

Disaster preparedness among physicians and medical interns in Egypt: A multi- center cross-sectional study

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Research Article

Keywords: Disaster preparedness, Physicians, Medical interns, Healthcare workers, Egypt, Disaster management

Posted Date: October 7th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11069399/v1>

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Additional Declarations: No competing interests reported.

Abstract

Background

Health emergencies are increasing in frequency and complexity, underscoring the need for adequately prepared healthcare workers. However, evidence on disaster preparedness among physicians and medical interns in Egypt remains limited and fragmented.

Methods

A cross-sectional study was conducted among physicians and medical interns between December 2025 and January 2026. Participants were recruited from 36 Egyptian healthcare institutions using convenience sampling. Data were collected online using the Disaster Management Assessment Tool for Health Care Practitioners (DMAT-HCP), which assesses knowledge, attitudes, practices, willingness to continue duties, and organizational preparedness. Group comparisons, correlations, and multivariable linear regression were performed.

Results

A total of 1,293 participants were included (649 interns and 644 physicians; 52% female; mean age 29 ± 8 years). Only 21% reported awareness of the disaster chain of command, 24% familiarity with institutional response systems, and 32% reported regular disaster drills. In contrast, 67% supported the need for a national disaster plan, and 65% for an institutional disaster plan. Willingness to continue duties was moderate to high across items (41–49%), even in the absence of adequate training or resources. All domains were significantly and positively correlated ($p < 0.001$). In multivariable analysis, higher knowledge ($\beta = 0.31$, $p < 0.001$), self-efficacy and self-awareness ($\beta = 0.24$, $p < 0.001$), and organizational preparedness ($\beta = 0.21$, $p < 0.001$) independently predicted better disaster preparedness practices. Willingness to continue duties was independently associated with self-efficacy ($\beta = 0.27$, $p < 0.001$), organizational preparedness ($\beta = 0.21$, $p < 0.001$), knowledge ($\beta = 0.07$, $p = 0.01$), and perceived need for disaster planning ($\beta = 0.08$, $p = 0.02$).

Conclusion

Egyptian physicians and interns showed suboptimal disaster preparedness, particularly in knowledge and practice domains, despite generally positive attitudes. Preparedness was strongly influenced by knowledge, self-efficacy, and organizational factors, highlighting targets for educational and institutional interventions.

Introduction

Health emergencies, including pandemics, natural disasters, mass-casualty incidents, and other public health crises, pose substantial challenges to healthcare systems worldwide. The World Health Organization (WHO) defines a health emergency as an event that threatens health, life, property, or the environment and requires immediate, coordinated action [1]. The frequency, scale, and complexity of such emergencies have increased considerably in recent decades [2]. In 2026, an estimated 239 million people require urgent humanitarian assistance worldwide, with more than 117 million forcibly displaced by mid-2025. Concurrently, global temperatures reached record highs in 2024 and remained among the warmest on record in 2025, contributing to increasingly frequent and severe natural disasters [2]. These challenges underscore the critical importance of maintaining a healthcare workforce that is adequately prepared to respond to a wide range of emergencies and disasters.

Importantly, recent public health emergencies, such as the COVID-19 pandemic, exposed important deficiencies in the healthcare workforce preparedness worldwide. Healthcare workers faced unprecedented challenges, including resource constraints, increased workloads, and heightened occupational risks [3]. In Egypt, many physicians reported inadequate pandemic-management training, limited infection prevention training, and the absence of institutional preparedness plans [4]. These experiences highlighted the importance of strengthening disaster preparedness and emergency response competencies among healthcare professionals.

Despite the recognized importance of disaster preparedness, evidence from various countries suggests that healthcare workers often demonstrate insufficient preparedness. Studies from Yemen [5], Pakistan [6], and the United Arab Emirates [7] have reported suboptimal disaster preparedness knowledge and only moderate preparedness competencies among healthcare professionals. Similar concerns have been raised among medical trainees, with evidence suggesting limited understanding of disaster response systems and operational roles during emergencies [8]. Furthermore, a study among emergency medical technicians in Egypt found notable gaps in disaster-related training, with approximately 70% reporting no terrorism-response training and nearly half having never participated in mass-casualty incident exercises [9]. Collectively, these findings suggest persistent deficiencies in disaster preparedness across different healthcare settings and professional groups.

Notably, disaster preparedness encompasses more than factual knowledge alone; it also includes attitudes toward disaster planning, willingness to respond during emergencies, and organizational readiness. Deficiencies in any of these domains compromise both the effectiveness of disaster response and the resilience of healthcare systems. Despite Egypt's vulnerability to a wide range of public health emergencies and the growing emphasis on emergency readiness within Egypt Vision 2030, evidence regarding disaster preparedness among Egyptian physicians remains limited and fragmented. For example, pre-COVID evaluations demonstrated significant gaps in preparedness among emergency personnel [10], but these findings do not account for the systemic shifts induced by recent global health crises. While a subsequent national survey during the first wave of the COVID-19 pandemic reported high knowledge of preventive measures [11], its scope was confined to infection control rather than disaster readiness. More recently, a cross-sectional study utilizing the WHO Hospital Emergency Response

Checklist identified insufficient institutional preparedness despite positive staff attitudes, though its generalizability is restricted by a single-center design and limited sample size [12]. Accordingly, this multi-center study aimed to bridge these gaps by evaluating disaster preparedness among physicians and interns in Egypt, with the latter representing the future workforce of the healthcare system. Additionally, the study sought to identify factors associated with preparedness practices and willingness to respond during disasters.

