

Current Understanding of Emergency Medicine and Knowledge, Practice, and Attitude toward Disaster Preparedness and Management among Healthcare Workers in Nepal

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ABSTRACT

Background

Disasters are serious disruptions to a community's functioning that exceed its capacity to cope using its resources. Natural, man-made, technological hazards and other factors may cause disasters and influence a community's exposure and vulnerability.

Objective

To assess the knowledge, practice, and attitude of healthcare workers in Nepal regarding disaster preparedness and management for emergencies.

Method

A retrospective study was conducted among healthcare workers in Nepal registered for the 1st World Academic Council of Emergency Medicine- Table-top Exercise and Communication in Disaster Medicine conference as participants or faculty. Information was collected using total enumeration sampling and a questionnaire developed from a literature review and the questionnaire was adapted from the Emergency Preparedness Information Questionnaire (EPIQ). Percentages, means, and medians were calculated for socio-demographic data, knowledge, practices, and attitudes toward emergency preparedness. A chi-square test assessed associations between socio-demographic characteristics, emergency procedures, and familiarity scores on the preparedness questionnaire.

Result

A total of 118 participants took part in the study, most with over six months of emergency department experience. There was a significant association between work experience and emergency procedure status ($\chi^2=6.982$, $p=0.008$), and between education level and familiarity with disaster management ($\chi^2=5.507$, $p=0.019$). However, there was a low correlation ($r=0.140$, $p=0.129$) between emergency procedure status and disaster management familiarity.

Conclusion

Emergency preparedness is crucial for life-saving in disasters. The availability of emergency services and skills related to emergency preparedness and disaster management are crucial for saving lives in emergency conditions. The hospital should provide emergency preparedness and disaster management training to all healthcare workers. In addition, the hospital authority should perform disaster exercises/tabletop simulation exercises or drills periodically.

KEY WORDS

Attitude, Disaster management, Emergency preparedness, Knowledge

INTRODUCTION

Disasters are serious disruptions caused by natural, man-made, or technological hazards that exceed a community's capacity to cope with its available resources, which affect exposure and vulnerability.¹ Disasters occur globally, significantly impacting lives and economies.²⁻⁴ Effective preparedness can save lives, accelerate recovery, and reduce costs.^{2,5} Disaster medicine training equips healthcare professionals with skills to mitigate, respond to, and recover from disasters.^{6,7} It relies on the knowledge, skills, and attitudes of healthcare workers towards preparedness and response.⁸ However, research suggests many healthcare workers, including doctors and nurses, are inadequately prepared for disaster response.⁹

Hospitals must be prepared to handle a surge of patients during disasters while maintaining quality care.¹⁰ Preparedness, through training, enhances healthcare workers' capacity and willingness to perform during emergencies.^{11,12}

Nepal introduced a health sector emergency preparedness and disaster response plan in 2003, followed by several strategies.¹³⁻¹⁵ However, assessing hospital disaster management capacity remains critical. This study evaluates healthcare workers' knowledge, attitudes, and practices towards disaster preparedness, contributing to a strategic roadmap for implementing effective disaster measures, thereby improving medical care during mass casualty incidents.

METHODS

A quantitative retrospective study was conducted among 118 healthcare workers attending the 1st World Academic Council of Emergency- Table-Top Exercise and Communication in Disaster Medicine (WACEM-TOPCOM) conference at, Dhulikhel Hospital, Kathmandu University Hospital from December 1st to 3rd, 2023. Participants included disaster responders and coordinators from 25 hub hospitals, as well as representatives from 11 Kathmandu University-affiliated medical colleges, major institutes in the Kathmandu Valley, as well as healthcare workers interested in enhancing their knowledge of disaster preparedness and management. Data collection utilized a total enumeration sampling method, with purposive involvement from hospitals. The questionnaire, adapted from the Emergency Preparedness Information Questionnaire (EPIQ), was developed after an in-depth literature review of similar studies.^{12,16-20} The EPIQ is a validated evidence-based competency tool for assessing awareness of emergency preparedness.²¹ It consists of five sections: 1) socio-demographic information, 2) knowledge of emergency services, 3) procedures adopted in emergencies, 4) attitudes toward disaster management, and 5) practices adopted in hospitals. A two-point Likert scale was employed

