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Original Study

Comparing disaster preparedness knowledge, attitudes, and practices between emergency medicine residents in Riyadh region

Abdulaziz Alrabiah[1], Falwah Alharthi[2], Yara BinSaleh[3], Razan Imad Bahkali[4], Lama Faisal AlDhawi[5]

1. Associate Professor, Emergency Medicine, King Saud University, Riyadh, Saudi Arabia
2. Senior Registrar, Emergency Medicine, King Saud University, Riyadh, Saudi Arabia
3. Senior Registrar, Emergency Medicine, King Saud University, Riyadh, Saudi Arabia
4. General Physician, King Saud Medical City, Riyadh, Saudi Arabia
5. Saudi Board Internal Medicine Resident, First Health Cluster, King Saud Medical City, Riyadh, Saudi Arabia

Abstract

Background: Disaster preparedness is important for emergency medicine residents because they should respond quickly and effectively during disasters. In this study we aimed to compare disaster preparedness knowledge, attitude, and practice in emergency medicine residents in the Riyadh region. **Methods:** A multicenter cross-sectional study was conducted 2025 using an electronic self-administered questionnaire. Emergency medicine residents from R1 to R4 from nine training centers in Riyadh were included. The questionnaire assessed demographic data and disaster preparedness knowledge, attitude, and practice. Scores were calculated for the three domains. Non-parametric tests and Spearman correlation were used in the analysis. **Results:** 111 residents were included, and 69.4% were male. The median knowledge score was 64.3% (IQR 57.1–78.6), median attitude score 87.5% (IQR 81.2–93.8), and the median practice score 33.3% (IQR 16.7–55.0). Knowledge was higher in males than females (p=0.013). Practice score differed by

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training level (p<0.001), with higher scores in senior residents, mainly R3 and R4 compared with R1. Knowledge showed a positive correlation with attitude (rho=0.378, p<0.001) and practice (rho=0.665, p<0.001), while attitude had a weak positive correlation with practice (rho=0.215, p=0.024). **Conclusion:** Emergency medicine residents in Riyadh had a strong attitude, moderate knowledge, and weak practice toward disaster preparedness. Practical training and regular drills are needed for junior residents.

Keywords: disaster preparedness; emergency medicine residents; knowledge; attitude; practice

Introduction

Disasters affect health systems and overwhelm available resources, and healthcare workers should have basic preparedness for response, triage, coordination, and continuity of care during these events [1–3]. Emergency medicine physicians are important in this area because they at the frontline when sudden surges, mass casualty incidents, or complex emergencies happen, and their role includes rapid assessment, decision-making, and working within disaster systems under pressure [2,4]. Many studies still show that preparedness is not fully developed and training in disaster medicine is not enough in healthcare education [2,5,6]. This makes disaster preparedness an important educational issue, not only a theoretical topic, because weak preparedness affect the response of individuals and health facilities [7–9].

Previous studies that assessed knowledge, attitude, and practice in disaster medicine show mixed incomplete preparedness levels in healthcare learners and workers [1,3,10]. In a cross-sectional study most participants had moderate knowledge, moderate attitude, and moderate readiness to practice, and knowledge and attitude were significant predictors of readiness to practice, which suggests that better understanding and better perceptions support preparedness behavior [1]. Another study in Sudanese healthcare professionals also found moderate perceived preparedness, knowledge, and skills, but there is a gaps in important areas such as familiarity with local emergency systems and disaster triage, and previous disaster experience was a significant predictor of competency [3]. In Saudi Arabia nurses, familiarity and attitude were not strong enough, and a short online educational program did not produce significant change, which mean that preparedness needs more practical educational approaches rather than limited exposure alone [10].

Studies that focused on residents and frontline clinical roles reported clear gaps in disaster education, drills, and participation [1,2,4]. Only a small proportion of family physician residents in Turke received disaster medicine training, most had never joined a disaster drill, most had never participated in applying a disaster plan, and almost all had never worked in a disaster, which reflected deficiencies in both knowledge and experience [5]. In emergency medicine residents in Riyadh, a structured rotation in emergency medical services and disaster medicine improved knowledge and attitude scores, which supports the value of formal and organized training during residency [4]. Residents felt unprepared for disaster incidents, while a tabletop exercise improved confidence even though it did not improve measured knowledge [2].