Methods

Study design and period

Between December 8, 2025, and January 25, 2026, a cross-sectional observational descriptive study with an analytical component was conducted among Egyptian healthcare professionals. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The study proposal was approved by the Research Ethics Committee of the Faculty of Medicine, Benha University (RC 30-7-2025).

Study setting and target population

The study population consisted of first- and second-year medical interns and practicing physicians across Egypt. Medical interns were included because, under the current Egyptian competency-based medical education system (5+2), graduates are required to complete a two-year compulsory internship program before obtaining full licensure [13]. During this period, interns are actively engaged in patient care and clinical duties within hospital settings and are frequently involved in frontline healthcare service delivery. Physicians were also included because of their critical role in emergency response and disaster management. Medical students, non-physician healthcare professionals, and healthcare professionals not currently practicing in Egyptian hospitals were excluded from the study.

To capture geographic differences, data were collected from healthcare institutions across all of Egypt's four main geographical regions (Upper Egypt, Lower Egypt, the Urban Governorates, and the Frontier Governorates). For medical interns, data were collected from teaching hospitals affiliated with Egyptian medical schools, reflecting the settings in which internship training is conducted. For practicing physicians, data were collected from governmental (including teaching) and private hospitals. Participating institutions were selected based on the availability of local collaborators to facilitate data collection, and a total of 36 institutions were included in the study.

Sample size calculation

The required sample size was calculated using the `samplingbook` package in R software. As no previous studies had reported Disaster Management Assessment Tool for Health Care Practitioners (DMAT-HCP) [14] scores among Egyptian healthcare professionals, separate pilot studies were conducted among 22 medical interns and 17 physicians to obtain the necessary parameters for sample size estimation.

Because the study had two primary (dependent) outcomes, disaster management practice and willingness to continue practice during emergencies, sample size calculations were performed for both outcomes in each study group. The calculation based on disaster management practice scores yielded the larger sample size requirements due to the greater variability of these scores, reflected by their larger standard deviations. Therefore, practice scores were used as the basis for the final sample size determination. The standard deviations (SDs) of practice scores obtained from the pilot study were 10.3 among interns and 11.3 among physicians.

The population size for physicians was obtained from the most recent census data of healthcare workers published by the Central Agency for Public Mobilization and Statistics (CAPMAS) [15], while the population size for interns was derived from CAPMAS data on students enrolled in higher education [16]. Assuming a 95% confidence level and a margin of error of ± 1 point, the minimum sample size required to estimate the mean DMAT-HCP practice score with the desired precision was 397 participants for the intern group and 482 participants for the physician group. A total of 1,293 participants were ultimately included in the analysis, comprising 649 interns and 644 physicians, exceeding the minimum required sample sizes for both groups.

Sampling method and data collection approach

Data collection took place between December 8th, 2025 and January 25th, 2026. Using a convenience and snowball sampling method, participants completed the questionnaire online on the Google Forms platform. To help spread the word and make it easier for people to participate, collaborators from institutions across Egypt's four main regions were recruited to share the survey with their professional networks and through social media and online communication channels. Participation was voluntary, and respondents were informed that the survey was anonymous and that no identifying information would be collected. This was done to encourage honest responses and reduce possible response bias.

Before the official data collection, a pilot study was carried out with 39 healthcare workers. Its purpose was to evaluate the clarity, suitability, and understandability of the questionnaire items. Based on the feedback received, a small change was made to improve the final version of the survey. Namely, a clarifying example was added to the item "I know the scope of my role in post-disaster situations" by including examples of post-disaster scenarios (e.g., collapsed infrastructure, displaced populations, toxic exposure, and mental health crises). Data from the pilot study were not included in the final analysis.

Study questionnaire

Data were collected using an online questionnaire administered through Google Forms. Disaster management knowledge, attitudes, practices, willingness to continue practicing duties during disasters, and perceptions of organization-based disaster management were assessed using the Disaster Management Assessment Tool for Health Care Practitioners (DMAT-HCP) [14]. The DMAT-HCP comprises 42 items distributed across five domains.

The knowledge domain consists of 9 items rated on a 5-point Likert-type scale ranging from 1 (no knowledge) to 5 (superior knowledge). The attitude domain includes 10 items rated from 1 (strongly disagree) to 5 (strongly agree). The practice domain comprises 7 items rated from 1 (never) to 5 (very frequently) and includes an additional non-ordinal response option of “not sure.” Willingness to continue practicing duties during disasters is measured using 6 items rated from 1 (strongly unwilling) to 5 (strongly willing). The organization-based disaster management domain consists of 10 items rated from 1 (strongly disagree) to 5 (strongly agree).