to assess attitudes toward disaster response.²² Data were collected and entered into Excel, then transferred to SPSS version 25.0 for statistical analysis. Ethical approval was obtained from the Kathmandu University School of Medical Sciences Institutional Review Committee (KUSMS IRC No: 82/24), with consent implied by participation. Inclusion criteria included healthcare workers over 18 years old who registered for the conference, while exclusion criteria included non-clinical healthcare workers and individuals under 18 years of age. Standardized protocols were followed for data collection, ensuring confidentiality and a chi-square test was performed to assess associations between independent and dependent variables. A p-value < 0.05 was considered statistically significant.

RESULTS

In this study, a total of 118 participants participated, representing 25 different hospitals of Nepal. The majority (55.1%) were female and most (58.5%) had no clinical experience. The median age of participants was 29 years (IQR=5.3). Furthermore, a majority (65.25%) were graduates (Table 1).

Table 1. Socio-demographic characteristics of Participants

Variables	Category of Variables	n	%
Designation	House Officer	33	28.0
	Intern Doctor	20	16.9
	MDGP	29	24.6
	Nurse/Paramedics	18	15.3
	Others	18	15.25
Educational Level in Health Science	Post Graduate	23	19.9
	Graduate	77	65.25
	PCL Level	18	15.25
Gender	Female	65	55.1
	Male	53	44.9
Work Experience ED	≤ 6 months	69	58.5
	7-23 months	29	24.5
	24 - 36 months	6	5.1
	≥ 37 months	14	11.9
Age: The median age of the participants was 29 years (IQR=5.3)			
Age Group	≤ 30 years	81	68.6
	≥ 30 years	37	31.4

#Others = M.Sc. Nursing, Oral Medicine, General Physician, Residents

Knowledge of Emergency Services

The study assessed the availability of emergency services through workshop participants. It was reported that 78% of hospitals had separate emergency rooms or departments. Of those surveyed, 92% reported that they conducted triage at their working facilities however, only 88% had categorized beds for triage in the emergency department (Table 2.1).

Table 2.1. Availability of Emergency Services and Disaster Management

Variable	n	%
Emergency Services		
Availability of ER/ED	92	77.96
Triage	108	91.52
Categorized bed for triage in the ER	104	88.13
Room for Gyne/Obs	85	72.03
Capacity to care for critically ill patients in Emergency condition	104	88.13
Availability of warehouse for Disaster Response	25	21.2

Procedures

Another category the survey inquired about was the adoption of emergency procedures. Of the participants surveys, 91% reported that they performed foley catheterization in the emergency department and only 47% of respondents reported that they did cardioversion in the Emergency room/department (Table 2.2).

Table 2.2. Procedure conducted in the Emergency Department

Name of Procedure	n	%
Intubation	98	83.05
Suturing	104	88.13
Chest tube insertion	75	63.55
CPR	102	86.44
Use of Cardioversion	55	46.61
Use of Defibrillator	68	57.62
Point of care Ultrasound	85	72.03
Basic airway maneuver	85	72.03
Catheterization	107	90.67
Arterial Blood Analysis	106	89.83
Application of cast plaster	106	89.83

Disaster Preparedness and Management

The study shows that the mean knowledge about disaster preparedness and management was 4.46±2.00. In addition, 57.6% were aware of disasters within the past five years. Only a few (14.4%) reported that their hospital had a disaster plan. Furthermore, 16.94% of participants had trained in disaster preparedness and management. However, the majority (64.40%) of participants had direct or professional experience working during a disaster. Furthermore, less than half (41.52%) of participants reported that their emergency department (ED) had experienced an emergency or disaster recently (last 5 years) (Table 3). Only 2.5% of participants had rated that they had excellent current knowledge regarding the management situations (Table 3).

