ORIGINAL RESEARCH ARTICLE

Evaluation the Preparedness of Students of Iran University of Medical Sciences in the field of Natural Hazards

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Abstract

Background Preparedness before natural disasters is critically important. University students in medical sciences represent the largest group of future healthcare providers and often serve as first responders to disaster-related injuries. This study aimed to assess the level of preparedness for natural hazards among students of Iran University of Medical Sciences.

Methods This descriptive cross-sectional study was conducted in 2023 among students of Iran University of Medical Sciences. A total sample of 680 participants was determined using a statistical formula. Data were collected using a demographic information checklist and a researcher-developed questionnaire on preparedness for natural hazards. The data were analyzed using SPSS version 24, applying descriptive statistics, independent t-tests, and analysis of variance (ANOVA).

Results The mean overall preparedness score was 18.81 ± 4.61, reflecting a moderate level of readiness. The mean component scores were 5.23 ± 2.21 for floods, 5.31 ± 1.79 for earthquakes, 4.40 ± 1.51 for droughts, and 3.86 ± 2.42 for extreme weather hazards. Overall, 69.3% of students demonstrated a moderate level of general preparedness. A significant association was observed between preparedness scores and prior experience in disaster relief.

Conclusion The findings suggest that students had a moderate level of preparedness for natural hazards. Targeted interventions are required to enhance their readiness. From a public health perspective, incorporating disaster risk reduction training as a standard component of university curricula could improve students' knowledge and promote behavioral change. This recommendation is particularly relevant for policymakers and academic institutions seeking to strengthen future healthcare response capacity.

Keywords Hazards, Iran, Natural disasters, Preparedness, Students

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1 Introduction

Natural hazards are naturally occurring events that can cause harm to people or the environment. These hazards are broadly categorized into two types: geophysical and biological.[1] Disasters such as floods, earthquakes, and droughts are inevitable and have historically inflicted substantial damage on human societies. Rapid and effective responses in the initial hours following a disaster can significantly reduce casualties and complications, underscoring the importance of preparedness and prompt action in mitigating disaster impacts.[2]

Iran is exposed to both natural and human-made hazards, resulting annually in an average of 3,000 deaths and affecting approximately 1.5 million people.[3] Owing to its geographical location, Iran is considered one of the most disaster-prone developing countries, ranking among the ten most vulnerable nations globally. Nearly 90% of its population is at risk of exposure to natural disasters. Over recent decades, the country has frequently experienced local floods and moderate earthquakes, with a major national disaster occurring roughly every ten years. During the past three decades, natural disasters have claimed an average of 2,689 lives annually and caused economic losses estimated at 737 million USD.[4]

Preparedness before encountering disasters is therefore crucial. Preparedness refers to the set of measures and actions taken before a crisis occurs to ensure an organized, effective, and timely response. Its objective is to understand what actions to take, how to implement them, and how to do so efficiently using available resources. By strengthening preparedness, systems, guidelines, and resources can be established to deliver rapid and coordinated assistance to victims, facilitating effective relief and recovery efforts.[5]

Preparation, which encompasses planning, education, and research, represents a vital phase in disaster management and has long been a global concern. Integrating preparedness within sustainable development frameworks emphasizes the importance of systematic activities that enhance readiness. With the increasing frequency and intensity of disasters, and given the critical role of healthcare services before, during, and after such events, ensuring adequate preparedness among healthcare providers is essential. Medical students, who represent the largest group of future healthcare providers, frequently act as first responders to disaster victims.[6]

According to the World Health Organization (WHO), crisis management involves four key stages: (1) prediction and prevention, aimed at reducing the likelihood of crises; (2) preparedness, involving planning, education, and research; (3) response, focused on providing emergency services immediately after an event; and (4) reconstruction, which seeks to restore normalcy within affected communities. Nurses play vital roles across all these stages and constitute an integral part of crisis management teams.[7]

Despite the recognized importance of preparedness, evidence suggests a lack of professional readiness among healthcare and medical personnel to perform effectively under disaster conditions. Several studies have reported insufficient training and limited preparedness among healthcare workers.[8,9] To reduce the consequences of disasters, healthcare organizations must prioritize developing comprehensive preparedness plans and providing targeted training programs for their staff.[10]