Domain scores were calculated by averaging item responses within each domain, with higher scores indicating greater knowledge, more positive attitudes, better practices, higher willingness, and stronger perceptions of organizational disaster management. The DMAT-HCP has demonstrated good internal consistency in its development study [14], with Cronbach’s alpha values ranging from 0.89 to 0.97 for its subscales.

In addition, anonymized sociodemographic data were collected, including age, sex, professional status (intern or physician), university affiliation, and area of residence.

Ethical approval

The study proposal was approved by the Research Ethics Committee of the Faculty of Medicine, Benha University (RC 30-7-2025), and the study was conducted according to the principles of the Helsinki Declaration. All participants were invited to voluntarily and anonymously complete an online survey, provided electronic informed consent, and were free to respond at their convenience.

Statistical Analysis

Statistical analysis was conducted using Jamovi statistical software. Continuous variables were summarized as means and SDs, while categorical variables were reported as frequencies and percentages. Internal consistency of the assessment tool scales was evaluated using Cronbach’s alpha. For item-level reporting on the DMAT_HCP, responses were collapsed into three categories: 'Low', 'Moderate/Neutral', and 'High'. To assess group differences across disaster management domains, independent samples t-tests were utilized for binary sociodemographic variables (e.g., gender, residence, hospital type) and one-way analysis of variance (ANOVA) for variables with more than two groups (e.g., career stage, university region). Correlations between DMAT_HCP domains were examined using Pearson correlation coefficients. Finally, multivariable linear regression models were constructed to identify factors independently predicting disaster preparedness practice and willingness to continue duties during emergencies. Hospital Type was excluded from the global regression model as it was structurally applicable only to the physician subgroup, and its inclusion would introduce listwise deletion of the intern cohort. A p-value of <0.05 was considered statistically significant for all tests.

Results

Participant characteristics

The final total number of participants was 1293 (52% female, mean age 29 (8) years), with physicians constituting 50% of the sample. Most of the participants were from public universities (86%) in Lower Egypt (62%). Regarding hospital type, 87% of physicians worked in governmental hospitals (n = 561) while 13% in private hospitals (n = 83) (Table 1).

Table 1. Participant Characteristics and Differences in Disaster Management Scores (N = 1293)

Characteristic	n (%)	Knowledge Mean (SD)	Attitude Mean (SD)	Practice Mean (SD)	Willingness Mean (SD)	Organization Mean (SD)
Gender		p < 0.001	p = 0.012	p = 0.027	p = 0.033	p = 0.500
Female	673 (52%)	23 (9)	35 (8)	17 (8)	19 (5)	31 (9)
Male	620 (48%)	26 (9)	36 (9)	18 (8)	20 (6)	31 (9)
Career Stage		p = 0.006	p < 0.001	p = 0.004	p = 0.300	p = 0.062
1st Year Intern	437 (34%)	24 (9)	34 (8)	17 (7)	19 (6)	30 (9)
2nd Year Intern	212 (16%)	24 (8)	36 (8)	17 (7)	19 (5)	32 (9)
Physician	644 (50%)	25 (9)	36 (9)	18 (8)	20 (6)	31 (9)
University Region		p = 0.800	p = 0.300	p = 0.046	p > 0.900	p = 0.041
Frontiers	4 (0.3%)	26 (11)	38 (14)	28 (7)	21 (7)	36 (14)
Lower Egypt	797 (62%)	25 (9)	36 (8)	18 (8)	20 (5)	32 (9)
Upper Egypt	193 (15%)	24 (9)	34 (8)	18 (7)	19 (6)	29 (9)
Urban	299 (23%)	24 (9)	35 (9)	17 (8)	20 (6)	30 (9)
University Type		p = 0.016	p = 0.600	p = 0.087	p > 0.900	p = 0.300
Al-Azhar	46 (3.6%)	25 (8)	36 (10)	18 (8)	20 (6)	29 (9)
Private	138 (11%)	27 (10)	35 (9)	19 (8)	19 (6)	32 (10)
Public	1,109 (86%)	24 (9)	35 (8)	18 (7)	20 (5)	31 (9)
Hospital Type¹		p = 0.400	p = 0.400	p = 0.083	p = 0.200	p = 0.013
Governmental	561 (87%)	25 (9)	36 (9)	18 (8)	20 (6)	31 (9)

Private	83 (13%)	26 (10)	37 (9)	20 (8)	21 (5)	34 (10)
Residence		p = 0.400	p < 0.001	p = 0.600	p = 0.004	p = 0.400
Rural	457 (35%)	24 (9)	34 (9)	18 (8)	19 (5)	31 (9)
Urban	836 (65%)	25 (9)	36 (8)	18 (8)	20 (5)	31 (9)
¹ Only applicable to physicians; SD: Standard Deviation						

Disaster management preparedness

As shown in Table 2, participants demonstrated moderate disaster management knowledge, with a mean score of 24.6 ± 8.97 (54.7% of the total score). Attitude scores were generally favorable (35.3 ± 8.57 ; 70.6% of the total score), with the highest performance observed in the self-efficacy and self-awareness domain (27.6 ± 6.82 ; 78.9% of the total score). In contrast, perceived need for a disaster plan and system (7.70 ± 2.25 ; 51.3% of the total score) and practice (17.8 ± 7.55 ; 50.9% of the total score) showed lower scores. Willingness to continue practicing and organizational-based management achieved 65.3% and 61.8% of their respective total scores. All scales demonstrated excellent internal consistency, with Cronbach's α values ranging from 0.908 to 0.959.