Institutional studies from Saudi Arabia support the idea that disaster preparedness is limited by weaknesses in drills, education, communication, and operational readiness [6–9]. Private hospitals in Riyadh showed important weaknesses in staff

education, training, monitoring, and disaster exercises, and few hospitals had done drills with unannounced exercises, even when written plans were available [7]. Hospitals in Al-Madinah showed insufficient preparedness before intervention, with important problems in triage, surge capacity, communication, safety, and continuity of essential services, although some areas improved after targeted interventions [8]. At the staff level in Riyadh, awareness about internal disasters was moderate, but detailed procedural knowledge and participation in drills were still limited, while in northern Saudi PHC clinics, lack of staff experience was reported as the most significant challenge to emergency preparedness [6,9]. Assessing disaster preparedness knowledge, attitude, and practice among emergency medicine residents in Riyadh is important to identify current gaps and support better training and preparedness planning in the local setting [4,6,7].

Method

Study design and setting

The present study is a multicenter cross-sectional study performed using an electronic self-administered questionnaire. We aimed to assess disaster preparedness knowledge, attitude, and practice in emergency medicine residents in Riyadh region. The study carried out in several training centers in Riyadh, Saudi Arabia including King Abdulaziz Medical City, King Khalid University Hospital, Prince Sultan Military Medical City, King Fahad Medical City, Security Forces Hospital, King Saud Medical City, King Abdullah bin Abdulaziz University Hospital, Prince Mohammed bin Abdulaziz Hospital, and King Faisal Specialist Hospital and Research Centre. Data collection was done from May to August 2025.

Population and sampling strategy

The study population included residents in training levels R1, R2, R3, and R4 who completed the questionnaire during the study period. A convenience sampling method was used. The questionnaire was distributed electronically, and all available eligible responses were included in the analysis. The final dataset contained 111 responses.

Variables and measurement tools

The data collection tool was a structured questionnaire in English adapted from previously cited studies in disaster medicine and preparedness. The questionnaire had four parts. The 1st part included demographic and training information; gender, nationality, training level, and center. The 2nd part included knowledge questions about disaster definitions, disaster plans, drills, evacuation process, disaster preparedness, and disaster management concepts. The 3rd part included attitude questions about the importance of disaster plans, training, committees, regular updates, and institutional preparedness. The 4th part included practice questions; previous exposure to disasters, participation in disaster management teams, previous teaching, and participation in workshops or drills. Most questions were answered as Yes/No/I don't know or Agree/Disagree/I don't know. There was also one question about disaster types known by the participants, and this item allowed multiple answers.

The study variables were grouped into three domains: knowledge, attitude, and practice. Each item was first described separately. Then composite scores were made for the three domains by giving

higher scores to correct or favorable answers. Negative attitude items were reverse-coded before calculating the total score. The final scoring included 14 knowledge items, 16 attitude items, and 6 practice items.

Data collection procedures

The questionnaire was distributed electronically during the study period. The first page included an informed consent statement, and only those who agreed continue to answer. Participation was voluntary, and the questionnaire was completed anonymously. After data collection, the responses were exported into a spreadsheet for cleaning and analysis. The data were checked for completeness before analysis. Missing responses were handled by available-case analysis, and each variable was analyzed according to the number of valid responses available for that item.

Statistical analysis plan

Categorical variables were presented as frequencies and percentages. For the knowledge, attitude, and practice scores, the results were presented using mean, SD, median and IQR. Internal consistency of the grouped items was checked using Cronbach's alpha. In the final analysis, Cronbach's alpha was 0.714, 0.720 and 0.543 for knowledge, attitude, and practice respectively.

Associations between categorical variables were tested using the chi-square test. When the sample was small, Fisher's exact test was used. For the composite scores, normality was checked first. Because the score distributions were not normal and the questionnaire responses were ordinal or categorical, non-parametric tests were used. Comparison between males and females was done using the Mann–Whitney U test. Comparison between training levels R1, R2, R3, and R4 was done using the Kruskal–Wallis test. When the Kruskal–Wallis test was significant, post hoc pairwise comparisons with Bonferroni adjustment were done. Correlation between knowledge, attitude, and practice scores was tested using Spearman's rank correlation. A p value less than 0.05 was considered statistically significant.