A key component of disaster preparedness is ensuring that healthcare personnel within medical institutions are adequately trained and equipped.[3] Nasrabadi et al. reported that insufficient knowledge and lack of preparedness contribute to emotional stress during crisis response, while enhanced preparedness improves confidence and reduces vulnerability.[11] Similarly, Nakhai et al. found that nurses' mean preparedness score (out of 10) was 6.47 ± 0.87, and their mean capability and attitude scores (out of 5) were 3.19 ± 0.72 and 3.28 ± 0.41, respectively (5). In another study, Jahani et al. observed that the knowledge and preparedness levels of hospital managers were moderate, with the highest and lowest awareness levels reported among nursing managers (69.92%) and medical records staff (63.16%), respectively.[12] Khanke et al. identified trained personnel as a key facilitating factor in providing healthcare services.[13] Similarly, Echso et al. emphasized that training healthcare workers has long been a fundamental component of disaster preparedness.[14]

Medical students will serve as the next generation of healthcare providers and play critical roles during crises in hospitals and health centers. Before, during, and after disasters, they are expected to apply their clinical skills and professional competencies to assist affected populations. Given the increasing frequency of disasters and the essential role of healthcare responders, ensuring the preparedness of medical students is a national priority. However, limited research has been conducted on the level of disaster preparedness among medical students in Iran. Therefore, the present study aimed to assess the preparedness of students at Iran University of Medical Sciences in relation to natural hazards.

2 Methods

Study Design and Setting

This descriptive cross-sectional study was conducted in 2023 among students of Iran University of Medical Sciences (IUMS). The study population included all undergraduate, graduate, and postgraduate students enrolled across eleven faculties of the university.

Sample Size and Sampling Method

The sample size was calculated using the standard statistical formula, yielding a total of 680 participants. To ensure representativeness, the sample included an equal number of male (n = 340) and female (n = 340) students. This balanced distribution was intended to enhance the reliability and validity of gender-based comparisons.

$$n = (\frac{Z\sigma}{d})^2$$

For a 95% confidence level, the corresponding z-value from the normal distribution table was 1.96. Based on prior studies, the standard deviation of preparedness scores was estimated at 5, and the maximum acceptable estimation error (d) was set at 0.3:

$$d = 0.3, n = 680$$

A cluster random sampling method was employed, considering each faculty as a separate cluster. Of the eleven faculties, five were randomly selected. The sample size for each faculty was proportional to its total student enrollment. Within each selected faculty, students were chosen through random selection using student identification numbers.

Inclusion and Exclusion Criteria

Inclusion criteria consisted of being an enrolled student at IUMS and willingness to participate until completion of the study. Exclusion criteria included unwillingness to participate or submission of incomplete questionnaires.

Data Collection Procedures

Prior to data collection, necessary permissions were obtained, and written informed consent was secured from all participants. Two trained interviewers administered the questionnaires, each taking approximately 20 minutes to complete.

Data were collected using a demographic information checklist and a researcher-developed questionnaire on preparedness for natural hazards. The questionnaire was designed based on a review of relevant literature and expert consultations with faculty members and professionals in disaster management and disaster risk reduction.[3,7,15,16]

Instrument Development and Validation

Content validity was assessed by a panel of six experts in health education, disaster health, and environmental health. Their feedback and recommendations were incorporated into the final version of the questionnaire. To evaluate reliability, 30 questionnaires were pilot-tested among students from the target population. The Cronbach's alpha coefficient was 0.83, indicating satisfactory internal consistency.

The final instrument consisted of 30 items categorized into four dimensions of natural hazard preparedness: Floods (8 items), Earthquakes (8 items), Extreme weather events (7 items), Droughts (7 items).

Each item had four response options, with correct answers scored as one and incorrect answers as zero. The total possible scores ranged from zero to 30, with higher scores indicating greater preparedness. Based on total scores, preparedness levels were classified into three categories: High (favorable): 20–30, Moderate (average): 10–19, Low (weak): 0–9.

Data Analysis

Data were entered into SPSS version 24 (IBM Corp., Armonk, NY, USA) and analyzed using descriptive statistics (mean, standard deviation, frequency, and percentage) as well as inferential tests, including independent t-tests and analysis of variance (ANOVA). A p-value of < 0.05 was considered statistically significant.

3 Results

The mean age of participants was 23.72 ± 4.01 years. Of the 680 students included in the study, 50% were female and 50% were male. Approximately 40.1% of the students were aged over 24 years, and 40.1% were enrolled at the undergraduate level. The Faculty of Health accounted for the largest proportion of participants (27.4%).

Regarding socioeconomic and personal characteristics, 61.0% of participants reported an average economic status, and 73.2% were single. Additionally, 42.2% of students reported prior experience assisting in disaster-related activities. The demographic characteristics of the participants are summarized in (Table 1).

