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Risk perception of emergency medical technicians in biological disasters: a comparison between COVID-19 and Non-COVID-19 cases

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Abstract

Background Emergency medical technicians (EMTs), positioned at the forefront of medical services, are at greater risk of contracting COVID-19 and passing it on to their families and communities than others. Recognizing the risks associated with this disease can play a crucial role in the care and prevention process. Consequently, this study evaluated the level of risk perception (RP) regarding COVID-19 among EMTs and compared it between those who have contracted the disease and those who have not.

Methods This was a cross-sectional descriptive-analytical study conducted in 2021. This study employed simple random sampling to select 200 EMTs affiliated with Birjand University of Medical Sciences. The sample included 100 EMTs who had contracted COVID-19 and 100 who had not. Data were collected through a researcher-designed questionnaire, distributed online via WhatsApp and Telegram groups among the participants. The data were analyzed using SPSS version 16, utilizing descriptive statistical methods (frequency, mean, and standard deviation) along with inferential statistical tests such as independent t-tests, chi-square, and two-way analysis of variance (ANOVA).

Results The infected EMTs exhibited a moderate perception of the risk of COVID-19, while the non-infected EMTs reported a high level of RP. The independent t-test confirmed that the mean total score for COVID-19 RP was significantly lower in the infected EMTs compared to the non-infected group (mean RP score: infected 150.82 ± 32.24 vs. non-infected 161.54 ± 22.50, $P = 0.007$). Additionally, ANOVA revealed that none of the demographic variables individually had a significant impact on the level of COVID-19 RP ($P > 0.05$). Furthermore, the interaction effect between the demographic variables and the groups was also insignificant ($P > 0.05$).

Conclusion EMTs who contracted COVID-19 had a significantly lower RP compared to their non-infected counterparts. This reduced awareness of COVID-19 risks likely contributed to their infection, highlighting the critical role of RP in disease prevention. Targeted educational programs to enhance RP among EMTs could foster stronger adherence to preventive measures, ultimately reducing infection rates during future biological disasters. Therefore,

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this study not only contributes to expanding existing knowledge in this field but also assists policymakers and health administrators in improving decision-making to strengthen epidemic preparedness.

Keywords Emergency medical technicians, Disasters, COVID-19, Perception, Risk

Background

Biological disasters pose a severe and unpredictable threat to public health and can rapidly spread beyond borders, overwhelming healthcare systems worldwide [1]. A prominent example of such disasters is COVID-19, an emerging infection caused by the human coronavirus SARS-CoV-2, which has had devastating consequences on global health, economies, and daily life [2]. This disease first emerged in late 2019 in China and was declared a global pandemic by the World Health Organization (WHO) on March 11, 2020 [3]. The main symptoms of COVID-19 include fever, dry cough, shortness of breath, muscle pain, fatigue, and radiological evidence of pneumonia [4]. Beyond its direct health effects, the pandemic has also caused significant psychological distress, social disruptions, and economic instability, making it one of the most impactful biological disasters of modern times.

To control this disease, preventive measures such as maintaining physical distancing, wearing masks, and using personal protective equipment (PPE) have been widely recommended and mandated in many countries [5]. In Iran, the official announcement of the spread of the coronavirus was made on February 18, 2020 [6]. Since then, the Iranian healthcare system has faced immense challenges in handling the crisis, including shortages of medical supplies, high infection rates among healthcare professionals, and public skepticism regarding preventive protocols.

Healthcare providers (HCPs), due to the nature of their profession, are always at risk of contracting infectious diseases [7]. According to one study, the rate of disease transmission to this group is reported to be as high as 29%, highlighting their vulnerability during pandemics [8]. In Iran, over 6,000 HCPs have contracted COVID-19, and more than 150 have lost their lives to the disease [9]. This high infection and fatality rate among HCPs underscores the urgent need for better protective strategies, adequate training, and stronger institutional support. Protecting HCPs and preventing the transmission of infection by this group plays a crucial role in managing an epidemic. This requires that HCPs be equipped with up-to-date knowledge regarding the origin of the disease, modes of transmission, symptoms, and preventive measures.

Among HCPs, emergency medical technicians (EMTs) serve as the first line of defense in medical emergencies, and they are among the first to have direct and close contact with suspected or confirmed COVID-19 patients. Given the professional nature of their role, they are expected to possess adequate awareness regarding health-promoting behaviors. However, the high infection rate among EMTs suggests a critical gap between theoretical knowledge and actual preventive practices in disease prevention. This discrepancy raises concerns about the effectiveness of current training programs, the availability of protective resources, and the psychological factors influencing EMTs' adherence to safety protocols.

