

Title: Factors Associated with Disaster Response Self-Efficacy among Medical Sciences Students:
An Empowerment Theory-Based Cross-Sectional Study

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Abstract

Background: Disasters pose major challenges to health systems worldwide, and the preparedness of healthcare personnel, particularly medical sciences students, is crucial for effective disaster management. This study aimed to identify factors associated with disaster response self-efficacy among students at Babol University of Medical Sciences, using Empowerment Theory as a framework.

Materials and Methods: A descriptive-analytical cross-sectional study was conducted in 2025 among 213 students selected through convenience sampling. A valid and reliable questionnaire assessing empowerment dimensions (self-efficacy, intention, motivation, participation, critical awareness, knowledge, and skills) was used. Data were analyzed using Pearson's correlation coefficient and multiple linear regression analysis in SPSS version 26.

Results: Disaster response self-efficacy was positively correlated with intention ($r = 0.61$), motivation ($r = 0.52$), participation ($r = 0.46$), skills ($r = 0.30$), and critical awareness ($r = 0.14$) ($P < 0.05$). In the multivariable regression model, intention ($\beta = 0.37$, $P < 0.001$), motivation ($\beta = 0.22$, $P = 0.001$), and participation ($\beta = 0.18$, $P = 0.004$) were positively associated with self-efficacy, whereas skills showed an inverse association ($\beta = -0.18$, $P = 0.002$). The model explained 48% of the variance in disaster response self-efficacy (adjusted $R^2 = 0.48$).

Conclusion: Intention, motivation, and participation were the strongest positive correlates of disaster response self-efficacy, highlighting the importance of behavioral and motivational dimensions over knowledge alone. The unexpected inverse association between self-reported skills and self-efficacy in the adjusted model warrants further investigation, possibly reflecting measurement limitations or metacognitive biases. Empowerment-oriented educational interventions that strengthen intention, motivation, and active participation—and that move beyond knowledge transfer—may be more effective in enhancing students' perceived capability for disaster response. Future longitudinal studies with objective skill assessments are needed to validate these findings.

Keywords: Disaster Planning; Self Efficacy; Students, Medical; Empowerment; Disaster Response

Introduction

Disasters caused by natural and human-induced hazards pose major challenges to health systems and societies worldwide [1]. Their consequences are shaped not only by the type and magnitude of the hazard but also by population exposure, vulnerability, and the capacity to respond effectively [2]. Climate change, environmental degradation, and poorly planned urbanization can further increase vulnerability and intensify disaster impacts [3-6]. The scale of these challenges highlights the importance of strengthening the ability of individuals, communities, and health systems to prepare for, respond to, and recover from disasters [5, 7]. In 2023 alone, more than 399 major natural disasters were recorded worldwide, resulting in 86,473 deaths, affecting over 93 million people, and causing economic losses exceeding USD 202.7 billion [8]. Iran is particularly vulnerable, with approximately 90% of its population exposed to natural hazards, especially earthquakes and floods [9]. In this context, effective preparedness is essential; however, preparedness requires more than simply knowing about risks. Individuals must also possess practical skills, emergency plans, and confidence in their ability to act effectively when a disaster occurs [10, 11]. This latter component—confidence in one's ability to act—highlights the importance of self-efficacy. Defined as an individual's belief in their ability to perform specific tasks successfully and manage challenging situations, self-efficacy is associated with motivation, decision-making, persistence, and performance [8, 12-14]. Its importance may be particularly pronounced among medical sciences students, who will constitute an important part of the future health workforce and may be expected to contribute to healthcare delivery, emergency response, and community support during disasters [15, 16]. Yet, evidence suggests that students may not be adequately prepared for these potential responsibilities, with reported gaps in disaster preparedness, knowledge, and disaster health literacy among medical sciences students [17-20]. Moreover, students have often been overlooked in emergency planning [20, 21], while disaster education in the health professions remains fragmented and insufficiently grounded in behavioral theory [22-24]. These limitations raise an important question: how can disaster education move beyond simply providing information to strengthen the psychological and behavioral capacities needed for effective response? One possible answer lies in the use of behavioral theories, which can help explain why individuals do or do not engage in preparedness behaviors and can guide the development of more targeted educational interventions [3, 24, 25]. Although studies in Iran have used the Theory of Planned Behavior to examine disaster preparedness intentions and behaviors [26], relatively little attention has been given to empowerment-based approaches, particularly among medical sciences students. Empowerment Theory provides a relevant perspective because it emphasizes individuals' control over their actions, self-efficacy, motivation, active participation, and the ability to make decisions and act effectively in challenging situations [8, 10, 27]. Unlike approaches that focus primarily on cognitive appraisal of risk, such as perceived susceptibility, perceived severity, or knowledge of hazards, Empowerment Theory adopts a broader behavioral perspective by emphasizing