Table 1 frequency distribution of demographic variables among the students of Iran University of Medical Sciences

Variable	Description	Number	Percent
Gender	Male	340	50
	Female	340	50
Age (year)	<21	209	30.7
	21-2,4	198	29.1
	>24	273	40.1
Level of education	Bachelor	273	40.1
	Masters	141	20.7
	PhD and professional doctorate	266	39.1
Faculty	Medical	93	13.7
	Paramedicine	107	15.7
	Nursing and Midwifery	183	26.9
	Health	186	27.4
	Management and information sciences	111	16.3

Economic status of the family	Good	148	21.8
	Moderate	415	61
	Weak	117	17.2
Marital status	Single	498	73.2
	Married	182	26.8
A person's history of disaster relief	Yes	287	42.2
	No	393	57.8

The mean (± standard deviation) preparedness scores of students at Iran University of Medical Sciences across the assessed components were as follows: flood, 5.23 ± 2.21; earthquake, 5.31 ± 1.79; drought, 4.40 ± 1.51; and extreme weather hazards, 3.86 ± 2.42. The overall preparedness score was 18.81 ± 4.61, indicating a moderate level of readiness. Overall, 69.3% of the students demonstrated a moderate level of preparedness for natural disasters (Table 2).

Table 2 Mean and standard deviation of Iran University of Medical Sciences students' preparedness score against natural hazards based on components

	Number	Range	Mean	SD	Score status		
					Good (%)	Medium(%)	Poor (%)
Total	680	30-0	18.81	4.61	0	69.3	30.7
Flood	680	8-0	5.23	2.21			
Earthquake	680	8-0	5.31	1.79			
Drought	680	7-0	4.40	1.51			
Extreme weather hazards	680	7-0	3.86	2.42			

The findings revealed a significant relationship between the total preparedness score and its component scores with both educational level and previous disaster relief experience among students of Iran University of Medical Sciences ($P < 0.05$) (Table 3).

4 Discussion

The management of accidents and the complications arising from them is critical to safeguarding societies and maintaining stability. Among all sectors involved in disaster and emergency management, the health system occupies a unique and vital position because public demand for health and safety is fundamental. Preparedness is a cornerstone of effective incident management and requires comprehensive planning, education, and evaluation. At the individual level, preparedness aims to enhance knowledge, shape attitudes, and build essential response skills. At the institutional and community levels, it involves developing programs, allocating resources, and defining local and national management structures through clear policies, protocols, and operational guidelines.

The present study evaluated the level of preparedness of students at Iran University of Medical Sciences regarding natural hazards. The findings indicated that students demonstrated a moderate level of preparedness, which is concerning given their academic background in health sciences. Despite receiving relevant theoretical instruction, many students appear unable to translate classroom knowledge into practical disaster readiness. This gap highlights the need for targeted educational interventions that promote experiential learning, personal responsibility, and contextual awareness.

Comparable findings have been reported in earlier Iranian studies, such as those by Jafari et al.[17] and Heidari,[3] which similarly identified moderate preparedness among various population groups. However, the reliance on domestic and relatively dated research limits broader generalizability. International evidence offers valuable context: studies by Khan[18] and Alim[19] in South Asia found even lower levels of preparedness among medical students, underscoring the global nature of this educational gap. In contrast, research conducted in high-income countries,including in Europe and North America,has shown that simulation-based training, disaster drills, and community engagement can substantially improve preparedness and response capabilities.[20] These findings highlight the importance of cross-cultural benchmarking and the integration of proven educational strategies from diverse health systems.

From the researcher's perspective, the moderate preparedness observed may stem from a lack of experiential learning opportunities and insufficient emphasis on crisis management dynamics within the curriculum. The finding that students in higher academic years exhibited greater preparedness suggests that experience and maturity contribute to readiness. This supports the case for a tiered educational approach, where disaster preparedness training becomes progressively more advanced as students move through their academic programs.

Furthermore, the increasing frequency and complexity of disasters,driven by technological advances, urbanization, and climate change,necessitate adaptive and forward-looking educational strategies.[20] Universities must therefore move beyond theoretical instruction and focus on fostering critical thinking, problem-solving,

Table 3 The mean score of preparedness of Iran University of Medical Sciences students against natural hazards according to demographic characteristics