Attitude to Disaster Management and Emergency

The mean attitude was 8.87±0.74. In total (n=118), 26.3% of participants agreed that emergency (disaster)

Table 3. Knowledge of disaster preparedness and management

Variables	Yes (n/%)	No (n/%)
Have you awareness of Disaster within the past five years?	68 (57.6%)	50 (42.37%)
Does your hospital have a disaster plan?	17 (14.40%)	101(85.59%)
Have you obtained training in disaster preparedness and management before?	20 (16.94%)	98 (83.1%)
Do you know the major components/issues that must be included in a disaster plan?	49 (41.52%)	69 (58.47%)
Have you participated in developing/ reviewing the hospital disaster plan?	19 (16.10%)	99 (83.89%)
Have you had simulation training about emergency preparedness in the past 2 years?	27 (22.88%)	91 (77.11%)
Have you prepared to handle emergencies in your emergency department?	59 (50%)	50 (50%)
Have you had direct or professional experience of an emergency or disaster?	76 (64.40%)	42 (35.59%)
Has your ED experienced an emergency or disaster recently?	49 (41.52%)	69 (58.47%)
Mean 4.46±2.00 (Mean±SD)		
Variables	Categories of Variable	n %
Disaster Understanding	Any sudden occurrence of events natural or manmade	101 85.61
	Only sudden natural occurrence of event	4 3.45
	Some understanding	13 11.01
Do you have awareness of regards to disasters in the past five years?	80 (67.79%)	38 (32.20%)
Rate your current knowledge regarding the management situations	Excellent	3 2.51
	Fair	57 48.31
	Good	41 34.72
	Poor	17 14.44
Practices on Drill		
Regularity of disaster drill	Regular	8 6.81
	Sometime	40 33.91
	Do not Know	26 22.02
	No	44 37.28

operational plans need to be updated regularly. Only a few (6.77%) of respondents agreed that they did not need to know the hospital disaster management plan. In addition, the majority (89.98%) of participants agreed that potential hazards are likely because disasters should be identified and dealt with in advance. Similarly, the majority (96.61%) of participants agreed that all institutes should have updated disaster management plans. When asked if a disaster management plan is only for doctors, nurses, and paramedics, only 9.32% of respondents agreed (Table 4).

The majority of respondents reported that there was no incident command system in the hospital. In addition, 66.9% of respondents reported that they were familiar with documentation on emergency preparedness. Similarly,

Table 4. Attitude to Emergency and Disaster Management

Variables	Agreed	Disagreed
	n (%)	n (%)
Emergency (disaster) operational plans need to be updated regularly.	31 (26.3)	87 (73.72)
I do not need to know the hospital disaster management plan	8 (6.77)	110 (93.22)
Hospital administration should be adequately prepared when a disaster occurs	113 (95.76)	5 (4.23)
Emergency departments should be adequately prepared when a disaster comes	112 (94.91)	6 (5.08)
Potential Hazards likely to cause disaster should be identified and death in advance	106 (89.98)	12 (10.2)
Training is necessary for all workers including hygiene staff, technicians, and other non-medical staff who work in hospital	116 (98.30)	2 (1.69)
All institutes should have updated disaster management plan	114 (96.61)	4 (3.38)
Disaster management plans should be regularly updated	117 (99.15)	1 (0.84)
A disaster management plan is only for doctors, nurses, and paramedics	11 (9.32)	107 (90.67)
Simulation exercises for disaster preparedness and management should occur regularly in the hospital for both medical and non-medical staff	113 (95.76)	5 (4.23)
Ongoing training on disaster preparedness and management should be conducted by hospitals	34 (28.8)	84 (71.18)
Drills should be conducted regularly	114 (96.61)	4 (3.38)
Mean 8.87±0.74 (Mean±SD)		

53.38% of respondents were familiar with epidemiology and surveillance. The mean familiarity score was 6.1±3.70 (Table 5).

Sociodemographic Characteristics with Emergency Procedure

Regarding the association between socio-demographic characteristics and emergency procedures, the majority of variables had no significant association with emergency procedures. However, there was a significant association between the work experience of health workers and emergency procedures delivered by the hospital (p=0.008) (Table 6).