In this regard, Zhao et al. identified a lack of proper risk perception (RP) among HCPs as a potential reason for this gap [10]. Studies conducted in other countries have also indicated that, despite HCPs' high level of knowledge, their RP and preventive behaviors regarding COVID-19 often remain inadequate or inconsistent [11]. Contributing factors to this issue include excessive workload, poor quality of protective equipment, limited access to updated guidelines, and negligence among some HCPs [12]. These challenges emphasize the need for a deeper understanding of how RP influences compliance with safety measures among frontline medical workers.

RP is a critical psychological construct that influences how individuals assess and respond to potential threats, particularly in the context of health-related behaviors [13]. It involves the evaluation of both the likelihood and severity of a risk, which can vary based on individual experiences, cultural factors, and the availability of information [14]. Studies have shown that higher perceived risk is associated with increased engagement in preventive behaviors, such as vaccination or adherence to public health guidelines [15]. Conversely, individuals with low RP may underestimate the dangers, leading to lax safety behaviors and increased exposure to infectious agents [14]. Furthermore, RP is not static but can be dynamically influenced by external factors such as media coverage, social norms, and personal experiences. Understanding these dynamics is essential for designing effective public health strategies that align with individuals' RP and promote protective behaviors.

Failure to perceive infectious diseases as a serious threat can contribute to their rapid spread, not only among EMTs but also within the broader community they serve. As frontline responders dealing directly with patients, EMTs play a crucial role in controlling and preventing the transmission of infections. Despite the importance of this issue, a more in-depth assessment of RP among this occupational group is essential, as understanding this factor can directly impact personal safety and reduce disease transmission.

Accordingly, this study was designed and conducted to assess the level of COVID-19 RP among EMTs and compare it between infected and non-infected individuals. Given the ongoing challenges posed by emerging diseases and the potential for future epidemics, the findings of this study have the potential to bridge critical knowledge gaps and inform targeted interventions. Furthermore, these insights can pave the way for developing more effective interventions aimed at enhancing occupational safety and improving emergency responses to public health disasters. By shedding light on EMTs' RP and behavioral responses, this research can contribute to shaping more resilient healthcare policies and preparedness strategies for future biological disasters.

Methods

Study design

This research was conducted as a cross-sectional descriptive-analytical study in 2021. To ensure a precise examination, a systematic random sampling method was employed, enhancing the study's reliability and reducing selection bias. Given the absence of similar studies and the lack of sufficient information regarding population variance, Morgan's table was utilized to determine optimal sample size, assuming a confidence level of 95% and a margin of error of 5%, ensuring statistical power and generalizability of the findings.

Participants

The study population comprised all EMTs employed in the Emergency Medical Services (EMS) system of Birjand University of Medical Sciences during the COVID-19 pandemic. Among this population, 180 individuals had contracted COVID-19. Based on Morgan's table, the required sample size for this study was estimated to be approximately 130 participants. However, due to practical constraints such as time limitations and resource availability, a final selection of 100 COVID-19-positive EMTs and 100 non-infected EMTs was made using systematic random sampling, ensuring equitable representation of both groups. The selection of infected EMTs was based on predefined inclusion criteria, which included at least one year of EMS experience, ensuring familiarity with emergency protocols, a confirmed positive PCR test for COVID-19, and willingness to participate in the study voluntarily. To establish a valid comparison, an equal number of non-infected EMTs were randomly selected. Participants who failed to complete the questionnaire in its entirety were excluded to maintain data integrity.

Data collection

To ensure participant safety and maximize response rates during the COVID-19 pandemic, data collection was conducted entirely online. A researcher-designed questionnaire was created using Google Forms, and the link was shared with participants via official WhatsApp and Telegram groups used by EMTs. The questionnaire was developed systematically to ensure alignment with the study's objectives. This process began with a comprehensive literature review to identify key dimensions of RP related to COVID-19, followed by consultation with EMS experts and infectious disease specialists to generate and refine items. Initial drafts were iteratively revised based on expert feedback to ensure clarity, relevance, and applicability to the study's goals.