Variable	Description	Flood		Earthquake		Drought		Extreme weather hazards		Total	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Male	5.32	2.22	5.29	1.79	4.37	1.56	3.76	2.38	18.75	4.67
	Female	5.16	2.20	5.32	1.80	4.43	1.47	3.94	2.45	18.86	4.56
	P	0.32		0.79		0.59		0.34		0.63	
Age (year)	<21	5.20	2.18	5.32	1.81	4.53	1.62	4.41	1.80	19.37	4.78
	21-2,4	5.22	2.24	5.26	1.78	4.29	1.43	4.35	2.41	19.16	4.46
	>24	5.28	2.22	5.32	1.79	4.35	1.44	4.15	2.13	20.20	4.11
	P	0.90		0.92		0.24		0.21		0.12	
Level of education	Bachelor	2.18	2.10	2.39	1.82	2.52	1.60	2.45	2.13	17.41	4.12
	Masters	4.26	2.25	3.16	1.73	4.25	1.42	3.90	2.50	18.76	4.48
	PhD and professional doctorate	5.28	2.23	5.31	1.80	5.36	1.45	5.20	1.79	20.21	4.72
	P	0.27		0.42		0.42		0.11		0.09	
Faculty	Medical	5.09	2.14	5.46	1.89	4.62	1.55	4.56	2.31	19.79	4.71
	Paramedicine	5.29	2.25	5.45	1.70	4.40	1.50	4.25	2.34	19.37	4.67
	Nursing and Midwifery	5.24	2.15	5.10	1.74	4.39	1.54	4.73	2.48	18.48	4.51
	Health	5.18	2.26	5.37	1.77	4.42	1.46	4.48	2.16	18.46	4.84
	Health Management and information sciences	5.38	2.28	5.28	1.92	4.20	1.51	4.72	2.24	18.62	4.13
	P										
Economic status of the family	Good	5.31	2.25	5.37	1.84	4.30	1.46	3.91	2.09	16.90	3.91
	Moderate	5.21	2.20	5.31	1.79	4.43	1.54	3.75	2.16	16.71	4.68
	Weak	5.24	2.22	5.22	1.76	4.41	1.45	3.16	3.16	16.06	4.32
	P	0.09		0.21		0.41		0.10		0.23	
Marital status	Single	5.22	2.20	5.30	1.80	4.41	1.53	4.30	2.40	19.24	4.70
	Married	5.27	2.24	5.33	1.77	4.37	1.44	4.65	2.05	19.64	4.15
	P	0.80		0.78		0.21		0.26		0.74	
A person's history of disaster relief	Yes	5.29	2.22	5.32	1.81	4.43	1.45	4.83	2.10	19.76	4.73
	No	2.19	2.20	3.29	1.78	2.36	1.55	2.53	2.19	17.52	4.11
	P	0.01		0.01		0.02		0.00		0.01	

and interprofessional collaboration skills.[12] Integrating virtual simulations, scenario-based exercises, and interdisciplinary courses into health sciences curricula can strengthen students' capacity to respond effectively to real-world crises.[21]

The study also identified a significant relationship between total preparedness scores and the components of disaster preparedness with both educational level and prior disaster relief experience. These findings are consistent with those reported by Heidari,[3] Giliani,[2] and Patel,[20] reinforcing the importance of practical exposure and active participation in disaster-related activities. Training future crisis managers should therefore focus not only on knowledge acquisition but also on the development of cognitive, behavioral, and problem-solving competencies. Simulated drills and experiential learning remain among the most effective strategies for achieving this balance.

This study has several limitations. First, reliance on self-reported data may introduce bias due to social desirability or inaccurate recall. Second, the cross-sectional design limits causal inference. Third, nonresponse bias may exist, as students who declined participation could differ systematically from those who completed the survey.

Future research should employ longitudinal designs to assess changes in preparedness levels over time and across different academic stages. Additionally, intervention-based studies, such as evaluating the effects of simulation training, community engagement, or curriculum reform, could yield practical insights for educators and policymakers seeking to enhance disaster readiness in health sciences education.

5 Conclusion

The findings of this study indicate that students of Iran University of Medical Sciences possess a moderate level of preparedness for natural hazards, with considerable potential for improvement. Evidence from previous research suggests that educational interventions focused on disaster awareness can effectively enhance knowledge, attitudes, and practical skills. Accordingly, it is recommended that disaster risk reduction and management training be incorporated as a standard component of the university curriculum across relevant departments. Furthermore, virtual learning platforms and simulation-based tools should be utilized as complementary educational strategies to strengthen students' preparedness and response capabilities.

Declarations

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Artificial Intelligence Disclosure
No artificial intelligence tools were used in the preparation of this article.

Authors' Contributions
The methodology, sampling, and data curation aspects of this study were handled by Ameneh Marzban, who also contributed to the investigation and resource gathering. Statistical analysis was conducted by Mohsen Dowlati, who collaborated with Ameneh Marzban, in writing the original draft of the manuscript.

Availability of Data and Materials
The data that support the findings of this study are available on request from the corresponding author.

Conflict of Interest
The authors declare that they have no conflict of interest.

Consent for Publication
Not applicable.

Ethical Considerations
This research was part of an approved project at Iran University of Medical Sciences and was reviewed and approved by the university's Ethics Committee (approval code: IR.IUMS.REC.1402.297). Participation was voluntary, informed consent was obtained from all participants, and all data were kept confidential.

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