Table 2. Descriptive Statistics and Reliability of Disaster Management Assessment Tool Scales

Scale	Range	Mean (SD)	% from total	Cronbach's α
Knowledge	9 – 45	24.6 (8.97)	54.7	0.949
Total Attitude	10 – 50	35.3 (8.57)	70.6	0.925
<i>Perceived need for a disaster plan and system</i>	3 – 15	7.70 (2.25)	51.3	0.913
<i>Self-efficacy and self-awareness</i>	7 – 35	27.6 (6.82)	78.9	0.908
Practice	7 – 35	17.8 (7.55)	50.9	0.959
Willingness to Continue Practicing	6 – 30	19.6 (5.49)	65.3	0.918
Organizational-Based Management	10 – 50	30.9 (9.06)	61.8	0.958
SD: Standard Deviation				

Disaster management preparedness showed considerable variability across its items (Table 3). The highest-scoring items were predominantly related to attitudes toward disaster preparedness systems. Participants most strongly agreed that it is necessary to have a national disaster plan (mean = 3.9 ± 1.2 ; 67% high agreement), followed by the need for an organizational disaster plan (mean = 3.8 ± 1.2 ; 65%). High scores were also observed within the attitudes' self-efficacy and self-awareness domain, especially with the belief that participants' roles during disasters are essential (mean = 3.8 ± 1.1 ; 65%), followed by perceived usefulness of media resources in enhancing disaster readiness (mean = 3.7 ± 1.1 ; 62%) and interest in attending disaster preparedness professional development programs (mean = 3.5 ± 1.1 ; 52%). In contrast, the lowest preparedness scores were mainly found within knowledge and practice domains. Even though the highest score within the knowledge domain was observed for knowledge of delivering basic first-aid measures during large-scale disasters (mean = 3.1 ± 1.2 ; 40%), this still represented less than half of participants reporting adequate preparedness. Substantially lower scores were reported for knowledge of the chain of command during disasters (mean = 2.5 ± 1.1 ; 21%), how to run a disaster awareness campaign (mean = 2.6 ± 1.2 ; 24%), and the organizational disaster response system (mean = 2.6 ± 1.2 ; 24%).

Similarly, practice-related items demonstrated low engagement, especially with participation in managing and supervising volunteers during disasters (mean = 2.5 ± 1.3 ; 22%) and participation in providing defensible solutions to ethical dilemmas during disasters (mean = 2.5 ± 1.2 ; 22%). Organizational preparedness indicators showed moderate levels overall, with mean ranging from 3.1 to 3.2, with regular disaster drills receiving the lowest organizational score (mean = 3.0 ± 1.1 ; 32%).

Table 3. Responses to the DMAT_HCP among physicians and interns in Egypt (N = 1503)

Domain & Item	Mean (SD)	High n (%)	Moderate / Neutral n (%)	Low n (%)
Knowledge				
I know the chain of command during disasters.	2.5 (1.1)	275 (21%)	346 (27%)	672 (52%)
I know the response system for disasters in my organization.	2.6 (1.2)	312 (24%)	329 (25%)	652 (50%)
I know how to deliver the basic first aid measures in a large-scale disaster event.	3.1 (1.2)	514 (40%)	329 (25%)	450 (35%)
I know the scope of my role in post-disaster situations.	2.7 (1.2)	355 (27%)	351 (27%)	587 (45%)
I know the circumstances that require immediate reporting to the responsible health agencies.	2.8 (1.2)	408 (32%)	349 (27%)	536 (41%)
I know how to run a disaster awareness campaign.	2.6 (1.2)	308 (24%)	309 (24%)	676 (52%)
I know how to collaborate with other healthcare professionals on mitigation initiatives.	2.8 (1.2)	374 (29%)	331 (26%)	588 (45%)
I know my scope of role in managing and responding to disasters.	2.7 (1.2)	363 (28%)	336 (26%)	594 (46%)
I know how to find information related to disaster preparedness in my organization.	2.8 (1.2)	391 (30%)	320 (25%)	582 (45%)
Attitude: Perceived Need for a Disaster Plan and System				
I believe that it is necessary to have an organizational disaster plan.	3.8 (1.2)	846 (65%)	274 (21%)	173 (13%)
I believe that it is necessary to have a national disaster plan.	3.9 (1.2)	864 (67%)	261 (20%)	168 (13%)
Attitude: Self-Efficacy and Self-Awareness				
I am interested in attending professional development programs about disaster preparedness that relate specifically to this country.	3.5 (1.1)	677 (52%)	441 (34%)	175 (14%)
I am prepared for rapid escalation of services.	3.3 (1.0)	585 (45%)	476 (37%)	232 (18%)
I believe that my role during disasters is essential.	3.8 (1.1)	844 (65%)	293 (23%)	156 (12%)
I feel confident in implementing disaster management plans and procedures in my setting.	3.4 (1.1)	611 (47%)	443 (34%)	239 (18%)
I am able to access disaster management resources using mobile technologies.	3.3 (1.1)	607 (47%)	412 (32%)	274 (21%)