The questionnaire comprised two main sections: demographic characteristics and COVID-19 RP assessment. Demographic variables included age group, marital status, educational level, work experience, and workplace. The COVID-19 RP section comprised 40 questions covering eight key dimensions: background knowledge of the disease (8 items), perceived severity of the disease (3 items), perceived susceptibility to the disease (3 items), perceived effectiveness of preventive measures (5 items), EMS-related factors (6 items), family environment-related factors (5 items), political factors (5 items), and motivational/inhibitory factors (5 items). All dimensions, except for the last one, were assessed using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The last dimension was scored in reverse order, from 1 (strongly agree) to 5 (strongly disagree). The total questionnaire score ranged from 40 to 200. To interpret the scores and assess the level of COVID-19 RP, the following categorization was applied: very low RP (40–79), indicating limited understanding of disease risk and low adherence to preventive measures; low RP (80–119), reflecting lower sensitivity to risk and partial adherence to precautions; moderate RP (120–159), showing concern about the disease and significant adherence to preventive measures, yet with potential for further improvement; and high RP (160–200), demonstrating high awareness, rigorous adherence to preventive measures, and a deep understanding of the disease's impacts. Mean scores for each dimension were also calculated and compared between groups.

Before implementation, content validity was assessed using the Content Validity Index (CVI). Seven faculty members evaluated the questionnaire, rating the relevance of each item on a four-point scale (1: irrelevant to 4: completely relevant). The CVI for each item was computed by dividing the number of experts who assigned a rating of 3 or 4 by the total number of experts. The resulting CVI values ranged from 0.89 to 1.00, with an overall CVI of 0.96, reflecting a high level of content validity. To assess reliability, a pilot study was conducted with 30 EMTs not included in the main study. The Cronbach's alpha coefficient was 0.87 for the entire questionnaire,

Table 1 Comparison of demographic characteristics of participants

Variable	Infected Group *n* (%)	Non-Infected Group *n* (%)	*P*-value*
Age, y			
20–29	51 (51%)	50 (50%)	0.94
30–39	42 (42%)	44 (44%)	
40–49	7 (7%)	6 (6%)	
Marital Status			
Married	69 (69%)	66 (66%)	0.65
Single	31 (31%)	34 (34%)	
Work Experience, y			
1–5	30 (30%)	29 (29%)	0.94
6–10	35 (35%)	38 (38%)	
11–15	29 (29%)	29 (29%)	
16–20	4 (4%)	2 (2%)	
21–25	2 (2%)	2 (2%)	
Education Level			
Diploma	1 (1%)	1 (1%)	0.98
Associate	58 (58%)	55 (55%)	
Bachelor's	39 (39%)	42 (42%)	
Master's	2 (2%)	2 (2%)	
Workplace			
Urban EMS	52 (52%)	56 (56%)	0.57
Roadside EMS	48 (48%)	44 (44%)	

*Results of the Chi-Square test

with subscale values ranging from 0.71 to 0.92, demonstrating good to excellent internal consistency.

Ethical considerations

The study protocol was approved by the Ethics Committee of Birjand University of Medical Sciences (Approval Code: IR.BUMS.REC.1399.436). The study objectives were clearly explained to all participants, and they were assured of the confidentiality of their personal information. Participation was voluntary, and informed consent was obtained from all individuals.

Statistical analysis

Data analysis was performed using SPSS version 16. Descriptive statistics, including frequency, mean, and standard deviation, were used for data summarization. The Kolmogorov-Smirnov test confirmed normal data distribution ($p > 0.05$). For inferential analysis, independent t-tests (for comparing mean RP scores between COVID-19-positive and non-infected EMTs), two-way ANOVA (to examine interaction effects between demographic variables and RP scores), and chi-square tests (to analyze categorical variables) were used. A significance level of $p < 0.05$ was considered for all statistical tests.

Results

The demographic characteristics of the participants in the two study groups are presented in Table 1. A thorough analysis of these characteristics revealed no statistically significant differences between the two groups ($P > 0.05$), confirming the comparability of the study populations.

The findings demonstrated a notable distinction in RP levels between the two groups. Specifically, non-infected EMTs exhibited a high level of RP regarding COVID-19, with a mean score exceeding 160, whereas infected EMTs displayed a moderate RP, with a mean score surpassing 150. Furthermore, results from the independent t-test highlighted that the mean RP score of infected EMTs was significantly lower than that of their non-infected counterparts ($P = 0.007$) (Table 2), underscoring the impact of infection status on RP levels.