The association between socio-demographic characteristics and familiarity with the dimension of emergency preparedness among training participants was done. The majority of variables had no significant association with familiarity with disaster management among training participants. However, there was a significant association between the educational level of health workers and familiarity with disaster management among training participants (p=0.019) (Table 7).

The Pearson correlation was performed to measure the correlation between a familiarity dimension score of

Table 5. Familiarity score by the dimension of emergency preparedness information questionnaire

Dimensions	Yes	No
	n (%)	n (%)
Incident command system	44 (37.3)	74 (62.7)
Ethical issues on triaging victims of Mass causality incident	52 (44.06)	66 (55.93)
Communication/ connectivity issues during disaster events	57 (48.3)	61 (51.7)
Psychological issues of the victims as well as healthcare providers	70 (59.3)	48 (40.7)
Special Populations, especially women, children, older people, and high-risk individuals	79 (66.9)	39 (33.1)
Documentation	74 (62.7)	44 (37.3)
Epidemiology and Surveillance	67 (56.77)	51 (43.22)
Accessing critical resources, reporting and referring appropriate hospital	70 (59.3)	48 (40.7)
Emergency disaster preparedness terms and activities	63 (53.38)	55 (46.61)
Isolation/quarantine	82 (69.5)	36 (30.5)
Overall familiarity	53 (44.91)	65 (55.08)
Mean familiarity items	64.64±12.002 (Mean±SD)	

Table 6. Association between sociodemographic characteristics and Emergency Procedure

Category	Status of Emergency Procedure		P-value
	Incomplete	Complete	
Work Experience			
≤ 6 months	49 (71.0%)	20 (29.0%)	0.008*
> 6 months	23 (46.9%)	26 (53.1%)	

*P-value significance

Table 7. Association between socio-demographic factors and familiarity with the dimension of emergency preparedness among training participants

Category	Status of familiarity with the dimension of emergency preparedness		P-value
	Incomplete	Complete	
Education level			
Bachelor or Equal to Bachelor	76 (85.4%)	13 (14.6%)	0.019*
Above Bachelor level	19 (65.5%)	10 (34.5%)	

*P-value significance

disaster management and emergency procedure score. It found a low positive correlation (r=0.140) between the emergency procedure score and the familiarity dimension score of disaster management (Fig. 1).

DISCUSSION

Health workers including physicians and nurses are the frontline staff of the hospital; however, their responsibilities arise several times in emergencies and crises at hospitals.

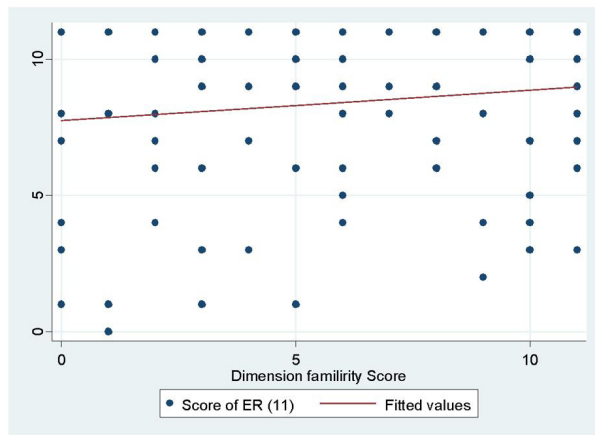


Figure 1. Correlation between emergency procedure score and familiarity dimension score of disaster management

It needs high efficacy and sound skills combined with factual capabilities to save human lives and promote their health in emergencies. We used nine items to assess the knowledge of the participants and it was revealed that the average knowledge in disaster preparedness was 4.46 ± 2.00 . It needs to improve the knowledge of health workers in our country on emergency preparedness and disaster management in comparison to other countries.^{17,24}