perceived control, self-efficacy, motivation, participation, and the capacity to translate knowledge into action [24, 27]. This broader perspective is particularly relevant to disaster response, where effective performance requires not only recognizing risks but also having the confidence and perceived capacity to make decisions and act under challenging and uncertain conditions [8, 10, 27]. From this perspective, effective disaster education should not merely provide students with knowledge; it should help them develop the motivation, confidence, participation, and practical capacity needed to translate knowledge into action. Evidence from educational interventions further suggests that structured disaster-related training can improve knowledge, skills, and attitudes, while empowerment-based education may additionally strengthen self-efficacy and other empowerment-related capacities [8, 28, 29]. Despite the potential relevance of this approach, few studies have examined disaster response self-efficacy among Iranian medical sciences students within an Empowerment Theory framework. Mazandaran Province, where Babol University of Medical Sciences is located, is exposed to a diverse range of natural hazards, including floods, earthquakes, landslides, storms, droughts, and other climate-related hazards [30]. This multifaceted hazard profile underscores the importance of disaster preparedness among future health professionals in the region and provides a contextually relevant rationale for selecting students at Babol University of Medical Sciences as the study population. Therefore, this study investigated factors associated with disaster response self-efficacy among students at Babol University of Medical Sciences. By examining empowerment-related constructs in relation to self-efficacy, this study aimed to provide evidence that can support the development of more targeted educational interventions and improve disaster preparedness curricula for future health professionals.

Materials and Methods

Study Design and Participants

A cross-sectional analytical study was conducted among students enrolled at Babol University of Medical Sciences, Iran, between February and May 2026. Participants were recruited from the university's faculties using convenience sampling. Eligible participants were students who were currently enrolled, voluntarily agreed to participate, and provided written informed consent. Data were collected face-to-face at the respective faculties. The self-administered questionnaires were distributed and collected with the assistance of class representatives, who facilitated access to eligible students in their respective classes. Each questionnaire required approximately 15–20 minutes to complete. A total of 258 questionnaires were collected during the study period. Following data screening, questionnaires with substantial missing or incomplete data were excluded, and 213 questionnaires were included in the final analysis. The study

protocol was reviewed and approved by the Ethics Committee of Babol University of Medical Sciences, and all study procedures were conducted in accordance with applicable ethical guidelines and regulations [8, 31].

Sample Size

The sample size was determined based on a minimum correlation coefficient of $r = 0.20$, assuming a two-sided significance level of 0.05 and 80% statistical power. Fisher's z-transformation was used to estimate the minimum sample size required to detect the specified correlation (Eq. 1) [32-34]:

$$N = \frac{(Z_{\alpha/2} + Z_{\beta})^2}{\omega^2} + 3 \quad (1)$$

Where:

N: minimum required sample size

$Z_{\alpha/2}$: critical value of the standard normal distribution for a two-tailed significance level (for $\alpha = 0.05$, $Z_{\alpha/2} = 1.96$)

Z_{β} : critical value corresponding to the desired statistical power (for 80% power, i.e., $\beta = 0.20$, $Z_{\beta} = 0.84$)

ω : Fisher's z-transformation of the correlation coefficient r , calculated as:

$$\omega = \frac{1}{2} \ln \left(\frac{1+r}{1-r} \right) \quad (2)$$

For $r = 0.20$, the corresponding Fisher's z-transformed value was approximately 0.203. The minimum required sample size was 194 participants. After allowing for 10% potential non-response or incomplete data, the target sample size was increased to 213 students.

