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Assessment of Hospital Disaster Preparedness and Knowledge, Attitude, and Readiness to Practice (KArP) of Emergency Medical Staff for Managing Mass-Casualty Incidents: A Descriptive Cross-Sectional Study

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Research Article

Keywords: disaster preparedness, mass-casualty incidents, hospital emergency readiness, emergency medical staff, Knowledge Attitude Readiness to Practice (KARP)

Posted Date: May 5th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9348921/v1

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Additional Declarations: No competing interests reported.

Abstract

Background: Disasters and Mass-Casualty Incidents (MCIs) impose a substantial burden on healthcare systems, requiring that hospitals and frontline medical staff to maintain high levels of preparedness. Evaluating institutional readiness and assessing healthcare workers' Knowledge, Attitude, and Readiness to Practice (KArP) are crucial for strengthening emergency response capacity, particularly during periods of regional instability.

Objective: To assess the level of hospital disaster preparedness and to describe the knowledge, attitude, and readiness to practice of emergency medical staff in managing mass-casualty incidents during a crisis context.

Methods: A descriptive cross-sectional study was conducted from June to July 2024 among emergency medical personnel at Menoufia University Hospital, Egypt. A total population sampling method was used, whereby all eligible healthcare providers working in the emergency department during the data collection period were invited to participate, while those on leave were excluded. Data were collected using: (1) a demographic data sheet, (2) the World Health Organization Hospital Emergency Response Checklist and (3) a structured Knowledge, Attitude, and Readiness to Practice (KArP) questionnaire. Descriptive statistics were used to summarize demographic characteristics and outcome measures.

Results: Ninety-two emergency healthcare workers participated in the study. The hospital obtained a preparedness score of 77/184 (41.8%), indicating an insufficient level of readiness for mass-casualty incidents. Only 21.7% of checklist items were fully implemented, with major deficits in surge capacity, safety and security, and command-and-control components. Staff demonstrated moderate knowledge, though awareness of institutional plans and individual roles was limited. Attitudes were generally positive, with strong interest in further training; however, only 46.8% of respondents considered themselves adequately prepared. Readiness-to-practice indicators showed willingness to respond rapidly and work extended hours, but limited disaster experience hindered practical preparedness.

Conclusion: Although emergency staff demonstrated positive attitudes and a willingness to engage in disaster response, institutional-level preparedness remains inadequate. Significant gaps were identified in operational knowledge, command-structure clarity, and practical readiness. Targeted training, simulation-based exercises, and systematic dissemination of disaster plans are urgently needed to enhance hospital resilience and staff competence in managing mass-casualty events.

1. Introduction

The world has faced an increasing number of natural and human-made disasters, including tsunamis, earthquakes, terrorism, wars, complex emergencies, and the ongoing Coronavirus Disease 2019 (COVID-19) pandemic (1). Disasters impose enormous social and economic costs, particularly on vulnerable populations (2). Consequently, healthcare is widely recognized as one of the most demanding professions in the world (3). Health care professionals are frequently exposed to physical and psychological challenges due to the nature of their work (4).

Catastrophic events are increasingly occurring worldwide, such as the Gaza events (5), causing a more pronounced impact on societies' health, quality of health services, the structure of healthcare systems, and countries' economies (6). The operational readiness of healthcare facilities plays a pivotal role in public health safety (7). The ongoing conflict in Gaza has severely damaged the health system, leading to its eventual collapse. Moreover, multiple attacks on health workers have been reported, creating obstacles in service delivery (8).

All hospitals are expected to have a preparedness plan for any anticipated disaster. Preparing healthcare systems to deal efficiently with all types of disasters is vital for providing a high standard of care and safe shelter to patients during a disaster (9).

Hospital disaster preparedness is defined as "an ongoing process designed to guarantee hospital resilience and functionality during disasters and the ability to reduce overall mortality and morbidity" (9). A hospital's capability to deal with disasters and mass casualties relies on the availability of qualified staff, space, and equipment (10).

During disasters that result in a patient surge, hospitals are expected to function as a safe environment for personnel and provide essential medical care to casualties (11). However, various studies have shown that hospitals overall suffer from an insufficient level of preparedness (12). This finding is consistent with previous studies highlighting weaknesses in hospital disaster management, including confusion over roles and responsibilities, poor communication, inadequate planning, and suboptimal training (13).

Previous studies conducted in various countries have demonstrated that hospitals face significant challenges in disaster preparedness and response, largely due to the widespread absence of formal training programs in emergency and disaster medicine (14). Therefore, the standardization of disaster preparedness protocols in hospitals is strongly recommended (9). The National Strategy for Disaster Risk Reduction 2030 outlines several objectives, one of which is to enhance the capacities of the Egyptian society to face crises and disasters at all phases, levels and sectors (15).

Given the increasing frequency and complexity of disasters globally and the profound consequences witnessed in crisis settings such as Gaza, there is an urgent need to evaluate the capacity of hospitals and frontline emergency medical staff to effectively manage mass-casualty incidents. Assessing disaster preparedness, together with the knowledge, attitude, and readiness to practice (KArP) among emergency medical personnel, is essential for identifying system gaps, strengthening organizational resilience, and informing evidence-based preparedness strategies.