Further analysis revealed significant differences across several dimensions. The mean scores for the dimensions of knowledge about the disease, perception of the impact of preventive measures, family environment factors, political factors, and motivational/inhibitory factors were significantly lower in the infected group compared to the non-infected group ($P < 0.05$). This suggests infection status is associated with reduced awareness, perception, and motivation related to COVID-19 preventive strategies. However, no significant differences were observed in the perception of the seriousness of COVID-19, sensitivity to

Table 2 Comparison of the mean scores of COVID-19 RP dimensions and overall RP score between the two groups

Row	RP Dimensions	Infected Group (Mean ± SD)	Non-Infected Group (Mean ± SD)	*P*-value*
1	Background Knowledge of COVID-19	28.00 ± 5.56	29.70 ± 4.05	0.01
2	Perceived Severity of COVID-19	11.85 ± 2.74	12.59 ± 2.58	0.06
3	Perceived Susceptibility to COVID-19	11.39 ± 2.79	11.72 ± 2.86	0.40
4	Perceived Effectiveness of Preventive Measures	20.66 ± 4.77	22.02 ± 3.51	0.02
5	EMS-Related Factors	25.36 ± 6.11	26.55 ± 4.02	0.10
6	Family Environment Factors	17.73 ± 4.85	19.39 ± 3.67	0.007
7	Political Factors	18.58 ± 4.70	20.11 ± 3.56	0.01
8	Motivational/Deterrent Factors	17.25 ± 4.75	19.46 ± 4.07	0.001
Overall RP Score		**150.82 ± 32.24**	**161.54 ± 22.50**	**0.007**

*Results of the Independent t-test

Table 3 Mean and standard deviation of overall RP score based on group and demographic variables

Variable	Infected Group (Mean ± SD)	Non-Infected Group (Mean ± SD)
Age, y		
20–29	147.76 ± 34.96	161.70 ± 18.87
30–39	155.04 ± 28.24	160.38 ± 27.14
40–49	147.71 ± 36.02	168.66 ± 11.43
Marital Status		
Married	149.17 ± 34.24	162.52 ± 23.32
Single	154.48 ± 27.43	161.03 ± 22.13
Work Experience, **y**		
1–5	150.80 ± 29.96	166.62 ± 10.03
6–10	154.85 ± 33.09	154.71 ± 32.37
11–15	146.58 ± 34.37	163.55 ± 13.29
16–20	160.75 ± 16.45	170.50 ± 4.94
21–25	122.48 ± 50.91	179.50 ± 12.02
Education Level		
Diploma	158.00 ± 0.00	179.00 ± 0.00
Associate	149.24 ± 34.44	163.70 ± 19.16
Bachelor's	152.56 ± 30.27	157.71 ± 26.44
Master's	159.00 ± 1.41	173.50 ± 13.43
Workplace		
Urban	154.61 ± 30.03	160.25 ± 24.60
Roadside	146.70 ± 34.31	162.93 ± 20.15

the disease, and EMS-related factors ($P > 0.05$) (Table 2), indicating that these dimensions remained relatively stable across both groups.

The mean overall RP score, categorized by group and demographic variables, is presented in Table 3. Results from the two-way between-group analysis of variance (ANOVA) demonstrated that the group effect was significant across all cases except for education level ($P < 0.05$). This finding reinforces that RP levels in the infected group were markedly lower than in the non-infected group. However, the individual effects of demographic variables on RP were not statistically significant ($P > 0.05$), suggesting that factors such as age, gender, and work experience did not independently influence RP. Moreover, the interaction effects between demographic variables and group membership on RP were also non-significant ($P > 0.05$) (Table 4), indicating that the primary determinant of RP differences was infection status rather than demographic factors.

Discussion

This study aimed to assess the RP of COVID-19 among EMTs and compare it between COVID-19-infected and non-infected EMTs. The findings of the present study suggest that EMTs demonstrated a relatively adequate RP of the disease. These results stand in contrast to those reported by Taghrir et al. [6], who found that Iranian medical students exhibited a low level of RP regarding COVID-19. This discrepancy may be attributable to

Table 4 Results of two-way between-groups ANOVA for examining the effect of demographic variables and group on overall RP score