Questionnaire

Data were collected using the questionnaire developed by Shahraki-Sanavi et al. (2025), which was originally developed in Persian based on the Empowerment Theory framework. The original questionnaire demonstrated acceptable content validity, with a content validity ratio (CVR) of 0.90 and a content validity index (CVI) ranging from 0.80 to 0.90, and satisfactory internal consistency (overall Cronbach's alpha = 0.75) [8]. The original Persian version was administered without modification, while the questionnaire

items were translated into English for reporting, with the wording and conceptual meaning of the original items preserved.

The questionnaire comprised two sections. The first section collected demographic and disaster-related characteristics, including age, sex, field of study, marital status, previous disaster experience, and participation in disaster preparedness training. The second assessed seven constructs within the Empowerment Theory framework: self-efficacy, motivation, intention, participation, critical awareness, knowledge, and skills (Table 1). All items were rated on a five-point Likert scale, except for one numerical item scored from 0 to 10, with higher scores indicating higher levels of the corresponding construct [8].

Table 1. Questionnaire constructs, items, and response scales

Construct	Item No.	Item statement
Demographic characteristics	1	Age
	2	Sex
	3	Field of study
	4	Marital status
	5	Have you ever been affected by a disaster?
	6	Have you ever participated in a disaster preparedness training program?
Self-efficacy	1	I can contribute to improving community preparedness for disasters.
	2	I can provide disaster preparedness training to others.
	3	During a disaster, I can effectively influence community management.
	4	During a disaster, I can collect information related to my community.
	5	During a disaster, I can encourage community members to participate in relief efforts.
	6	During a disaster, I can provide first aid to community members.
Motivation	1	I think it is important for me to take action in the community during disasters.
	2	I feel that efforts to address community problems during disasters are valuable.
	3	I am motivated to take action in the community during disasters.
Intention	1	I intend to provide first aid to community members during disasters.
	2	I plan to participate in disaster-related activities.
	3	I intend to contribute to planning for community disaster preparedness.
	4	I intend to participate in community relief efforts during disasters.

Participation	1	I actively participate in community activities during disasters.
	2	I volunteer to participate in community activities during disasters.
Critical awareness	1	I believe that the problems faced by my community during disasters are serious.
Knowledge	1	I have knowledge of earthquake disaster management.
	2	I have knowledge of storm disaster management.
	3	I have knowledge of flood disaster management.
	4	I have knowledge of fire disaster management.
	5	I have knowledge of drought disaster management.
	6	I have knowledge of tornado disaster management.
	7	I have knowledge of first aid.
	8	During a disaster, I know how to protect community members from hazards.
	9	During a disaster, I know how to reduce harm to my community.
	10	Based on your knowledge of disasters, how likely are you to recommend that your friends or family learn more about disasters?
Skills	1	I have cardiopulmonary resuscitation (CPR) skills.
	2	I have triage skills for disaster victims.

Note: The original Persian version of the questionnaire developed by Shahraki-Sanavi et al. (2025) [8] was administered to participants. The English wording presented in this table was prepared for reporting purposes and does not represent a separate version of the questionnaire.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics, version 26. Descriptive statistics were used to characterize the study variables, and Cronbach's alpha coefficient was calculated to assess the internal consistency of the multi-item constructs. Pearson correlation coefficients were then calculated to examine associations among the empowerment constructs. Multiple linear regression analysis was subsequently performed to identify factors independently associated with disaster response self-efficacy, with self-efficacy entered as the dependent variable and motivation, intention, participation, critical awareness, knowledge, and skills as predictors. The assumptions of the regression model were assessed using residual diagnostics, variance inflation factors (VIFs), and the Durbin–Watson statistic. The adjusted R^2 was reported to indicate the explanatory power of the model. Statistical significance was defined as a two-sided P value < 0.05 .

Results

Demographic Characteristics

Table 2 presents the demographic characteristics of the 213 participants. The mean age was 25.98 ± 8.19 years, with most participants being female (69.0%) and single (75.1%). Regarding previous disaster experience and preparedness training, 41.8% reported having been affected by a disaster, whereas 35.2% had previously attended disaster preparedness training. The largest proportions of participants were enrolled in paramedicine and rehabilitation (27.2%) and nursing (22.5%).