The significance of this study lies in its ability to provide critical insights into the current preparedness status of hospitals during crises, to highlight priority areas that require improvement, and to support the development of targeted interventions to enhance emergency response capabilities, ultimately contributing to reduced morbidity, mortality, and disruption of the health system during future disasters.

2. Methods

2.1 Design and setting

A descriptive cross-sectional study was conducted in the Emergency Department of Menoufia University Hospital, Menoufia, Egypt. The study had a dual focus: (1) to evaluate the level of institutional disaster preparedness for mass-casualty incidents and (2) to describe the knowledge, attitude, and readiness to practice (KArP) of emergency medical staff toward disaster management.

2.2 Study population

All medical staff working in the emergency department during the data collection period were eligible for inclusion. A total population sampling strategy was adopted because the target group was relatively small and easily accessible, allowing us to approach the entire eligible workforce (N = 110) rather than select a probabilistic sample. Staff who were absent due to annual, sick or maternity leave at the time of data collection were excluded

2.3 Instruments of data collection

2.3.1 Demographic data sheet

A brief demographic form was developed specifically for this study to capture participants' age, gender, specialty, years of experience, educational level, workplace and governorate.

2.3.2 Hospital Emergency Response Checklist

Institutional disaster preparedness was evaluated using the Hospital Emergency Response Checklist developed by the WHO Regional Office for Europe (2011), an all-hazards tool designed to support hospital administrators in reviewing emergency readiness (16). The checklist covers 92 priority actions grouped into nine domains, including command and control, communication, safety and security, triage, surge capacity, continuity of essential services, human resources, logistics and

supply management, and post-disaster recovery. Each item is rated according to its implementation status and converted into a domain score and an overall preparedness score, which are then expressed as percentages and categorised following the WHO evaluation toolkit threshold (17). values.

2.3.3 Knowledge, Attitude, and Readiness to Practice (KArP) Questionnaire

A questionnaire was used to evaluate participants' knowledge, attitude, and readiness to practice (KArP) regarding disaster management. The questionnaire was pre-validated by Al-Ziftawi et al. (18) and further revised by Gillani et al. (19) to enhance its applicability across different settings. It has three sections:

Knowledge, attitude and readiness to practice in relation to disaster management were measured using a structured questionnaire previously validated by Al-Ziftawi et al. and later refined by Gillani et al. for use in diverse settings. The tool consists of three sections that assess: (1) knowledge through closed-ended items, (2) attitudes via Likert-type statements, and (3) readiness to practice using Likert-type items reflecting willingness and perceived capability to respond during disasters. Scores in each domain are summed and interpreted using established cut-off points to classify respondents into low, moderate or high levels. Negatively worded readiness items are reverse-coded so that higher total scores consistently correspond to greater readiness, and internal consistency of the three domains has been shown to be acceptable to good (Cronbach's alpha values ranging from 0.75 to 0.87 in the present sample).

2.4 Ethical considerations

Official permissions for data collection were obtained from the Hospital directors and the head manager of the Emergency Department. The study was approved by the Institutional Review Board of the Faculty of Medicine prior to data collection (Approval Number: 5/2024 SURG 8). Written informed consent was obtained from all study participants after explaining the aim of the study and assuring confidentiality.

2.5 Data collection procedure

Data were collected between June and July 2024, following receipt of ethical approval. Eligible emergency department staff completed the demographic form and KArP questionnaire independently, without researcher assistance. Survey packets were handed out in paper format by trained data collectors who visited staff during their shifts, ensuring wide coverage across the department. To minimise disruption to clinical work, participants were directed to a quiet space and given up to 30–45 minutes to fill in the forms during off-peak periods. Before entry into the database, each completed questionnaire was reviewed to confirm it was fully filled out and internally consistent, and all records were then anonymised and securely stored. Out of 110 eligible staff members, 92 submitted usable questionnaires, giving a response rate of 83.6%. Reporting of the study adhered to the STROBE guidelines for cross-sectional observational research.

2.6 Statistical Analysis

The data were coded and organized into a structured format to facilitate the computer data entry process. Statistical analysis of the data was conducted using Statistical Package for Social Science Software (SPSS) version 22 on a compatible IBM computer. Data were analyzed statistically using descriptive statistics, including frequencies, percentages, means, and standard deviations, which used to summarize demographic data and assess levels of disaster preparedness, knowledge, attitude, and readiness to practice among participants.

3. Results

Table 1 shows that a total of 92 healthcare staff responded to the questionnaire. The mean age ± SD was 31 ± 6.1 years, ranging from 27 to 36 years. Most respondents were female (n = 49, 53.3%). The largest professional groups were ER nurses (n = 35, 38.0%) and ER doctors (n = 28, 30.4%).

Regarding professional experience, the majority had 1–3 years (57.6%), while 20.7% reported more than 10 years. Educational levels were diverse, with most participants holding a General Practitioner (GP) degree (34.8%) or a master's degree (29.4%). Smaller proportions reported fellowship training (14.1%), residency training (16.9%), or an MD degree (4.3%).

Table 1
Demographic data of the participants.