Ethical considerations

Electronic informed consent was taken from all participants before they answered the questionnaire. Participation was voluntary, and the responses were collected anonymously. No direct personal identifiers were included, and the data were kept confidential. Access to the dataset was limited to the research team only.

Result

A total of 111 emergency medicine residents from Riyadh region were included in this study. Most participants were male (77, 69.4%). Regarding training level, 40 (36.0%) were R1, 29 (26.1%) R2, 27 (24.3%) R3, and 15 (13.5%) R4. The respondents were distributed in 9 centers, with the largest groups coming from KAMC (23.4%) and KKUH (22.5%) (Table 1).

Regarding knowledge items, the highest correct or favorable responses were seen in knowing what a disaster is (94.6%), identifying who is responsible for disaster management (93.7%), knowing that surrounding hazards should be identified and managed (91.9%), disaster planning covers the period before, during, and after a disaster (89.2%). Good responses were found for the idea that disaster management is collaborative in agencies

(84.7%) and for understanding the disaster-resource imbalance concept (73.9%). Lower knowledge was found in where to find the disaster plan (35.1%), the immediate evacuation process (35.1%), the special exit doors during evacuation (38.7%), and understanding own function during a drill (40.5%) (Table 2 & 3).

Regarding attitude most participants agreed that a disaster plan is necessary (97.3%), that management should be adequately prepared (96.4%), an emergency plan is necessary for anticipated hazards (96.4%), and hazards should be identified and managed (95.5%). A high proportion also agreed that it is necessary to know their own role during disaster situations (94.6%) and drills or workshops should be provided to improve disaster management (94.6%). Some items showed lower support, such as the belief that disaster training should be part of internship, where only 45.0% gave a favorable response, and the belief hospital drills should be conducted, where the favorable response was 69.4% (Table 3 & 4).

The practice domain showed lower preparedness compared with knowledge and attitude. 27.9% had ever faced a disaster, and 18.0% had worked on a disaster management team. 43.2% had performed a disaster drill in the university or city, and 50.5% had been taught about disaster planning. 64.0% had heard about the disaster concept, 15.3% showed a favorable response regarding their own preparedness practice (Table 4).

When the composite scores were calculated, the knowledge score had a median of 64.3% (IQR 57.1–78.6), the attitude 87.5% (IQR 81.2–93.8), and the practice score 33.3% (IQR 16.7–55.0). Attitude was the strongest domain in the sample, while practice was the weakest. Cronbach's alpha was 0.714 for knowledge, 0.720 for attitude, and 0.543 for practice (Table 5 & 6). When scores were compared by gender, there was a significant difference in knowledge score. Male residents had a higher median knowledge score than female residents. There was no significant gender difference in attitude score. The difference in practice score by gender was not statistically significant [$p = 0.067$] (Table 6).

Comparison by training level showed no statistically significant difference in knowledge score in R1, R2, R3, and R4 residents ($p = 0.139$). There is no significant difference in attitude score by training level ($p = 0.341$). There was a significant difference in practice score in the four levels ($p < 0.001$). The median practice score increased from 16.7% in R1 to 66.7% in R4, showing better readiness in senior residents. In post hoc analysis, the significant pairwise differences were between R1 and R3 (adjusted $p = 0.014$) and between R1 and R4 (adjusted $p = 0.001$). Other pairwise comparisons were not statistically significant after Bonferroni correction (Table 7 & 8).

Correlation analysis showed that knowledge had a moderate positive correlation with attitude (rho = 0.378, $p < 0.001$) and practice (rho = 0.665, $p < 0.001$). Attitude had a weak positive correlation with practice (rho = 0.215, $p = 0.024$) (Table 9). In the multiple-response question about disaster types, the most commonly recognized disaster was epidemics (89.2%), followed by fire (82.9%), flood (63.1%), and earthquake (61.3%). Lower recognition was found for volcano eruption (36.0%) and landslide (31.5%) (supplementary Tables 1&2).