I am able to perform my role in post-disaster situations.	3.3 (1.1)	608 (47%)	435 (34%)	250 (19%)
I feel confident in doing my job independently without the supervision of others during disasters.	3.3 (1.1)	557 (43%)	416 (32%)	320 (25%)
I believe that media resources can help my readiness to practice during a disaster.	3.7 (1.1)	796 (62%)	306 (24%)	191 (15%)
Practice¹				
I participate in communicating important information immediately to the appropriate authorities during disasters. (n=1,251)	2.6 (1.2)	283 (23%)	347 (28%)	621 (50%)
I participate in managing and supervising volunteers during disasters. (n=1,257)	2.5 (1.3)	279 (22%)	322 (26%)	656 (52%)
I participate in providing defensible solutions to ethical dilemmas arising during disasters. (n=1,248)	2.5 (1.2)	276 (22%)	332 (27%)	640 (51%)
I participate in maintaining my personal safety and the safety of others during disasters. (n=1,239)	2.8 (1.3)	365 (29%)	367 (30%)	507 (41%)
I participate in responding to disasters within the scope of my professional role. (n=1,236)	2.7 (1.3)	336 (27%)	356 (29%)	544 (44%)
I participate in reflecting on my own performance post-disaster. (n=1,249)	2.7 (1.3)	349 (28%)	332 (27%)	568 (45%)
I participate in helping my organization to maintain functional post-disaster. (n=1,232)	2.7 (1.3)	320 (26%)	329 (27%)	583 (47%)
Willingness to Continue Practicing Duties During Disasters				
I am willing to continue practicing my duties during a disaster even if there was no preventive measures taken by my organization to prevent it.	3.2 (1.1)	572 (44%)	442 (34%)	279 (22%)
I am willing to continue practicing my duties during a disaster, even in the absence of adequate training in disaster management.	3.3 (1.1)	598 (46%)	425 (33%)	270 (21%)
I am willing to continue practicing my duties during a disaster even if I am not mentally prepared.	3.2 (1.1)	553 (43%)	439 (34%)	301 (23%)
I am willing to continue practicing my duties during a disaster even if I am asked to perform additional hours of duties.	3.4 (1.1)	632 (49%)	428 (33%)	233 (18%)
I am willing to continue practicing my duties during a disaster even if the special equipment that are required for disaster management is unavailable.	3.2 (1.1)	529 (41%)	418 (32%)	346 (27%)
I am willing to continue practicing my duties in post-disaster situations even if there are no after-action reports.	3.3 (1.1)	561 (43%)	444 (34%)	288 (22%)

Organizational-Based Management				
My organization has a disaster plan.	3.1 (1.1)	501 (39%)	499 (39%)	293 (23%)
My organization periodically updates the disaster plan.	3.1 (1.0)	451 (35%)	506 (39%)	336 (26%)
My organization has a public health surveillance system.	3.2 (1.0)	525 (41%)	483 (37%)	285 (22%)
My organization has all the needed medical equipment that are needed to manage an increase in the number of patients.	3.1 (1.1)	453 (35%)	468 (36%)	372 (29%)
My organization makes plans for staff needs, including supplies of food, water, rest areas, and hygiene items.	3.1 (1.1)	450 (35%)	499 (39%)	344 (27%)
My organization conducts regular disaster drills.	3.0 (1.1)	409 (32%)	490 (38%)	394 (30%)
My organization supports the continuous professional development of healthcare professionals on topics related to disaster management.	3.1 (1.0)	456 (35%)	506 (39%)	331 (26%)
My organization maintains a safe work environment during disasters.	3.1 (1.1)	438 (34%)	509 (39%)	346 (27%)
My organization communicates information with the healthcare professionals throughout a disaster situation in an effective and efficient manner.	3.1 (1.0)	472 (37%)	509 (39%)	312 (24%)
My organization recognizes the efforts of the healthcare professionals who contributed to disaster management.	3.1 (1.1)	468 (36%)	488 (38%)	337 (26%)
SD: Standard Deviation				
¹ Missing responses from the practice domain correspond to “not sure”				

Bivariate associations of disaster management scores

Significant differences in disaster management competency scores were observed across several participant characteristics (Table 1). Males scored higher than females in knowledge (26 ± 9 vs. 23 ± 9), attitude (36 ± 9 vs. 35 ± 8), practice (18 ± 8 vs. 17 ± 8), and willingness (20 ± 6 vs. 19 ± 5) (all $p < 0.05$). Physicians reported higher knowledge (25 ± 9 vs. 24 ± 9 and 24 ± 8), attitude (36 ± 9 vs. 34 ± 8 and 36 ± 8), and practice scores (18 ± 8 vs. 17 ± 7 and 17 ± 7) than first- and second-year interns (all $p < 0.01$). Participants from private universities had higher knowledge scores than those from public and Al-Azhar universities (27 ± 10 vs. 24 ± 9 and 25 ± 8 , $p = 0.016$). Organizational management scores were higher among participants from private hospitals than governmental hospitals (34 ± 10 vs. 31 ± 9 , $p = 0.013$). Urban residents reported higher attitude (36 ± 8 vs. 34 ± 9 , $p < 0.001$) and willingness scores (20 ± 5 vs.