Characteristics		Mean (SD)	Median (IQR)	Frequency (n)	Percentage (%)
Age		31.6(6.1)	29.5(27–36)	92	
Gender	Female			49	53.3
	Male			43	46.7
Specialty	Anesthesiology			3	3.3
	Cardiology			1	1.1
	ER Nurse			35	38.0
	Hepatology& gastroenterology			2	2.2
	Internal medicine			8	8.7
	Pediatric			2	2.2
	Obstetrics and gynecology			4	4.3
	Orthopedic			5	5.4
	ER Doctor			28	30.4
	Surgery			4	4.3
Years of experience	1–3			53	57.6
	3–5			6	6.5
	5–10			14	15.2
	> 10			19	20.7
Education level	Fellowship			13	14.13
	GP			32	34.78
	Master			27	29.35
	MD			4	4.3

The combined assessment of hospital disaster preparedness revealed substantial shortcomings across the evaluated domains. Of the 92 checklist items, only (21.7%) were fully completed, while (40.2%) were in progress and (38%) remained due for review. Critical components particularly Surge Capacity, Safety and Security, and Command and Control showed the lowest levels of readiness, highlighting limited ability to respond effectively to mass-casualty events. Although moderate advancement was observed in areas such as Triage and Continuity of Essential Services, overall preparedness remained inadequate.

Using the WHO Hospital Emergency Response Checklist scoring system, the hospital achieved 77 out of a possible 184 points, corresponding to an overall preparedness level of (41.8%). Based on WHO criteria, this classifies the hospital's disaster preparedness status as insufficient, underscoring the urgent need for targeted improvements across multiple

operational domains. A detailed breakdown of the implementation status for each preparedness category and the corresponding WHO classification is presented in Table 2.

Table 2
Combined Assessment of Hospital Disaster Preparedness Based on WHO Checklist

Category	pending Review	In Progress	Completed	Total Items	Total Possible Score	Score Obtained	Percentage Score	WHO Preparedness Level
Command and control	3	4	0	7	14	4	28.6%	Insufficient
Communication	2	5	2	9	18	9	50%	Insufficient
Safety and Security	7	2	2	11	22	6	27.3%	Unacceptable
Triage	1	5	4	10	20	13	65%	Insufficient
Surge Capacity	10	2	1	13	26	4	15.4%	Unacceptable
Continuity of Essential Services	0	5	3	8	16	11	68.8%	Insufficient
Human Resources	5	7	3	15	30	13	43.3%	Insufficient
Logistics and Supply Management	3	4	3	10	20	10	50%	Insufficient
Post-Disaster Recovery	4	3	2	9	18	7	38.9%	Insufficient
Overall Preparedness Summary	35 (38%)	37 (40.2%)	20 (21.7%)	92	184	77	41.8%	Insufficient

WHO = World Health Organization.

Regarding the knowledge assessment of the respondents, the majority (82.6%) of participants demonstrated an understanding of the concept of a medical disaster and (87%) recognized that disasters can arise from natural or man-made causes. Only (39.1%) were familiar with the four stages of the disaster cycle. Although (67.4%) reported that their hospital has a disaster response plan, less than half (42.4%) were aware of its content and only (41.3%) were aware of their specific role in it. Similarly, while a hospital command system was reported by (71.7%) of respondents, less than half (46.7%) could identify its members or structure, reflecting a lack of operational clarity during emergencies. Knowledge of operational and logistical components such as safety measures (60.9%), communication systems (53.3%), and record systems (48.9%) remained suboptimal, signaling weak preparedness in coordination and documentation during crises. The familiarity with triage systems (62%) and the use of treatment zones (76.1%) indicates that clinical aspects of emergency response are comparatively better understood. Overall, the mean knowledge score of participants was [14.28 ± 2.11] out of 22, reflecting a good level of knowledge based on the established cut-off values [> 12 = good; 7–12 = moderate; <7 = low]. Table 3 outlines the specific frequencies and percentages of respondents' answers to each individual disaster knowledge item.

Table 3
Knowledge assessment of the respondents regarding disaster preparedness.

Statement	Yes n (%)	No n (%)
1. Do you know what a medical disaster is?	76 (82.6%)	16 (17.4%)
2. Do you know the four stages of the disaster cycle?	36 (39.1%)	56 (60.9%)
3. A disaster can occur either from natural or man-made causes?	80 (87.0%)	12 (13.0%)
4. Do you think your country/city might be affected by disaster?	72 (78.2%)	20 (21.7%)
5. Do you think your facility might be affected by disaster?	72 (78.2%)	20 (21.7%)
6. Have you ever been taught about disaster planning?	42 (45.7%)	50 (54.3%)
7. Disaster planning is preparing for what might be needed to be done, how, before, and after a disaster?	81 (88.0%)	11 (12.0%)
8. Disaster management involves collaboration between hospitals, health authorities, civil defense, etc.?	76 (82.6%)	16 (17.4%)
9. Disaster management includes both health and non-health employees in the facility?	75 (81.5%)	17 (18.5%)
10. Does your hospital have a disaster response plan?	62 (67.4%)	30 (32.6%)
11. Do you know about this plan?	39 (42.4%)	53 (57.6%)
12. Do you know your role in this plan?	38 (41.3%)	54 (58.7%)
13. Is there a hospital command system in your hospital?	66 (71.7%)	26 (28.3%)
14. If yes, do you know its members and the chain of command?	43 (46.7%)	49 (53.3%)
15. Is there a hospital command center for meetings during incidents?	52 (56.5%)	40 (43.5%)
16. Are there job description sheets listing duties of hospital members?	61 (66.3%)	31 (33.7%)
17. Do you know the safety measures in your hospital during disasters?	56 (60.9%)	36 (39.1%)
18. Do you know the communication system used during disasters?	49 (53.3%)	43 (46.7%)
19. Do you know the triage system used during disasters?	57 (62.0%)	35 (38.0%)
20. Do you know the use of different treatment areas (red, yellow, green, etc.)?	70 (76.1%)	22 (23.9%)
21. Do you know the inlets, outlets, and assembly point in the hospital?	66 (71.7%)	26 (28.3%)
22. Do you know the medical record system used during disasters?	45 (48.9%)	47 (51.1%)