Table 1: Participant characteristics (N = 111)

Category	n (%)
Male	77 (69.4)
Female	34 (30.6)
Saudi	111 (100.0)
R1	40 (36.0)
R2	29 (26.1)
R3	27 (24.3)
R4	15 (13.5)
KAMC	26 (23.4)
KKUH	25 (22.5)
PSMMC	17 (15.3)
KFMC	16 (14.4)
SFH	14 (12.6)
KSMC	6 (5.4)
KAAUH	3 (2.7)
PMAH	2 (1.8)
KFSHRC	2 (1.8)

Table 2: Knowledge items

Item	Favorable n (%)	Unfavorable, other n (%)	I don't know n (%)
Know what a disaster is	105 (94.6)	2 (1.8)	4 (3.6)
Know what a disaster plan is	70 (63.1)	26 (23.4)	15 (13.5)

Item	Favorable n (%)	Unfavorable, other n (%)	I don't know n (%)
Know where to find the plan	39 (35.1)	53 (47.7)	19 (17.1)
Know what drills are	79 (71.2)	23 (20.7)	9 (8.1)
Understand own function during a drill	45 (40.5)	50 (45.0)	16 (14.4)
Know what disaster preparedness is	60 (54.1)	36 (32.4)	15 (13.5)
Understands disaster-resource imbalance concept	82 (73.9)	12 (10.8)	17 (15.3)
Knows disaster planning covers before/during/after disaster	99 (89.2)	3 (2.7)	9 (8.1)
Knows surrounding hazards should be identified and managed	102 (91.9)	1 (0.9)	8 (7.2)
Knows the immediate evacuation process	39 (35.1)	55 (49.5)	17 (15.3)
Knows special exit doors during evacuation	43 (38.7)	44 (39.6)	24 (21.6)
Correct safest area during floods	77 (69.4)	34 (30.6)	0 (0.0)
Correctly identifies who is responsible for disaster management	104 (93.7)	7 (6.3)	0 (0.0)
Knows disaster management is collaborative across agencies	94 (84.7)	4 (3.6)	13 (11.7)

Table 3: Attitude items

Item	Favorable n (%)	Unfavorable, other n (%)	I don't know n (%)
Needs to know about disaster plans	99 (89.2)	12 (10.8)	0 (0.0)
Believes management should be adequately prepared	107 (96.4)	4 (3.6)	0 (0.0)
Rejects idea that disaster planning is for only a few people	82 (73.9)	22 (19.8)	7 (6.3)

Item	Favorable n (%)	Unfavorable, other n (%)	I don't know n (%)
Believes likely hazards should be identified and managed	106 (95.5)	2 (1.8)	2 (1.8)
Believes training is necessary for all health management staff	101 (91.0)	6 (5.4)	4 (3.6)
Believes a disaster plan is necessary	108 (97.3)	2 (1.8)	1 (0.9)
Believes disaster plans should be regularly updated	98 (88.3)	5 (4.5)	8 (7.2)
Rejects idea that disaster management is only for nurses and doctors	91 (82.0)	13 (11.7)	7 (6.3)
Believes hospital drills should be conducted	77 (69.4)	12 (10.8)	22 (19.8)
Believes disaster training should be part of internship	50 (45.0)	43 (38.7)	17 (15.3)
Agrees disaster planning should be taught in university/city	94 (84.7)	11 (9.9)	6 (5.4)
Agrees disaster planning training is necessary	103 (92.8)	3 (2.7)	4 (3.6)
Agrees an emergency plan is necessary for anticipated hazards	107 (96.4)	0 (0.0)	4 (3.6)
Agrees a disaster management committee is necessary	102 (91.9)	3 (2.7)	6 (5.4)
Agrees it is necessary to know one's disaster role	105 (94.6)	3 (2.7)	3 (2.7)
Agrees drills/workshops should be provided to improve disaster management	105 (94.6)	1 (0.9)	4 (3.6)

Table 4: Practice items

Item	Favorable n (%)	Unfavorable, other n (%)	I don't know n (%)
Has ever faced a disaster	31 (27.9)	78 (70.3)	2 (1.8)