Table 2. Demographic characteristics of study participants

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	66	31.0
	Female	147	69.0
Marital status	Married	53	24.9
	Single	160	75.1
Previous disaster experience	Yes	89	41.8
	No	124	58.2
Disaster preparedness training	Yes	75	35.2
	No	138	64.8
Field of study	Environmental Health	13	6.1
	Public Health	23	10.8
	Nursing	48	22.5
	Midwifery	43	20.2
	Medicine	28	13.1
	Paramedicine and Rehabilitation	58	27.2

Descriptive Statistics and Reliability

Table 3 presents the descriptive statistics and internal consistency of the study constructs. Motivation had the highest mean score (3.96), whereas participation had the lowest (2.83). Cronbach's alpha coefficients for all multi-item constructs were ≥ 0.76 , indicating acceptable to good internal consistency.

Table 3. Descriptive statistics and reliability of study variables

Variable	Min	Max	Mean	SE	Cronbach's α
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Self-efficacy	1	5	3.49	0.04	0.83
Motivation	2	5	3.96	0.04	0.78
Intention	1	5	3.56	0.04	0.80
Participation	1	5	2.83	0.07	0.80
Critical awareness	1	5	3.49	0.07	N/A*
Knowledge	1.2	5	3.54	0.04	0.76
Skills	1	5	3.48	0.07	0.87

*Note: Cronbach's alpha was not applicable to critical awareness because this construct was measured using a single item.

Correlation Analysis

Table 4 reports the Pearson correlation coefficients for the study variables. Disaster response self-efficacy was positively correlated with intention ($r = 0.61$, $p < 0.001$), motivation ($r = 0.52$, $p < 0.001$), participation ($r = 0.46$, $p < 0.001$), skills ($r = 0.30$, $p < 0.001$), and critical awareness ($r = 0.14$, $p = 0.03$). In contrast, no significant correlation was observed between self-efficacy and knowledge ($r = -0.09$, $p = 0.15$). Motivation, intention, and participation were positively correlated with one another ($r = 0.39$ – 0.60 , $p < 0.001$), whereas skills were negatively correlated with motivation, intention, and participation ($r = -0.19$ to -0.33 , $p < 0.001$).

Table 4. Pearson correlation coefficients for the study variables

Variable	Self-efficacy	Motivation	Intention	Participation	Critical awareness	Knowledge	Skills
Self-efficacy	1						
Motivation	0.52**	1					
Intention	0.61**	0.60**	1				
Participation	0.46**	0.39**	0.46**	1			
Critical awareness	0.14*	0.28**	0.10	0.30**	1		
Knowledge	-0.09	0.00	-0.13	-0.22**	0.09	1	
Skills	0.30**	-0.19**	-0.20**	-0.33**	-0.12	0.36**	1

Note: * $p < 0.05$; ** $p < 0.001$.

Regression Model

Multiple linear regression analysis was performed to identify factors independently associated with disaster response self-efficacy. Before the analysis, the assumptions of the regression model were assessed. The normality of the regression residuals was evaluated using skewness and kurtosis statistics, together with visual inspection of the residual histogram (Figure 1) and normal P–P plot (Figure 2). Although the Kolmogorov–Smirnov test was statistically significant ($KS = 0.09$, $p < 0.001$), indicating a deviation from normality, the skewness (-0.52) and kurtosis (0.23) values were within commonly accepted ranges (± 2 and ± 3 , respectively), and the graphical assessments showed no substantial departure from an approximately normal distribution of the residuals. Multicollinearity was assessed using variance inflation factors (VIFs), and all VIF values below 1.73, indicating no evidence of problematic multicollinearity. The Durbin–Watson statistic was 1.91, within the range of 1.5–2.5, supporting the assumption of independent residuals.