According to respondents' attitudes regarding disasters preparedness, over one-third of participants (35.9%) agreed and another (10.9%) strongly agreed that they consider themselves prepared for managing medical disasters. Confidence levels were relatively high around 69.6% (Agree + Strongly Agree) felt capable of functioning effectively during disaster situations, and (68.5%) expressed confidence in managing patients independently. Encouragingly, nearly (87%) of participants expressed interest in educational courses related to disaster preparedness, highlighting strong motivation for capacity building. Similarly, a large proportion (78.2%) supported future participation in healthcare response teams, and (75%) felt confident in managerial or leadership roles during disasters. Only (52.2%) reported having family emergency plans, and (65.3%) confirmed having agreements with family members about emergency procedures. Meanwhile, (53.3%) agreed or strongly agreed that their facility is well-prepared for disasters. (73.9%) believed they could contribute to improving hospital preparedness. Notably, the majority (78.2%) agreed that simulation exercises, drills, and workshops should be regularly implemented to improve disaster readiness, while (29.4%) disagreed that additional training was unnecessary indicating a clear demand for more structured and continuous disaster education. The overall mean attitude score was [59.7 ± 10.24] out of 80, indicating a positive attitude toward disaster preparedness based on the established cut-off values (> 56 = positive; 42–56 = moderate; <42 = negative). The complete distribution of responses across the Likert scale for respondents' attitudes regarding disasters preparedness is detailed in Table 4.

Table 4
Attitude assessment of the respondents regarding disaster preparedness.

Statement	Strongly Disagree n (%)	Disagree n (%)	Neither Agree nor Disagree n (%)	Agree n (%)	Strongly Agree n (%)
1. I consider myself prepared for the management of medical disaster	5 (5.4%)	11 (12.0%)	33 (35.9%)	33 (35.9%)	10 (10.9%)
2. I would feel confident in my abilities as healthcare personnel in medical disaster situation	2 (2.2%)	8 (8.7%)	23 (25.0%)	48 (52.2%)	16 (17.4%)
3. I am interested in educational courses and subjects in medical disaster preparedness	0 (0.0%)	4 (4.3%)	8 (8.7%)	45 (48.9%)	35 (38.0%)
4. I would be considered a key leadership figure in my community in a disaster medicine situation	2 (2.2%)	9 (9.8%)	22 (23.9%)	47 (51.1%)	12 (13.0%)
5. I have personal/family emergency plans in place for medical disaster situations	0 (0.0%)	7 (7.6%)	37 (40.2%)	38 (41.3%)	10 (10.9%)
6. I have an agreement with family members on how to execute our personal/family emergency and medical disaster plans	1 (1.1%)	8 (8.7%)	23 (25.0%)	41 (44.6%)	19 (20.7%)
7. I would feel confident as a future manager or coordinator of a facility help in medical disasters and crises	2 (2.2%)	7 (7.6%)	14 (15.2%)	47 (51.1%)	22 (23.9%)
8. I would be willing to be a future member of a healthcare response team in a medical disaster	0 (0.0%)	3 (3.3%)	14 (15.2%)	45 (48.9%)	30 (32.6%)
9. I feel reasonably confident I can care for patients independently without supervision in a medical disaster situation	2 (2.2%)	8 (8.7%)	21 (22.8%)	47 (51.1%)	14 (15.2%)
10. I would feel confident implementing emergency and disaster medicine plans and procedures	1 (1.1%)	6 (6.5%)	20 (21.7%)	47 (51.1%)	18 (19.6%)
11. I would feel confident in providing medicine-related education in case of disaster or emergency	2 (2.2%)	4 (4.3%)	23 (25.0%)	38 (41.3%)	25 (27.2%)
12. I do not need more workshops and simulated training to be ready for dealing with disaster medicine	10 (10.9%)	17 (18.5%)	36 (39.1%)	23 (25.0%)	6 (6.5%)
13. To improve disaster management, training through exercises, drills or workshops should be provided	2 (2.2%)	4 (4.3%)	14 (15.2%)	42 (45.7%)	30 (32.6%)
14. It is necessary to know my duty and role during disaster response in my facility	0 (0.0%)	3 (3.3%)	10 (10.9%)	30 (32.6%)	49 (53.3%)
15. I see my facility is prepared for medical disasters	4 (4.3%)	6 (6.5%)	33 (35.9%)	40 (43.5%)	9 (9.8%)
16. I see I can help in improving the preparedness of my facility for medical disasters	3 (3.3%)	4 (4.3%)	17 (18.5%)	45 (48.9%)	23 (25.0%)