Item	Favorable n (%)	Unfavorable, other n (%)	I don't know n (%)
Has worked on a disaster management team	20 (18.0)	89 (80.2)	2 (1.8)
Does not believe own preparedness practice is insufficient	17 (15.3)	73 (65.8)	21 (18.9)
Has heard about the disaster concept	71 (64.0)	31 (27.9)	8 (7.2)
Has been taught about disaster planning	56 (50.5)	51 (45.9)	4 (3.6)
Has performed a disaster drill/workshop in university or city	48 (43.2)	62 (55.9)	0 (0.0)

Table 5: Composite score distribution and internal consistency

Domain	Items in score	Cronbach alpha	Mean ± SD (%)	Median (IQR) (%)	Min–Max (%)	Shapiro–Wilk p
Knowledge	14	0.714	66.8 ± 19.3	64.3 (57.1 - 78.6)	21.4 - 100.0	0.013
Attitude	16	0.720	86.6 ± 14.8	87.5 (81.2 - 93.8)	20.0 - 100.0	< 0.001
Practice	6	0.543	36.6 ± 24.9	33.3 (16.7 - 55.0)	0.0 - 100.0	< 0.001

Table 6: Comparison of KAP domain scores by gender

Domain	Female, n=34 Median (IQR) %	Male, n=77 Median (IQR) %	Mann–Whitney U	p value	Effect size r
Knowledge	57.1 (42.9 - 71.4)	71.4 (57.1 - 85.7)	924.0	0.013	0.234
Attitude	93.8 (82.8 - 100.0)	87.5 (81.2 - 93.8)	1494.5	0.225	0.113

Domain	Female, n=34 Median (IQR) %	Male, n=77 Median (IQR) %	Mann–Whitney U	p value	Effect size r
Practice	33.3 (0.0 - 50.0)	33.3 (16.7 - 66.7)	1028.0	0.067	0.171

Table 7: Comparison of KAP domain scores by training level

Domain	R1 Median (IQR) %	R2 Median (IQR) %	R3 Median (IQR) %	R4 Median (IQR) %	Kruskal–Wallis H	p value	Epsilon-squared
Knowledge	57.1 (48.2 - 75.0)	71.4 (57.1 - 78.6)	71.4 (60.7 - 78.6)	78.6 (64.3 - 82.1)	5.489	0.139	0.023
Attitude	90.6 (81.2 - 95.3)	87.5 (81.2 - 93.8)	87.5 (84.4 - 93.8)	93.8 (90.6 - 93.8)	3.349	0.341	0.003
Practice	16.7 (16.7 - 37.5)	33.3 (16.7 - 50.0)	33.3 (33.3 - 66.7)	66.7 (33.3 - 66.7)	17.937	< 0.001	0.140

Kruskal Wallis was used for the four-group comparison by training level (R1–R4).

Table 8: Post hoc pairwise comparisons for practice score by training level

Comparison	n1	n2	U	Unadjusted p	Bonferroni-adjusted p
R1 vs R2	40	29	453.0	0.115	0.688
R1 vs R3	40	27	306.0	0.002	0.014
R1 vs R4	40	15	109.0	< 0.001	0.001
R2 vs R3	29	27	315.5	0.201	1.000
R2 vs R4	29	15	125.0	0.019	0.114
R3 vs R4	27	15	144.0	0.118	0.705

Table 9: Correlation between domain scores

Domain pair	Spearman	p value
Knowledge vs Attitude	0.378	<0.001
Knowledge vs Practice	0.665	<0.001
Attitude vs Practice	0.215	0.024

Discussion

The present study showed that emergency medicine residents a strong performance in attitude, a moderate level in knowledge, and the weak performance in practice, with median scores of 87.5%, 64.3%, and 33.3%, respectively. According to several previous studies where participants showed better attitudes than actual practice, even when knowledge was acceptable or moderate, which suggests that positive beliefs about disaster preparedness do not mean strong practical readiness [11–13]. The same issue was also seen in studies that reported inadequate performance in more than one domain, especially in practice, such as in emergency unit staff in Ethiopia and healthcare professionals in central Saudi Arabia, where important proportions had poor knowledge, weak attitudes, and inadequate practice levels [14,15]. The current findings mean that residents in Riyadh understand the importance of disaster planning and institutional preparedness, but this understanding not translated into practical exposure and hands-on readiness yet [14,15].