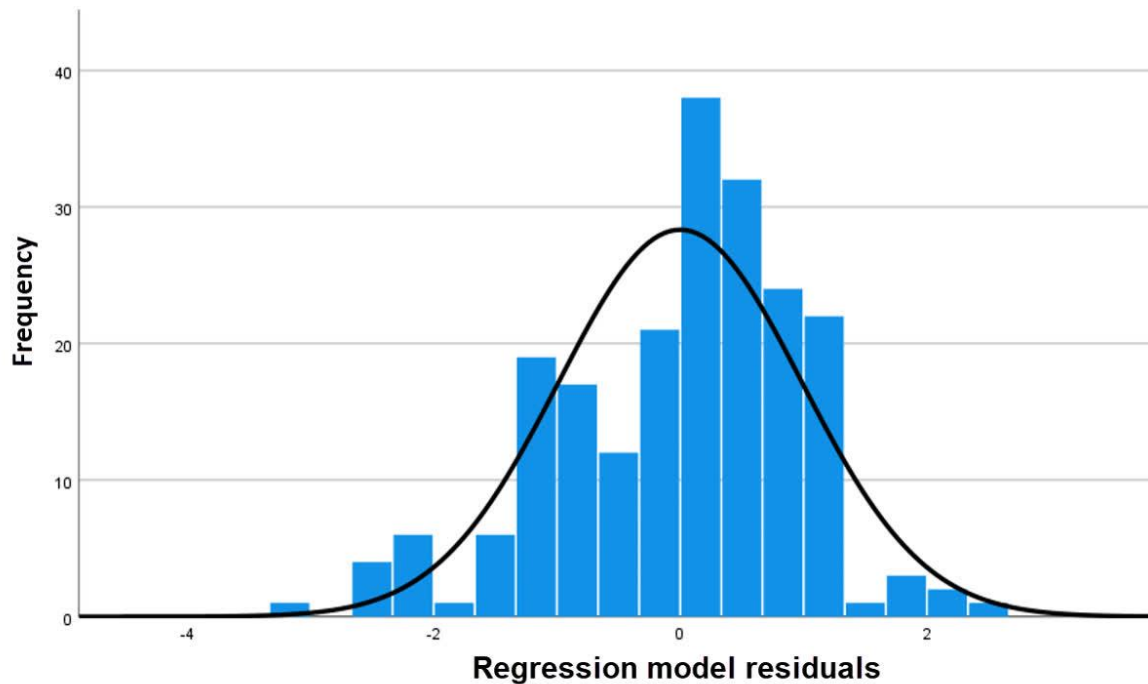


Figure 1. Histogram of regression model residuals.

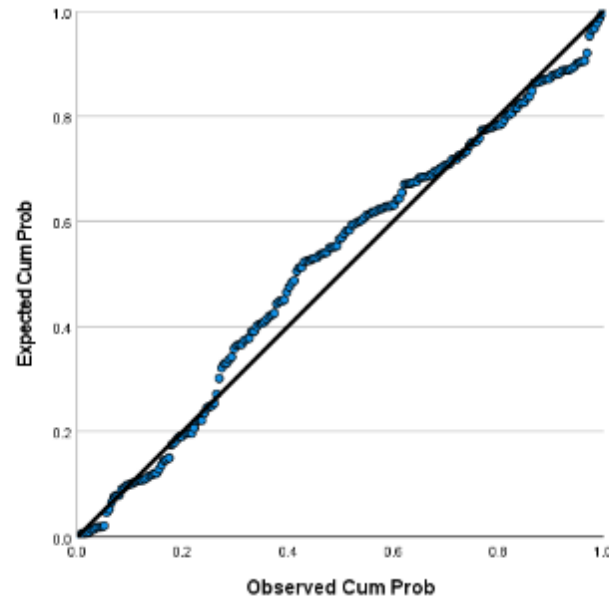


Figure 2. P-P plot of regression model residuals.