Table 5 demonstrated that regarding the respondents' readiness to practice in disaster situations, more than half of participants (46.8%) reported that their roles in disaster medicine were clear, while (39.1%) remained neutral. The majority

(71.7%) expressed readiness to practice even under resource constraints such as medication shortages. Only (40.3%) had previous disaster response experience, while (39.1%) were neither agreed nor disagreed. Correspondingly, half of the participants (50%) neither agreed nor disagreed that their previous performance was poor, suggesting self-perceived uncertainty about their effectiveness. 63% (Agree + Strongly Agree) reporting effective engagement in workshops or courses. However, (43.5%) admitted that they perform based on personal knowledge rather than institutional training, indicating gaps in standardized disaster response training. High readiness indicators were observed in willingness to work extended hours (70.6%) and to respond promptly when called back (78.2%), Similarly, (71.7%) believed their current health status enables effective performance. (77.1%) agreed or strongly agreed that they need assurance of safety for themselves and their families before engaging in disaster response. (78.2%) demonstrated flexibility in adapting to changing procedures during disasters. Conversely, about 46.8% agreed or strongly agreed that they might refuse new practices during disaster response. The overall mean readiness-to-practice score was [44.5 ± 9.36] out of 60, indicating a moderate level of readiness among emergency staff based on the established cut-off values (> 38 = high; 31–38 = moderate; <31 = low).

Table 5
Readiness to practice assessment of the respondents regarding disaster medicine preparedness.

Statement	Strongly Disagree n (%)	Disagree n (%)	Neither Agree nor Disagree n (%)	Agree n (%)	Strongly Agree n (%)
1. My role in disaster medicine situations is clear.	4 (4.3%)	9 (9.8%)	36 (39.1%)	33 (35.9%)	10 (10.9%)
2. I am ready to practice under disaster despite medication shortage.	3 (3.3%)	7 (7.6%)	16 (17.4%)	54 (58.7%)	12 (13.0%)
3. I have real experience in disasters.	7 (7.6%)	12 (13.0%)	36 (39.1%)	34 (37.0%)	3 (3.3%)
4. My performance was not good during previous disasters.	4 (4.3%)	11 (12.0%)	46 (50.0%)	26 (28.3%)	5 (5.4%)
5. I perform based on what I know, not facility training.	3 (3.3%)	8 (8.7%)	41 (44.6%)	30 (32.6%)	10 (10.9%)
6. I participate effectively in facility workshops/courses.	3 (3.3%)	8 (8.7%)	23 (25.0%)	46 (50.0%)	12 (13.0%)
7. I am ready to work long hours during disasters.	2 (2.2%)	5 (5.4%)	20 (21.7%)	53 (57.6%)	12 (13.0%)
8. I am ready to respond quickly if called back to work.	2 (2.2%)	3 (3.3%)	15 (16.3%)	59 (64.1%)	13 (14.1%)
9. My current health allows me to work effectively.	2 (2.2%)	3 (3.3%)	21 (22.8%)	53 (57.6%)	13 (14.1%)
10. I need assurance of safety for myself/family to participate.	2 (2.2%)	0 (0.0%)	19 (20.7%)	36 (39.1%)	35 (38.0%)
11. I refuse new practices during disaster response.	5 (5.4%)	12 (13.0%)	32 (34.8%)	26 (28.3%)	17 (18.5%)
12. I am flexible to deal with actions taken during disasters.	1 (1.1%)	2 (2.2%)	17 (18.5%)	53 (57.6%)	19 (20.7%)

Note: Items 4 ("My performance was not acceptable during previous disasters") and 5 ("I perform based on what I know, not on facility training") are negatively worded and were reverse-coded prior to analysis, such that higher scores reflect greater readiness to practice.

4. Discussion

This descriptive cross-sectional study assessed the level of disaster preparedness at Menoufia University Hospital and described the knowledge, attitude, and readiness to practice (KArP) of emergency medical staff toward mass-casualty incident management. The overall hospital preparedness score was (41.8%), classified as insufficient according to WHO criteria, and notable gaps were identified across the three KArP domains. These findings are discussed below in the context of the existing literature.

Our study cohort captured the critical frontline of mass-casualty response: predominantly young (mean age 31.6 ± 6.1 years), female emergency nurses and physicians. This demographic profile is highly consistent with the typical emergency healthcare workforce described in recent regional disaster literature (20, 22), In contrast, Al-Ali and Abu Ibaid reported an older, male-dominated participant pool (23). However, such demographic variations likely reflect localized institutional hiring practices rather than systemic anomalies in the broader emergency workforce. The demographic profile of our cohort consisted primarily of frontline emergency nurses and physicians, aligning with the target populations of similar regional disaster preparedness studies (20–22).