The weak practice findings in our study is understandable when looking at the item-level results, because 27.9% had ever faced a disaster, 18.0% had worked on a disaster management team, and 43.2% had performed a disaster drill, while favorable self-perceived preparedness practice was very low at 15.3%. This is similar to previous resident-based findings where disaster experience was limited, including reports that residents had never joined disaster drills, had never participated in making a disaster plan, and had never worked in an actual disaster situation [5]. A related Saudi study in emergency medicine residents also found that structured exposure to EMS and disaster medicine improved knowledge after a one-month rotation, which supports the idea that practice gaps improved when residents receive direct training instead of only theoretical awareness [4].

Another important finding in our study was that male residents had higher knowledge scores, while attitude and practice did not differ by gender, although practice was close to significance. This male advantage in knowledge is in agreement with some previous studies, including studies from Sudan and UAE, where male participants showed higher knowledge or higher perceived preparedness and skills in disaster management [3,16]. Other studies did not find a significant gender difference in readiness to practice, which means that the effect of gender is consistent in all domains or all settings [13]. The present study found no significant difference in knowledge or attitude by training level, but practice improved with advancing residency year, especially between R1 and R3 and between R1 and R4, which indicate that seniority alone not guarantee better knowledge, but it improves readiness through gradual exposure and experience.

The correlation analysis in the current study adds useful point because knowledge had a moderate positive correlation with attitude and practice, while attitude had a weaker correlation with practice. This finding is consistent with other studies showing that the three domains are connected, and that better knowledge and better attitudes contribute to stronger readiness or practice in disaster medicine [1,15]. In Pakistan, knowledge and attitude were significant predictors of readiness to practice, and in central Saudi Arabia positive correlations were reported between awareness, attitude, and practice [1,15]. Our findings support

the need for structured disaster education inside residency, regular drills, and practical training activities that move residents from favorable attitudes to performance, especially for junior residents who had the lowest practice scores in this study [4,5]. Riyadh emergency medicine residents are willing and positive toward disaster preparedness, but the gap is still in practical readiness, and this gap need repeated, hands-on, and curriculum-based training to improve.

Conclusion

Emergency medicine residents in the Riyadh region showed a good attitude toward disaster preparedness, but their knowledge was moderate and practice level weak. The findings indicate that residents understand the importance of disaster planning, training, and institutional readiness. Senior residents had better practice scores than junior residents. Our study results show the need for stronger disaster education during residency, more structured workshops, repeated drills, and practical exposure to improve practice for disaster response locally.

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Supplementary Table S1: Descriptive KAP scores by center

Center	n	Knowledge median (IQR) %	Attitude median (IQR) %	Practice median (IQR) %
KAMC	26	78.6 (57.1 - 85.7)	93.8 (82.8 - 93.8)	41.7 (20.8 - 66.7)
KKUH	25	64.3 (50.0 - 71.4)	93.8 (87.5 - 93.8)	33.3 (16.7 - 33.3)
PSMMC	17	64.3 (57.1 - 85.7)	87.5 (81.2 - 93.8)	33.3 (16.7 - 50.0)
KFMC	16	50.0 (48.2 - 58.9)	87.5 (85.9 - 93.4)	33.3 (16.7 - 37.5)
SFH	14	71.4 (64.3 - 83.9)	93.8 (87.5 - 98.4)	33.3 (33.3 - 50.0)
KSMC	6	53.6 (44.6 - 67.9)	84.4 (75.0 - 93.8)	8.3 (0.0 - 54.2)
KAAUH	3	85.7 (75.0 - 89.3)	81.2 (78.1 - 87.5)	83.3 (50.0 - 91.7)
KFSHRC	2	64.3 (50.0 - 78.6)	59.4 (42.2 - 76.6)	33.3 (16.7 - 50.0)
PMAH	2	60.7 (55.4 - 66.1)	90.6 (89.1 - 92.2)	41.7 (37.5 - 45.8)

Supplementary Table S2: Disaster types recognized by respondents

Disaster type	Selections, n (%)
Epidemics	99 (89.2)
Fire	92 (82.9)
Flood	70 (63.1)
Earthquake	68 (61.3)
Volcano eruption	40 (36.0)
Landslide	35 (31.5)
Others	22 (19.8)