Most of the participants expressed a positive attitude towards disaster management, while few ($n=8$; 6.77%) of them agreed that it does not need to know the hospital disaster management plan. The disaster management committee of the hospital may have to work to enhance the attitude of hospital staff to be capable with an expectation that their department is ready to manage any disaster. Only 5 (4.23%) participants disagreed with the importance of simulation exercises for disaster preparedness and management regularly. The condition of the drill/Simulation exercises/ Table-top exercises of the hospital may increase the knowledge and regularly enhance its practice in disaster and emergency preparedness. It is similar to another study where it also may need to perform simulations for emergency preparedness and disaster management.¹⁷

The familiarity of the dimension of emergency preparedness and disaster management is crucial for health workers. The current study reveals that the average familiarity for the dimension of emergency and disaster management is 66.43 ± 38.34 . This means that many health workers do not know the strategic activities to cope with disasters at their hospitals. The skills and knowledge cannot be used during the disaster conditions without the availability of previous experiences, documentation, and communication. In general, it also indicates a need for regular structured training on emergency preparedness and disaster management. In addition, the proper material needed during emergency management should be available at the training period. The current study shows that 69.5% of participants were familiar with Isolation/quarantine during

a disaster which is better to compared of other.^{17,24,26}

In the current study more than half females participated. It is similar to other studies conducted outside Nepal.²³ It shows the gender presence to serve the patient through health care by both genders. In this study, many fresh graduate house officers and Nursing officers were participants for the study. Most of them were 29 years old. It shows the interest of young people towards emergency preparedness and disaster management. By knowing this participation and the age of participants. The prevalence of train manpower may be increased. It is also similar in other places.^{17,23} The current study shows that 16.1% of Nurses (M.Sc. Nursing/Nurse/Paramedical staff) participated. In addition, the number of female participation of female is not similar in other countries. This contradictory result might be because of the variation of study sites with a variation of different levels of staff working in the medical teaching university hospital and general hospitals.

In the last ten years, our country has faced two major disaster situations (earthquake and COVID-19). The COVID-19 pandemic has affected all over the world. However, this study revealed that only 16.94% of health workers were trained in emergency preparedness and disaster management. Then, it has raised many questions about the management of patients in critical situations. It also raises a question for all hospital administrations including the country that they would not be fully prepared during the COVID-19 pandemic. It also shows the importance of post-academic training in saving lives in disaster conditions. This situation has also been observed in other countries from other study.^{25,26}

CONCLUSION

This study examined emergency preparedness among healthcare workers with diverse backgrounds using a validated tool. This study revealed a significant gap in disaster management knowledge and training. While most participants recognized the need for updated emergency plans and hazard identification, few had received formal training, and many institutions lacked a comprehensive disaster plan.

Findings align with existing literature, indicating the need for more standardized training. Future efforts should focus on regular drills, improved education, and institution-specific disaster plans to enhance emergency response readiness.