19 ± 5, $p = 0.004$) than rural residents. Regional differences were observed for practice and organizational management scores ($p < 0.05$).

As shown in Table 4, all disaster management domains were positively and significantly correlated (all $p < 0.001$). Knowledge demonstrated moderate correlations with total attitude ($r = 0.438$), self-efficacy and self-awareness ($r = 0.466$), and practice ($r = 0.446$). The strongest correlation was observed between the two attitude subdomains, perceived need for a disaster plan and system, and self-efficacy and self-awareness ($r = 0.708$). Practice, willingness to continue practicing, and organization-based management showed consistent moderate positive correlations with the other domains ($r = 0.303$ – 0.438).

Table 4. Intercorrelations Among Disaster Management Assessment Domains

Variable	1	2	3	4	5	6
1. Knowledge	—					
2. Total Attitude	0.438***	—				
3. Attitude: Perceived need for a disaster plan and system	0.254***	0.438***	—			
4. Attitude: Self-efficacy and self-awareness	0.466***	0.254***	0.708***	—		
5. Practice	0.446***	0.466***	0.438***	0.438***	—	
6. Willingness	0.303***	0.446***	0.438***	0.438***	0.438***	—
7. Organization-Based Management	0.386***	0.303***	0.438***	0.438***	0.438***	0.438***
*** p -value < 0.001						

Multivariable predictors of disaster preparedness and willingness

Higher knowledge ($\beta = 0.31$, $p < .001$), self-efficacy and self-awareness (attitude) ($\beta = 0.24$, $p < .001$), and organizational-based management ($\beta = 0.21$, $p < .001$) were associated with higher disaster preparedness practice scores, while perceived need for a disaster plan and system (attitude) was negatively associated with practice ($\beta = -0.25$, $p < .001$). Physicians scored higher than first-year interns ($\beta = 0.18$, $p = 0.01$), and participants from the Frontiers region scored higher than those from Upper Egypt ($\beta = 0.96$, $p = 0.03$). Age showed a weak negative association with practice ($\beta = -0.06$, $p = 0.05$; Table 5).

As regards to willingness to continue duties during emergencies, self-efficacy and self-awareness (attitude) was the strongest predictor ($\beta = 0.27$, $p < .001$), followed by organizational-based management

($\beta = 0.21, p < .001$), perceived need for a disaster plan and system (attitude) ($\beta = 0.08, p = 0.02$), and knowledge ($\beta = 0.07, p = 0.01$). Demographic and professional variables were not significantly associated with willingness ($p > 0.05$; Table 6).

Table 5. Multiple Linear Regression Predicting Disaster Preparedness Practice

Variables	Unstandardized Estimate [95% CI]	Standardized Estimate	p- value
Age	-0.06 [-0.11, 0.00]	-0.06	0.05
Gender			
Female (Ref)	—	—	—
Male	0.01 [-0.71, 0.73]	0	0.99
Career Stage			
1st Year Intern (Ref)	—	—	—
2nd Year Intern	0.02 [-1.05, 1.09]	0	0.97
Physician	1.34 [0.40, 2.27]	0.18	0.01
University Region			
Upper Egypt (Ref)	—	—	—
Lower Egypt	-0.57 [-1.59, 0.45]	-0.08	0.27
Urban	-0.82 [-2.05, 0.41]	-0.11	0.19
Frontiers	7.21 [0.78, 13.65]	0.96	0.03
University Type			
Public (Ref)	—	—	—
Private	0.50 [-0.73, 1.73]	0.07	0.42
Al-Azhar	1.45 [-0.60, 3.49]	0.19	0.17
Residence			
Urban (Ref)	—	—	—
Rural	0.20 [-0.56, 0.96]	0.03	0.6
Knowledge	0.26 [0.21, 0.31]	0.31	<.001
Attitude - Perceived need for a disaster plan and system	-0.84 [-1.07, -0.62]	-0.25	<.001
Attitude - Self-efficacy and self-awareness	0.27 [0.18, 0.35]	0.24	<.001
Organizational-Based Management	0.18 [0.13, 0.22]	0.21	<.001
CI: Confidence Interval			

Table 6. Multiple Linear Regression Predicting Disaster Preparedness Practice and Willingness to Continue Duties During Emergencies