Table 5 presents the regression coefficients, significance levels, adjusted coefficient of determination (R^2), and variance inflation factor (VIF) values for all independent variables. As shown in Table 5, intention ($\beta = 0.37$, $p < 0.001$), motivation ($\beta = 0.22$, $p = 0.001$), and participation ($\beta = 0.18$, $p = 0.004$) were positively associated with disaster response self-efficacy. Intention showed the strongest standardized association, with each one-unit increase in intention associated with a 0.34-unit increase in self-efficacy. Similarly, one-unit increases in motivation and participation were associated with 0.22- and 0.10-unit increases in self-efficacy, respectively. In contrast, skills showed a significant inverse association with self-efficacy ($\beta = -0.18$, $p = 0.002$), with each one-unit increase in the skills score corresponding to a 0.10-unit decrease in self-efficacy. Knowledge was not significantly associated with disaster response self-efficacy ($\beta = 0.04$, $p = 0.41$).

Table 5. Multiple linear regression analysis of factors associated with disaster response self-efficacy

Variable	B	SE	β	t	p-value	VIF	Adjusted R^2
Motivation	0.22	0.06	0.22	3.25	0.001	1.70	0.48
Intention	0.34	0.06	0.37	5.48	<0.001	1.73	
Participation	0.10	0.04	0.18	2.88	0.004	1.52	

Critical awareness	-0.01	0.03	-0.03	-0.53	0.59	1.20
Knowledge	0.04	0.05	0.04	0.81	0.41	1.22
Skills	-0.10	0.03	-0.18	-3.18	0.002	1.27

Note: B = unstandardized regression coefficient; β = standardized regression coefficient.

Discussion

This study examined factors associated with disaster response self-efficacy among students at Babol University of Medical Sciences within an Empowerment Theory framework. Intention, motivation, and participation showed the strongest positive independent associations with self-efficacy, and the regression model explained 48% of its variance. This finding indicates that differences in students' perceived ability to respond to disasters were more strongly related to motivational and behavioral dimensions than to knowledge alone. An additional finding was the contrast between motivation and participation: motivation had the highest mean score among the constructs (3.96/5), whereas participation was considerably lower (2.83/5). This pattern may indicate that students are willing to engage in disaster-related activities but have limited opportunities to translate this willingness into practical involvement. Intention had the strongest independent association with disaster response self-efficacy ($\beta = 0.37$). A similar pattern was reported by Ahmadi Tabatabaei et al., who identified behavioral intention as the strongest predictor of disaster preparedness behavior among residents of Kerman, Iran [35]. The finding is also consistent with the Theory of Planned Behavior (TPB), in which intention represents a proximal determinant of behavior [36]. In the present study, however, intention was examined in relation to self-efficacy rather than actual preparedness behavior. Therefore, the observed association should not be interpreted as evidence that intention increases self-efficacy. One possibility is that students who feel more capable of responding to disasters are also more likely to form stronger intentions to engage in disaster-related activities. Conversely, stronger intentions may reinforce students' perceived readiness to act. Paton similarly emphasized self-efficacy as an important psychological component of disaster preparedness [10]. Longitudinal research would be needed to clarify the temporal relationship between these constructs. Motivation was also independently associated with self-efficacy ($\beta = 0.22$). This finding is compatible with empowerment-oriented perspectives, which regard motivation and the perceived meaningfulness of action as relevant to individuals' sense of competence, control, and empowerment [37, 38]. The relatively high motivation score suggests that students generally recognized the importance of taking action during disasters. Yet, their lower participation score indicates that motivation was not necessarily accompanied by comparable levels of engagement. This discrepancy may reflect limited opportunities for involvement, insufficient practical training, structural barriers, or the

limited integration of disaster-related activities into existing curricula. Previous research has also identified weaknesses in both the disaster-related content and practical orientation of medical sciences curricula in Iran [16]. Thus, strengthening motivation without creating opportunities to act may have limited value for developing students' perceived capability. Several recommendations may help address this gap: First, disaster preparedness should be integrated into the core medical curriculum as a mandatory, credit-bearing component, ensuring all students receive foundational training rather than relying on voluntary participation. Second, structured service-learning opportunities should be established through partnerships with local disaster organizations (e.g., the Red Crescent), allowing students to participate in community risk assessments and public education campaigns. Third, universities should establish a 'Disaster Response Student Task Force' with faculty mentorship to organize peer training, simulation drills, and campus preparedness initiatives, providing students with a legitimate outlet for their motivation. Fourth, dedicated institutional resources—including budgets for simulation equipment, protected faculty time, and administrative support—are essential for sustaining these initiatives. Finally, periodic low-stakes practical drills should be mandated to reinforce skills in a safe environment, ensuring that theoretical knowledge is translated into practical competence.