This study assessed the disaster preparedness level in the emergency department of Menoufia University hospital. The results revealed that the hospital's overall preparedness score of 41.8%, classified as *insufficient* according to the WHO Hospital Emergency Response Checklist, reflects a concerning gap in disaster readiness. Also, the results revealed that of the 92 items evaluated, only 21.7% were fully implemented, 40.2% were in progress, and 38% remained due for review. Critical domains such as surge capacity, safety and security, and command and control exhibited the lowest readiness levels, indicating institutional vulnerability and insufficient operational capacity. These findings are consistent with the study conducted by Woyessa et al. (24) who reported that hospitals in Western Ethiopia had a weak preparedness level, averaging 45.6%, without documented disaster plans, evacuation procedures, or designated emergency committees. Similar findings were observed by Getu et al. (12) who assessed 17 hospitals in the northwest region of Ethiopia and found that 12 hospitals had an *insufficient* level of preparedness and 2 hospitals had an unacceptable level, while only three hospitals achieved an acceptable level. Likewise, Ayenew et al. (25) reported that public hospitals in Northwest Ethiopia demonstrated low levels of emergency and disaster preparedness, with an average score of 54.75%, indicating inconsistency across critical domains. Notably, the lowest level of readiness was observed in logistics and finance (43.33%), while the highest of preparedness is patient care and support services (60%). In contrast, a study conducted by Bin Shalhoub et al. (26) in private hospitals in Central Saudi Arabia demonstrated markedly higher institutional readiness. All assessed hospitals possessed formal Hospital Disaster Preparedness plans supervised by dedicated committees, and most (92.3%) addressed both internal and external disaster scenarios with plans made available across clinical departments. Furthermore, 69.2% reported mutual agreements with neighboring facilities to manage patient overflow during emergencies. However, despite these positive indicators, none of the hospitals conducted unannounced disaster drills in the preceding year, highlighting a persistent gap in real-time operational readiness.

The present study evaluated knowledge, attitude, and readiness to practice of the medical staff towards disaster management. In terms of knowledge, the present study showed that most respondents were aware of the basic concepts of disasters (82.6%) and recognized that disasters can result from both natural and human causes (87%). A high proportion (88%) also understood the purpose of disaster planning and (82.6%) acknowledged the collaborative role of multiple agencies during disasters. These results are consistent with those of Shanableh et al. (27), who reported that 82.6% of healthcare practitioners were aware of the basic concepts of disasters, 86.6% recognized that disasters come in many shapes and sizes, and 81.4% acknowledged the role of multiple agencies in disaster management. Also, those finding aligns with previous studies in which healthcare professionals demonstrated strong baseline awareness of the threat posed by disasters (17, 28).

However, notable knowledge gaps were evident in specific operational and institutional aspects of disaster management. Less than half (39.1%) of participants knew the four stages of the disaster cycle, and only (45.7%) had ever received training

or education related to disaster planning. Awareness of institutional preparedness measures was limited only (42.4%) knew about their hospital's disaster plan and (41.3%) were aware of their own roles within it. These findings are consistent with those reported in the United Arab Emirates, where only 36% of participants recognized the stages of the disaster cycle and less than one-third had prior disaster exposure (27). Similarly, comparable trends were observed in Pakistan, where familiarity with institutional preparedness and command systems was moderate, and approximately half of healthcare workers had ever participated in formal disaster training (19). Comparable knowledge deficits have been reported in study conducted by Fallah-Aliabadi, et al. (29), where less than half of staff were able to outline the disaster cycle.

In the present study, approximately 71.7% of respondents reported the presence of a hospital command system; however, less than half (46.7%) could identify its members or articulate the chain of command. This discrepancy highlights a recurring theme in disaster preparedness research: the existence of structural frameworks without sufficient operational familiarity among staff. Bahrami et al. (30), in their systematic review of the Hospital Incident Command System (HICS), similarly noted that although many hospitals formally adopt HICS, staff often remain unclear about specific roles and responsibilities within the structure. Comparable findings were reported in Iran, where hospitals had implemented a modified HICS, but staff performance during drills was hindered by poor understanding of role assignment and command hierarchy (31). A qualitative study in Sweden also emphasized that managers and staff knew of contingency organizations but often lacked clarity on the relationships between command structures and the routine hospital hierarchy, creating uncertainty during emergencies (32). Furthermore, a study of Iranian nursing managers demonstrated that while command-and-control preparedness scored relatively high, weaknesses persisted in staff awareness of command members and reporting lines (33).

Therefore, staff unfamiliarity with the chain of command may reduce the effectiveness of disaster response by delaying decision-making and impairing coordination during mass-casualty incidents. Evidence from intervention studies indicates that targeted education, job action cards, and simulation-based training can substantially improve staff awareness of command hierarchies and enhance operational efficiency during real events (30, 31).

The study findings that only 53.3% of respondents knew the hospital communication system, 48.9% were familiar with the record system, and 60.9% understood safety procedures highlight a critical gap in operational readiness. These systems are fundamental to effective disaster response, ensuring coordination, continuity of care, and protection of both patients and staff. The incomplete awareness suggests that institutional disaster plans, while perhaps in place, are not adequately disseminated or practiced among staff. Similar challenges have been documented by Al Thobaity (34) who identified deficiencies in communication, training, and infrastructure as persistent barriers to disaster nursing preparedness. Motsepe and Schmollgruber (35) emphasize that competencies in communication and coordination are key components of emergency nursing readiness. In developing countries, Songwathana and Timalsina (36) observe that nurses often lack adequate training and institutional support in areas such as communication protocols, safety measures, and documentation.