Variables	Unstandardized Estimate [95% CI]	Standardized Estimate	p- value
Age	-0.00 [-0.04, 0.04]	0	0.93
Gender			
Female (Ref)	—	—	—
Male	0.30 [-0.23, 0.84]	0.05	0.27
Career Stage			
1st Year Intern (Ref)	—	—	—
2nd Year Intern	-0.59 [-1.38, 0.21]	-0.11	0.15
Physician	-0.32 [-1.01, 0.37]	-0.06	0.37
University Region			
Upper Egypt (Ref)	—	—	—
Lower Egypt	-0.22 [-0.98, 0.54]	-0.04	0.57
Urban	0.28 [-0.63, 1.20]	0.05	0.54
Frontiers	-0.14 [-4.92, 4.64]	-0.03	0.95
University Type			
Public (Ref)	—	—	—
Private	-0.57 [-1.48, 0.34]	-0.1	0.22
Al-Azhar	-0.46 [-1.98, 1.06]	-0.08	0.55
Residence			
Urban (Ref)	—	—	—
Rural	-0.27 [-0.83, 0.29]	-0.05	0.35
Knowledge	0.04 [0.01, 0.08]	0.07	0.01
Attitude - Perceived need for a disaster plan and system	0.21 [0.04, 0.37]	0.08	0.02
Attitude - Self-efficacy and self-awareness	0.22 [0.16, 0.28]	0.27	<.001
Organizational-Based Management	0.13 [0.10, 0.16]	0.21	<.001
CI: Confidence Interval			

Discussion

This study investigated disaster preparedness among physicians and interns in Egypt. Overall, participants reported suboptimal levels of disaster-related knowledge and practical preparedness, despite generally positive attitudes toward disaster planning and a moderate willingness to continue working during disasters. Organizational preparedness was also perceived as only moderate. Furthermore, higher knowledge, greater self-efficacy and self-awareness, and stronger organizational-based disaster management were independently associated with better preparedness practices and greater willingness to continue duties during emergencies. These findings suggest important gaps in disaster preparedness among Egypt's healthcare workforce while highlighting key individual and organizational factors that may serve as targets for future interventions.

In our study, participants demonstrated suboptimal disaster preparedness knowledge, achieving only 54.7% of the maximum attainable knowledge score. Perhaps most concerning, nearly half of participants reported low knowledge regarding the chain of command during disasters (52%), their organization's disaster response system (50%), and their professional roles during disasters and post-disaster situations (45-46%). Similar observations have been reported among medical interns in India [17], where participants possessed reasonable theoretical knowledge but demonstrated limited understanding of operational responsibilities during disaster drills. Our findings are also consistent with reports from several low- and middle-income countries such as in Yemen [5], Pakistan [6] and the United Arab Emirates [7], where healthcare professionals exhibited suboptimal disaster preparedness knowledge and moderate disaster preparedness competencies. This pattern suggests that healthcare education may emphasize the clinical management of emergencies while providing less exposure to disaster governance, hospital incident command systems, and organizational response structures. Supporting this interpretation, evidence from Saudi Arabia indicates that disaster medicine education remains predominantly clinically oriented, with insufficient emphasis on systems-based disaster management competencies [18]. Similar concerns have also been raised in systematic and scoping reviews of disaster medicine curricula, which consistently report fragmented educational approaches, substantial heterogeneity in curricular content, and insufficient integration of simulation-based and experiential learning strategies [19, 20]. Nevertheless, as our study did not directly evaluate disaster medicine curricula, training programs, or educational exposures, these explanations remain speculative. Further research is needed to identify the specific educational, institutional, and experiential factors underlying disaster preparedness knowledge gaps among physicians and interns.

In our study, male participants demonstrated significantly higher knowledge, attitude, practice, and willingness scores than females in the bivariate analyses. Similar sex-related differences have been reported in several studies from Arab countries, including Lebanon [21], Qatar [22], the UAE [7], and Yemen [23], where males generally exhibited more favorable attitudes toward disaster preparedness and a greater willingness to respond during emergencies. However, sex was not independently associated

with preparedness practices or willingness in the multivariable analyses, suggesting that the observed differences may be attributable to other factors captured in the models rather than sex itself. This finding is consistent with the notion that preparedness is primarily shaped by modifiable factors such as knowledge, self-efficacy, training, and organizational support [24]. In this light, comparisons with previous studies should also be interpreted cautiously, as they typically relied on bivariate analyses, and utilized diverse instruments to assess disaster preparedness that vary in both the domains measured and their psychometric properties.

We found that physicians working in private hospitals reported significantly higher perceived organizational management scores than those in governmental hospitals. This finding is consistent with those of Lucifora et al., who reported systematic management underperformance in public-sector hospitals across multiple countries, highlighting persistent differences in organizational structures and managerial practices between the two sectors [25]. Within the Egyptian context, this disparity may also reflect ongoing reforms in healthcare quality and accreditation. The transition from the Ministry of Health and Population standards to the more comprehensive General Authority for Healthcare Accreditation and Regulation (GAHAR) framework has introduced increasingly rigorous requirements for organizational governance, workforce management, and quality assurance [26]. Private hospitals may be better positioned to adapt to these evolving standards because of greater organizational flexibility and resource availability. Consequently, the higher organizational management scores observed among physicians in private hospitals may reflect a greater capacity to implement and sustain quality and governance practices. Nevertheless, given the cross-sectional nature of the study, causal inferences cannot be drawn, and the specific factors underlying these differences cannot be determined.