Participation showed the third-strongest positive association with self-efficacy ($\beta = 0.18$). This finding is particularly relevant to the empowerment framework because participation provides opportunities through which individuals may develop competence, agency, and perceived control. Paton's Community Engagement Theory likewise places participation, empowerment, and collective efficacy among the processes that support decision-making and action under uncertain conditions [10, 39]. Nevertheless, the direction of this relationship cannot be established from the present cross-sectional data. Participation may contribute to self-efficacy by providing experience and opportunities for successful action, while students with greater self-efficacy may also be more inclined to participate. The relatively low participation score therefore deserves attention as an educational issue rather than simply as an individual deficit. Providing students with repeated and meaningful opportunities to participate in disaster preparedness activities may help bridge the gap between willingness and actual engagement. This interpretation is also consistent with the broader intention-behavior gap described in health behavior research [39]. The negative adjusted association between skills and self-efficacy ($\beta = -0.18$) was unexpected and requires cautious interpretation. At the bivariate level, skills were positively correlated with self-efficacy ($r = 0.30$, $p < 0.001$), but skills were negatively correlated with motivation ($r = -0.19$), intention ($r = -0.20$), and participation ($r = -0.33$). The change in direction after adjustment may therefore reflect a suppression effect or shared variance among the empowerment constructs. Importantly, the regression coefficient does not indicate that acquiring greater skills reduces self-efficacy. Rather, after accounting for the other variables in the model, the unique statistical component of the self-reported skills score was inversely associated with self-efficacy. Although

the VIF values did not indicate severe multicollinearity, low VIF values do not rule out suppression effects. A possible psychological interpretation is that students who report greater competence may also have a greater awareness of the complexity and limitations of disaster response. Beyond statistical explanations, this inverse association may reflect meaningful psychological processes. The Dunning–Kruger effect has been proposed as a possible explanation, whereby individuals with greater competence may have greater metacognitive awareness of their limitations, leading to more moderate self-appraisals, whereas less skilled individuals may overestimate their readiness. Furthermore, disaster environments are inherently chaotic. Students with more training may recognize these operational challenges—including cognitive tunneling, information overload, and pressure—and, when assessing their global self-efficacy, may implicitly consider their ability to navigate such complexity. Their cautious self-assessment may therefore reflect realistic calibration rather than diminished competence. Future qualitative research is needed to clarify these mechanisms. The Dunning–Kruger effect has been proposed as one possible explanation for situations in which perceived competence does not correspond straightforwardly to perceived ability [40, 41]. Skills were assessed through self-report rather than objective performance measures, and neither metacognitive awareness nor actual competence was evaluated. Consequently, the inverse association should be regarded as a finding requiring further investigation rather than as evidence of a psychological mechanism. The findings regarding knowledge provide another important consideration for disaster education. Knowledge was not significantly associated with self-efficacy in either the bivariate analysis ($r = -0.09$, $p = 0.15$) or the multivariable model ($\beta = 0.04$, $p = 0.41$). This does not imply that disaster-related knowledge is unimportant. Rather, it suggests that possessing or perceiving oneself as knowledgeable may not, by itself, correspond to greater confidence in performing disaster-response tasks. Previous research has similarly questioned whether conventional knowledge-focused education is sufficient to produce sustained preparedness or behavioral change [24, 25, 42, 43]. Codreanu et al. reported improvements in theoretical knowledge without corresponding behavioral change, while Ejeta et al. emphasized the value of incorporating behavioral theories into disaster and emergency preparedness education [24, 44]. Nakano and Yamori’s Proactive Attitude Model further emphasizes active participation, experiential learning, communities of practice, and sustained engagement rather than one-way information transfer [25]. Taken together, these findings suggest that disaster education for medical sciences students may benefit from combining theoretical knowledge with opportunities for application [45]. Simulation exercises, scenario-based learning, interdisciplinary activities, supervised practice, feedback, and reflection could provide students with opportunities to test their abilities in realistic contexts and potentially strengthen both competence and perceived capability. Such approaches are consistent with evidence that empowerment-based education can improve disaster-related knowledge, skills, and attitudes among university students [8, 28, 29]. Importantly, the present findings do not demonstrate that these educational strategies will increase

self-efficacy; rather, they identify motivational and participatory dimensions that may be relevant targets for future intervention research.