Despite these shared deficiencies, 76.1% of respondents recognized the use of color-coded treatment areas (red, yellow, green), 71.7% were aware of hospital inlets, outlets, and assembly points, and 62% demonstrated awareness of the triage system used during disasters. These findings reflect a satisfactory level of operational awareness among healthcare providers in organizing patient flow and prioritization during mass-casualty incidents. Comparable results were reported by Almukhlifi et al. (37), who found that Saudi emergency medical services personnel exhibited a high level of skill in applying triage principles during disasters (M = 4.06, SD = 1.22). Similarly, Alyaseen et al. (38) reported that the majority of Saudi healthcare workers showed strong awareness of triage procedures (96.4%). However, our results are relatively higher than noted in Pakistani studies, where Gillani et al. (19) reported moderate awareness of emergency response systems (56.6%) and triage principles (58.1%).

Overall, healthcare institutions often have structural preparedness measures such as plans and command systems, but staff knowledge and role-specific clarity lag behind. The key difference in our setting is relatively stronger knowledge of triage and treatment areas, but weaker familiarity with communication systems and the disaster cycle. This underscores the need for

targeted training programs and simulation-based exercises to translate institutional preparedness into practical staff readiness.

In terms of attitude, the current study revealed that the respondents exhibited a positive attitude toward disaster medicine preparedness. A high proportion (81.5%) agreed or strongly agreed that they would be willing to be future members of a healthcare response team and 78.2% supported the provision of training through simulation exercises, drills, or workshops to improve disaster management. Similarly, 85.9% recognized the importance of knowing their duty and role during disaster response. A substantial majority of participants (86.9%) were interested in educational courses related to disaster medicine preparedness, and 70.7% reported confidence in implementing emergency and disaster plans. Additionally, 68.5% expressed confidence in their abilities as healthcare personnel during disaster situations. These findings are consistent with those of Shanableh et al. (27), where healthcare professionals also demonstrated a positive outlook toward disaster preparedness. Over 75% agreed or strongly agreed that they were confident in their disaster roles, and more than 79% supported the need for ongoing workshops and simulated training.

Moreover, Gillani et al. (19) found that 88.1% of healthcare professionals were interested in disaster preparedness education, 78.2% were willing to join response teams, and 70.3% felt confident in their disaster response abilities. Also, Ahayalimudin and Osman (39) found that physicians, nurses, and assistant medical officers in Malaysia demonstrated an optimistic attitude toward disaster management. Likewise, Naser and Saleem (40) illustrated that healthcare professionals in Yemen showed a surprisingly positive attitude. In contrast, Nofal et al. (21) discovered that the attitude of hospital staff in Saudi Arabia was generally neutral. Similarly, Far et al. (41) reported that the level of attitude among nurses in Iran was moderate. However, our study also revealed that only 46.8% of respondents considered themselves adequately prepared for managing disasters, indicating a gap between awareness and actual readiness. Moreover, 39.1% of participants were neutral regarding their need for more workshops, suggesting limited prior exposure to hands-on disaster training. 65.2% of respondents had an agreement with family members on how to execute personal or family emergency and disaster plans, which aligns with the findings of Al-Ali and Abu Ibaid (23) in Jordan, where only 30.2% of participants reported similar preparedness.

In the term of readiness to practice, the current study's results demonstrated that a large proportion of participants expressed high readiness to engage in disaster response, including 78.2% who were ready to respond quickly to calls for duty, 70.6% ready to work long hours, and 63% who actively participated in training and workshops. These findings align with Gillani et al. (19), who reported that the majority of respondents showed strong willingness to enhance their readiness through training and professional development, 83.6% were willing to attend emergency medicine education programs, 75.6% felt they needed more training to provide patient-centered care during disasters, and 73.4% acknowledged that preparedness requires time and effort. Similarly, Far et al. (41) observed that nurses in Iran had moderate performance in disaster management. However, Nofal et al. (21) found that emergency staff in Saudi Arabia showed a low practice level toward disaster situations. Overall, these findings suggest that while readiness and willingness exist among healthcare professionals, actual practice and confidence in disaster response remain variable across contexts, emphasizing the need for continuous hands-on training and institutional preparedness programs.

In the present study, only 46.8% of respondents clearly understood their roles during disasters, a pattern consistent with studies across Sub-Saharan Africa and Asia that identified weaknesses in organizational coordination, leadership, and communication during emergencies (41, 42). Also, a systematic review by Labrague and Hammad (43) revealed that nurses in disaster-prone countries often possess inadequate disaster knowledge and skills, limiting their response capacity. The review further emphasized that prior disaster experience, targeted education, and continuous training significantly enhance preparedness levels.

Overall, the present study demonstrated a generally positive level of readiness to practice in disaster medicine, with most participants expressing willingness to respond rapidly and work extended hours during emergencies. However, gaps in institutional training and clarity of roles persisted. These findings are consistent with those of Ličen and Prosen (44), who identified that participation in disaster training, frequent emergency drills, formal qualifications, and leadership roles were

statistically significant predictors of disaster management competencies. Conversely, limited resources, lack of organizational support, and low engagement in preparedness activities were key barriers, particularly among less experienced nurses. The alignment between these results suggests that improving structured training opportunities and leadership involvement could substantially enhance disaster readiness and practical competence among healthcare professionals.