Regarding willingness to continue practicing duties during disasters, approximately half of the participants reported being willing to continue working despite inadequate organizational support, insufficient training, increased workload, or the unavailability of specialized disaster-management equipment. Similar findings have been reported among healthcare workers in Saudi Arabia, where nearly half of respondents expressed unconditional willingness to work during disasters and emergencies [27]. Nevertheless, willingness alone should not be interpreted as evidence of preparedness. Effective disaster response requires not only motivated personnel but also adequate knowledge, training, organizational support, and access to essential resources. In our study, willingness scores were independently associated with knowledge, self-efficacy, and organizational management, indicating that healthcare workers are more likely to remain engaged during disasters when they feel competent and supported. Importantly, willingness to respond in the absence of adequate preparedness may place healthcare workers at increased risk of physical and psychological harm, particularly when they are required to operate in high-risk environments without sufficient training or organizational support. Therefore, efforts to strengthen disaster preparedness should focus on improving training opportunities, fostering confidence in disaster-response skills, and enhancing institutional preparedness. Such measures may not only improve disaster response capacity but also help sustain healthcare workforce participation while promoting the safety and well-being of healthcare workers during emergencies.

Addressing the disaster preparedness gaps identified in this study may require interventions such as integrating disaster medicine into undergraduate medical education and internship training. International organizations, including the American Medical Association (AMA) through its policy statements [28] and the World Association for Disaster and Emergency Medicine (WADEM) through its education and training recommendations [29], have emphasized the importance of equipping healthcare professionals with competencies in disaster preparedness and public health emergency response. Educational intervention studies have further demonstrated that structured disaster preparedness programs can significantly improve both knowledge and practical response skills [30, 31]. Within the Egyptian context, the two-year mandatory hospital-based internship period may provide a particularly valuable opportunity for experiential learning, enabling trainees to engage directly with hospital disaster plans, interprofessional coordination, and emergency response activities. Regional evidence from Saudi Arabia further suggests that embedding structured crisis-management experiences within internship training can enhance preparedness for real-world disaster response [32]. Therefore, integrating structured disaster preparedness education into undergraduate and internship curricula may represent a feasible and effective strategy for strengthening disaster readiness among Egypt's future healthcare workforce.

Limitations

Some limitations must be acknowledged when interpreting this study's findings. The cross-sectional design precludes causal inferences regarding the relationships observed between disaster management domains and the other studied variables. Using convenience sampling via online platforms may have also introduced selection bias, as healthcare professionals with greater interest in disaster preparedness may have been more likely to participate. Similarly, the use of a self-administered questionnaire carries a risk of response bias, including social desirability, which may have led to respondents' overestimation of knowledge, practices, or willingness to continue practice during disasters. Finally, although the sample included participants from all four geographical regions of Egypt, the predominance of respondents from Lower Egypt and public universities may limit the generalizability of the results to other healthcare settings.

Conclusion

Egyptian physicians and interns demonstrated suboptimal disaster preparedness, with notable deficiencies in disaster-related knowledge and practical engagement despite generally positive attitudes toward disaster planning and a moderate willingness to continue duties during emergencies. Higher knowledge, greater self-efficacy, and stronger organizational disaster management were consistently associated with better preparedness outcomes. These findings highlight the need for strengthened disaster medicine education, practical training opportunities, and institutional preparedness strategies to enhance the disaster readiness of Egypt's future and current healthcare workforce.

Declarations

Funding

No funding or sponsorship was received from any companies, groups, individuals, organizations, or any other entities.

Competing Interests

The authors declare that they have no conflict of interest.

Data Availability

The data of this study is available from the corresponding author upon reasonable request.

Ethical approval

The study proposal was approved by the Research Ethics Committee of the Faculty of Medicine, Benha University (RC 30-7-2025), and the study was conducted according to the principles of the Helsinki Declaration. All participants were invited to voluntarily and anonymously complete an online survey, provided electronic informed consent, and were free to respond at their convenience.

Author contributions

The conception and design of the study were done by all authors except YMO. Acquisition of data was done by the IFMSA-Egypt team of collaborators. Analysis and interpretation of data were done by YMO. Drafting the manuscript was done by all authors. Revising the manuscript critically for important intellectual content was done by MS, YMO, and DIAO. All authors read and approved the final manuscript.

Acknowledgements

The authors extend their profound gratitude to Dr. Hagar H. Sallam, Dr. Yehia M. Y. Ahmed, and Ms. Rowaydah Alfiqi for their invaluable guidance and support throughout this research project. We are equally grateful to the students who contributed to the data collection, including Nouran Magdy Teima, Arwa Okasha, Mahmoud Alsayed Elwan and Caroline Bwanali.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Consent for participation

All participants were invited to voluntarily and anonymously complete an online survey, provided electronic informed consent, and were free to respond at their convenience.

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