately, there is a lot of commonality between different disasters, which should be considered and planned based on the comprehensive disasters management. In addition, it is better for the hospital to plan for the main risks it is exposed to. This includes forecasting, prevention, preparation to face it, coping with it through the formation of disaster management team and the training of forces and its trial implementation, and finally a written plan for reconstruction.

Also, through these comprehensive programs, hospital managers can reduce the possible effects of disasters on various aspects of the hospital, and obtain proper preparation in response to disasters. Ensuring the quantity and quality of human, physical, equipment and information resources is one of the basic requirements of the hospital to cope with disasters.

Abbreviations

HICS Hospital Incident Command System
HSE Health, Safety, Environment
ICU Intensive Care Units

Supplementary Information

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Supplementary Material 1

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Author contributions

L.M., and R.B conceived of the presented idea. L.M. was involved in planning and supervised the work. SH.P.M.S and F.M. collected the data. R.B and M.S performed the data analysis and drafting of the manuscript. L.M and R.B revised the manuscript. All authors read and approved the final manuscript.

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Data availability

All data generated or analysed during this study are included in this published article [and its supplementary information files.

Declarations

Ethics approval and consent to participate

Ethical approval from the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1400.126.). Requested and received. After explaining the purpose of the study, participants were asked to complete and sign an informed consent form. This study also adheres to the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Watson JT, Gayer M, Connolly MA. Epidemics after natural disasters. Emerg Infect Dis. 2007;13(1):1–5.
2. Ritchie H, Rosado P, Roser M. Natural disasters. Our world in data. 2022.
3. Parsaei M, Khankeh H, HabibiSaravi R, Hosseini SH. Hospital disaster preparedness in Mazandaran Province, Iran 2017. J Mazandaran Univ Med Sci. 2019;28(168):108–17.
4. Islam MZ, Wang C. Cost of high-level flooding as a consequence of climate change driver? A case study of China's flood-prone regions. Ecol Ind. 2024;160:111944.
5. Organization WH. Risk reduction and emergency preparedness: world health organization six-year strategy for the health sector and community capacity development. World Health Organization (WHO); 2007.
6. Kanteler D, Bakouros I. A collaborative framework for cross-border disaster management in the Balkans. Int J Disaster Risk Reduct. 2024;108:104506.
7. Verheul ML, Dückers ML. Defining and operationalizing disaster preparedness in hospitals: a systematic literature review. Prehosp Disaster Med. 2020;35(1):61–8.
8. Khirekar J, Badge A, Bandre GR, Shahu S. Disaster preparedness in hospitals. Cureus. 2023;15(12):e50073.
9. Mojtahedi M, Sunindijo RY, Lestari F, Wijaya O. Developing hospital emergency and disaster management index using Topsis method. Sustainability. 2021;13(9):5213.
10. Mirzaei S, Eftekhari A, Mohammadinia L, Dehghani Tafti AA, Norouzinia R, Nasiriani K. Comparison of the effect of lecturing and tabletop exercise methods on level of preparedness of nurses against natural disasters. J Holist Nurs Midwifery. 2020;30(1):17–26.
11. Nofal A, Alfayyad I, Khan A, Al Aseri Z, Abu-Shaheen A. Knowledge, attitudes, and practices of emergency department staff towards disaster and emergency preparedness at tertiary health care hospital in central Saudi Arabia. Saudi Med J. 2018;39(11):1123.
12. Li X, Wang Y. [Retracted] construction of urban flood disaster emergency management system using scenario construction technology. Comput Intell Neurosci. 2022;2022(1):8048327.
13. Mehta S. Disaster and mass casualty management in a hospital: how well are we prepared? J Postgrad Med. 2006;52(2):89.
14. Samei B, Babaie J, Tabrizi JS, Sadeghi-bazargani H, Azami-Aghdash S, Derakhshani N, et al. Factors affecting the functional preparedness of hospitals in response to disasters: A systematic review. Bull Emerg Trauma. 2023;11(3):109–18.
15. Callaway DW, Burstein JL. Operational and medical management of explosive and blast incidents. Springer; 2020.

16. Wei Q, Zhang X, Yi W, Pan R, Gao J, Duan J, et al. Association between floods and hospital admissions for schizophrenia in Hefei, China: the lag effects of degrees of floods and time variation. Sci Total Environ. 2020;698:134179.
17. Bidaki MZ, Balalimood M. Bioterrorism and biological warfare, from past to the present: A classic review. J Birjand Univ Med Sci. 2015;22:03.
18. Zarei V. Emergency preparedness of hospitals in Tehran and its relation with crisis management measures. Int J Med Res Health Sci. 2016;5(9S):471–8.
19. Bazyar J, Pourvakhshoori N, Safarpour H, Farrokhi M, Khankeh HR, Daliri S, et al. Hospital disaster preparedness in Iran: a systematic review and meta-analysis. Iran J Public Health. 2020;49(5):837.
20. Alruwaili A, Islam MS, Usher K. Hospitals disaster preparedness and management in the Eastern Province of the Kingdom of Saudi Arabia: a cross-sectional study. Disaster Med Pub Health Prep. 2022;16(3):1038–45.
21. Hosseini SM, Bahadori M, Raadabadi M, Ravangard R. Ranking hospitals based on the disasters preparedness using the TOPSIS technique in Western Iran. Hosp Top. 2019;97(1):23–31.
22. Najafbagy R. The crisis management capabilities and preparedness of organizations: a study of Iranian hospitals. Int J Manage. 2011;28(2):573.
23. Ghaedi H, Nasiripour A, Tabibi SJ. Hospital preparedness in radiation crisis in selected countries and developing a conceptual model for Iran. ISMJ. 2018;21(5):393–408.
24. Yarmohammadian MH, Alavi A, Ahmadi F, Fatemi M, Moghadasi M. An investigation of the status of preparedness and crisis management restrictions in hospitals of Isfahan university of medical sciences. Int J Health Syst Disaster Manage. 2016;4(2):58.
25. Ojaghi Sh, Nourizadeh S, Mahboubi M, Khazaei AAR. GH.A. N. Disaster crisis handling preparendess level of hospitals in Kermanshah. J Jermanshah Univ Med Sci. 2009;13(3):267–74.
26. Ezzati E, Kaviannezhad R, Karimpour H, Mohammadi S. Preparedness of crisis and disaster management in social security hospitals in Kermanshah in 2016: A short report. J Rafsanjan Univ Med Sci. 2016;15(6):583–90.
27. Alruwaili A, Islam S, Usher K. Disaster preparedness in hospitals in the middle East: an integrative literature review. Disaster Med Pub Health Prep. 2019;13(4):806–16.
28. Moheimani A, Sheikh R, Hosseini SMH, Sana SS. Assessing the preparedness of hospitals facing disasters using the rough set theory: guidelines for more preparedness to Cope with the COVID-19. Int J Syst Science: Oper Logistics. 2022;9(3):339–54.
29. Sapkota B, Shrestha S, Khorram-Manesh KCB. Disaster management and emergency preparedness in Low-and Middle-Income countries. Encyclopedia of evidence in pharmaceutical public health and health services research in pharmacy. Springer; 2023. pp. 1–22.

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