Overall, the results indicate that students' disaster response self-efficacy was more closely related to intention, motivation, and participation than to knowledge, while the unexpected inverse association with self-reported skills requires further examination. The findings therefore support an educational perspective in which preparedness is not limited to the acquisition of information but also involves students' willingness to act and opportunities to engage in meaningful practice. This consideration is particularly relevant in Iran, where exposure to multiple natural hazards reinforces the need to prepare future health professionals for emergency situations [16]. The experience of the COVID-19 pandemic further demonstrated the demands placed on health personnel working under conditions of uncertainty and high pressure [43]. Future longitudinal and intervention studies should examine whether strengthening intention, motivation, and meaningful participation leads to higher self-efficacy and, importantly, whether changes in self-efficacy are accompanied by improvements in objectively assessed disaster-response performance.

Limitations and Recommendations

Despite adhering to scientific and methodological principles, this study has certain limitations that may affect the interpretation and generalizability of the results. First, the use of convenience sampling increases the risk of selection bias. Second, data were collected through self-report questionnaires, which may be subject to recall bias or social desirability bias. Third, the cross-sectional design limits causal inferences; the observed relationships are correlational in nature. Based on these findings, we recommend: (1) revising medical sciences curricula to integrate operational training grounded in empowerment; (2) designing and implementing interdisciplinary educational programs with an emphasis on realistic simulations, clinical scenarios, and hands-on workshops that simultaneously strengthen students' technical skills and psychological self-efficacy; (3) conducting future longitudinal and interventional studies to evaluate the impact of empowerment programs on the actual disaster preparedness of medical sciences students; and (4) the self-reported nature of the skills construct may not accurately reflect objective technical competence. As noted in the discussion, the inverse association between self-reported skills and self-efficacy in the multivariable model may reflect a suppression effect or metacognitive bias (e.g., the Dunning-Kruger effect) rather than a true negative relationship. Future studies should incorporate objective performance assessments alongside self-report measures to validate these findings.

Conclusion

This study demonstrated that intention, motivation, and participation were significantly associated with disaster response self-efficacy among medical sciences students. In contrast, knowledge was not significantly associated with self-efficacy, whereas skills showed a significant negative association in the multivariable analysis. These findings emphasize the importance of moving beyond traditional “knowledge-transfer” approaches toward more “empowerment-oriented” strategies. Educational programs should go beyond theoretical instruction and focus on strengthening behavioral intention, fostering intrinsic motivation, creating opportunities for active participation, and enhancing self-efficacy through guided practical experiences such as simulations and field internships.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the research, authorship, and/or publication of this article.

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Ethical Considerations

This study was derived from a research project with code 724137173 and ethics approval number IR.MUBABOL.REC.1404.210, approved by the Ethics Committee of Babol University of Medical Sciences. All ethical principles were fully observed, including obtaining informed consent from all participants, maintaining confidentiality, respecting participants’ rights, and avoiding plagiarism, duplicate publication, data fabrication, and falsification.

Author Contributions

Elham Falahati Naghibi: Conceptualization, data management, formal analysis, supervision, methodology, visualization, validation, investigation, writing – original draft, review & editing.

Mohammad Shirmardi: Conceptualization, formal analysis, validation, investigation, review & editing.

Danial Habibi: Statistical analysis, formal analysis, validation, methodological guidance. **Morteza**

Valipour Baboli: Investigation, data collection, data entry. **Bitā Rezanejad Malekshah:** Investigation, data collection, data entry. **Khosro Zabihian:** Investigation, data collection, data entry. **Neda Ahmadzadeh Tori:** Project administration, conceptualization, formal analysis, methodology, visualization, validation, supervision, funding acquisition, resources, review & editing.

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