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REFERENCES

- IFRC. What is a disaster? About disasters: Learn about different hazards. :1–5. Available from: <https://www.ifrc.org/our-work/disasters-climate-and-crises/what-disaster>
- IFRC T, Societies N. Disaster preparedness Watch : An introduction to National Society preparedness. :1–13. Available from: <https://www.ifrc.org/our-work/disasters-climate-and-crises/disaster-preparedness>
- Li PP. Annual Report 2023. AIMS Energy [Internet]. 2024;12(1):271–6. Available from: <https://www.ifrc.org/document/world-disasters-report-2022>
- IFRC. Global Plan 2023. 2023; Available from: <https://www.ifrc.org/our-work/disasters-climate-and-crises/disaster-preparedness>
- Rural Health Information Hub. Rural Emergency Preparedness and Response Overview. *Rural Heal Inf Hub* [Internet]. 2019;1–12. Available from: <https://www.ruralhealthinfo.org/topics/emergency-preparedness-and-response>
- Markenson D, DiMaggio C, Redlener I. Preparing health professions students for terrorism, disaster, and public health emergencies: Core competencies. *Acad Med*. 2005;80(6):517–26.
- Introduction PM, Management ID, Shop E. Introduction to international disaster management. 2015;10–2.
- Al-Ali NM, Abu Ibaid AH. Health-care providers' perception of knowledge, skills and preparedness for disaster management in primary health-care centres in Jordan. *East Mediterr Heal J*. 2015;21(10):713–21.
- Isangula KG, Lyimo M, Ndungile Y, Robert E. Nurses' preparedness for disaster response in rural and urban primary healthcare settings in Tanzania. *Rural Remote Health*. 2023 Apr;23(2):7547. doi: 10.22605/RRH7547. Epub 2023 Apr 17. PMID: 37062540.
- Li X, Huang J, Zhang H. An analysis of hospital preparedness capacity for public health emergency in four regions of China: Beijing, Shandong, Guangxi, and Hainan. *BMC Public Health*. 2008;8:1-11.
- Thorne CD, Curbow B, Oliver M, Al-Ibrahim M, McDiarmid M. Terrorism preparedness training for nonclinical hospital workers: Empowering them to take action. *J Occup Environ Med*. 2003;45(3):333-7.
- Hsu EB, Thomas TL, Bass EB, Whyne D, Kelen GD, Green GB. Healthcare worker competencies for disaster training. *BMC Med Educ*. 2006;6:1-9.
- DOHS. health sector emergency preparedness and response for electioneering period 2017.pdf [Internet]. Available from: https://www.dpnet.org.np/uploads/files/Health_sector_emergency_preparedness_and_disaster_response_plan_nepal-min_2020-04-16_08-26-21.pdf
- Pujiyono P. National Policy Reform for Disaster Risk Reduction. Yogyakarta Earthq May 27, 2006. 2008;22-1-22–6.
- Government N. Disaster reduction strategies 2018-2030. 2015; Available from: <https://bipad.gov.np/en/introduction>
- Corrigan E, Samrasinghe I. Disaster preparedness in an Australian urban trauma center: Staff knowledge and perceptions. *Prehosp Disaster Med*. 2012;27(5):432-8.
- 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):1123-9.
- Matlock TA. Emergency Preparedness Competencies Among Nurses in Northwest Arkansas. 2017;1-15. Available from: <http://scholarworks.uark.edu/nursuht>
- Shinhoster S. Increasing Awareness of Emergency Preparedness and Mass Sheltering among Georgia Department of Public Health Nurses with Core Competency Training: A 2023; Available from: https://scholarworks.gsu.edu/nursing_dnp/projects/41/%0Ahttps://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1043&context=nursing_dnp/projects
- Tilahun L, Desu B, Zeleke M, Dagnaw K, Andualem A. Emergency and disaster handling preparedness among front line health service providing nurses and associated factors at emergency department, at amhara regional state referral hospitals, ethiopia. *Open Access Emerg Med*. 2021;13(June):221–32.
- Asiva Noor Rachmayani. Emergency Preparedness Information Questionnaire. 2015;6. Available from: https://cdn-links.lww.com/permalink/jnpd/a/jnpd_2021_11_11_shortstrand_jnpd-d-21-00057_sdc4.pdf
- Taherdoost H. What is the best response scale for survey and questionnaire design; review of different lengths of rating scale/attitude scale/Likert scale. Hamed Taherdoost. 2019 Mar 29:1-0. Available from: <https://hal.science/hal-02557308>
- Chegini Z, Arab-Zozani M, Kakemam E, Lotfi M, Nobakht A, Aziz Karkan H. Disaster preparedness and core competencies among emergency nurses: A cross-sectional study. *Nurs Open*. 2022;9(2):1294-302.
- Zhang J, Yang L, Cao X, Ren Y, Han X, Zang S, et al. Assessment of disaster preparedness and related impact factors among emergency nurses in tertiary hospitals: a descriptive cross-sectional study from Henan Province of China. *Front Public Heal*. 2023;11.
- Ahmad Suleiman M, Magaji MG, Mohammed S. Evaluation of pharmacists' knowledge in emergency preparedness and disaster management. *Int J Pharm Pract*. 2022;30(4):348-53.
- Nofal A, Alfayyad I, AlJeria N, Alowais J, AlMarshady M, Khan A, et al. Knowledge and preparedness of healthcare providers towards bioterrorism. *BMC Health Serv Res*. 2021;21(1):1-13.