To strengthen hospital disaster preparedness, it is recommended that institutions adopt a comprehensive, competency-based approach to training that ensures all healthcare personnel possess foundational theoretical knowledge of disaster concepts, hospital emergency plans, and the phases of the disaster management cycle. Staff understanding of roles, responsibilities, and the hierarchy within the hospital incident command system should be enhanced through focused educational sessions, supported by the visible display of organizational charts and role assignments in clinical areas and emergency operation centers. Digital micro-learning modules can further reinforce essential competencies related to communication systems, documentation procedures and safety protocols.

Practical readiness should be cultivated through regular drills that activate the incident command structure, enabling personnel to practice real-time communication and reporting pathways. Interdisciplinary simulation exercises, including unannounced drills, are also essential for translating theoretical knowledge into operational proficiency. These activities should be complemented by the use of disaster-specific job action sheets that clarify duties, reduce confusion, and strengthen functional performance during emergencies. Ongoing assessments, such as quizzes or scenario-based evaluations, can help ensure sustained recognition of command roles and reporting mechanisms.

Promoting a positive safety culture is equally important and can be achieved by emphasizing the professional responsibility of healthcare workers in disaster response through awareness campaigns and leadership support. Psychological preparedness sessions may help maintain staff motivation and reduce anxiety associated with disaster participation. Standardized communication protocols and periodic refresher training will further ensure that staff remain familiar with the communication tools required during emergency operations. Additionally, institutional policies that provide support for staff family safety like childcare arrangements or guaranteed communication channels may enhance willingness to report for duty during crises.

Finally, continuous quality improvement should be ensured through performance audits and post-drill debriefings, which can identify system gaps and guide the refinement of disaster preparedness curricula and hospital emergency response plans. This integrated approach helps cultivate a resilient and well-prepared healthcare workforce capable of responding effectively to disasters.

Limitation

Several limitations of the present study should be acknowledged when interpreting the findings. First, the study was conducted in a single tertiary teaching hospital in the Menoufia Governorate of Egypt, which limits the generalizability of the findings to other hospital types (e.g., private, district, or primary care facilities), geographic regions, or national healthcare contexts. Second, the use of self-administered questionnaires introduces the potential for social desirability bias, whereby participants may have responded in a manner perceived as more favorable rather than reflecting their actual knowledge or attitudes. Third, the study primarily relied on descriptive statistics, which limits the ability to identify predictors of disaster preparedness or to establish associations between demographic characteristics and outcome measures. Fourth, data collection was conducted over a relatively short period, which may not capture temporal variations in staff workload, training opportunities, or institutional preparedness activities. Fifth, the cross-sectional design precludes the establishment of causal relationships between the variables examined. Sixth, the study was not prospectively registered in a clinical trial registry prior to data collection, which may affect transparency; however, this limitation is common in descriptive observational studies and does not compromise the validity of the findings. Future research should employ longitudinal or quasi-experimental designs to evaluate the impact of structured training interventions such as simulation-based drills and incident command system workshops on disaster preparedness outcomes among hospital staff.

5. Conclusion

The findings of this study indicate that Menoufia University Hospital demonstrates a foundational level of disaster preparedness for mass casualty incidents; however, significant gaps remain in operational knowledge dissemination, communication systems, and role clarity within the incident command structure. While emergency medical staff exhibited generally positive attitudes toward disaster preparedness and a willingness to participate in response activities, deficiencies were evident in their knowledge of key disaster management components. Readiness to practice was moderate, with confidence influenced by training exposure, role understanding, and concerns for personal and family safety. Overall, these results highlight the need for systematic training, enhanced communication, role-specific education, and regular simulation exercises to strengthen hospital-wide preparedness and optimize emergency response capacity. Longitudinal studies assessing the impact of targeted interventions on KArP outcomes, as well as multi-site investigations across diverse hospital settings, are warranted to build robust evidence base for disaster preparedness policy in Egypt and the broader region.

Abbreviations

COVID-19
Coronavirus Disease 2019
ER
Emergency Room
GP
General Practitioner
IBM
International Business Machines Corporation
KArP
Knowledge, Attitude, and Readiness to Practice
MCIs
Mass-Casualty Incidents
MD
Doctor of Medicine
SPSS
Statistical Package for the Social Sciences
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
WHO
World Health Organization

Declarations

Authors contribution

S.D. contributed to data collection, manuscript writing, and editing. O.A. contributed to the statistical analysis, manuscript writing, and editing. A.L contributed to data collection, manuscript writing, and editing. S.G. and A.I. contributed to manuscript writing and editing. MD contributed to the statistical analysis, conducted the final revision, and participated in manuscript writing and editing. P.T provided overall supervision for the study, along with manuscript writing and editing. All authors read and approved the final manuscript.

Funding statement:

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Conflict of Interest Disclosure:

There is no conflict of interest has been declared by the author.

Patient Consent Statement:

Not applicable

Data Availability Statement:

All data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethical approval

The study was approved by the Institutional Review Board of the Faculty of Medicine prior to data collection (Approval Number: 5/2024 SURG 8). Written informed consent was obtained from all study participants after explaining the aim of the study and assuring confidentiality.

Consent for publication

Not applicable. This manuscript does not contain any identifying images, case details, or other personal clinical information relating to individual participants that would require consent for publication.

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