Source	Sum of Squares	df	Mean Square	F	*P* value	Eta Squared
Group	5029.084	1	5029.084	6.409*	0.012	0.032
Age	19.295	2	9.648	0.012	0.988	0.000
Group * Age	807.062	2	403.531	0.514	0.599	0.005
Error	152237.243	194	784.728			
Group	4036.314	1	4036.314	5.189*	0.024	0.026
Marital Status	302.935	1	302.935	0.389	0.533	0.002
Group * Marital Status	300.174	1	300.174	0.386	0.535	0.002
Error	152460.492	196	777.860			
Group	5739.469	1	5739.469	7.459**	0.007	0.038
Work Experience	1429.638	4	357.409	0.464	0.762	0.010
Group * Work Experience	5434.667	4	1358.667	1.766	0.137	0.036
Error	146199.295	190	769.470			
Group	956.578	1	956.578	1.221	0.271	0.006
Education Level	999.571	3	333.190	0.425	0.735	0.007
Group * Education Level	1596.228	3	532.076	0.679	0.566	0.010
Error	150467.802	192	783.686			
Group	5965.752	1	5965.752	7.727**	0.006	0.038
Workplace	340.002	1	340.002	0.440	0.508	0.002
Group * Workplace	1400.812	1	1400.812	1.814	0.180	0.009
Error	151322.787	196	772.055			

Dependent Variable: RP

Significance Levels: $p < 0.01$ (bold) **, $*p < 0.05$

the timing of the two studies, as theirs was conducted just one week after the initial diagnosis of COVID-19 in Iran. Another potential explanation for the observed discrepancy is the type of instrument used to assess RP. They relied on only two general questions to evaluate RP, which may have limited the depth and accuracy of their findings. These variations highlight the dynamic nature of RP, which evolves with increasing knowledge about COVID-19 and can be significantly influenced by the assessment tools employed.

Additionally, the findings of the present study indicated that the mean overall RP score was significantly lower among individuals who had contracted COVID-19 compared to those who had not. This observation prompts a critical question regarding causality: Does a lower level of RP predispose individuals to a higher risk of infection, or does the experience of infection itself diminish RP, potentially due to a false sense of immunity, fatalistic beliefs, or shifts in psychological perception? Given the scarcity of comparable studies in this domain, the current findings were examined in light of the results reported by Zandifar et al. [16]. In line with the findings of the present study, they also reported a significant difference in the prevalence of stress, anxiety, and depression between HCPs who had contracted COVID-19 and their uninfected counterparts. These psychological outcomes underscore the broader implications of RP for mental health, suggesting a possible association between lower RP and increased psychological distress among infected individuals. However, the causal direction of this relationship remains uncertain. It is conceivable that diminished RP may lead to reduced compliance with preventive measures, thereby elevating the risk of infection, as previous studies have shown that higher RP is positively associated with the adoption of protective behaviors [17]. Conversely, the experience of infection may lower perceived risk, potentially due to assumptions of acquired immunity or psychological adaptation. Although the cross-sectional design of this study limits causal inference, future research employing longitudinal approaches, such as tracking RP levels before and after infection or evaluating the impact of RP-enhancing interventions on subsequent infection rates, could provide greater clarity on these complex dynamics.

Another finding of the present study showed that the average score in the dimensions of COVID-19 disease background knowledge, perceived effectiveness of preventive measures, family environment factors, political factors, and motivational/inhibitory factors was significantly lower in the infected group compared to the non-infected group. In a study conducted by Ronald Olum et al. [18] to assess the knowledge, attitude, and preventive measures of HCPs toward COVID-19 in teaching hospitals of Makerere University in Uganda, the results showed that HCPs had sufficient knowledge, and 74% of participants were implementing preventive measures effectively. However, poor attitudes toward COVID-19 were observed among them. Similarly, the results of several other studies emphasize the importance of knowledge and preventive measures regarding COVID-19 [11, 19, 20, 21]. These findings highlight the complex relationship between knowledge, attitude, and practice, reinforcing that knowledge alone does not always translate into optimal preventive behaviors.

On the other hand, a limited number of studies in China concluded that RP of COVID-19 might negatively impact mental health outcomes [22, 23]. This suggests a delicate balance: while high RP is essential for promoting preventive behaviors, excessive risk awareness may contribute to anxiety, stress, or burnout among HCPs. Considering these points, it seems that while a high RP of COVID-19 is crucial for HCPs to implement preventive measures in both the workplace and community, necessary measures must also be taken to protect the mental health of this group. For infected EMTs who exhibited lower RP in this study, post-infection counseling or peer support programs could help address potential fatalism or reduced risk awareness, potentially restoring their engagement with preventive measures. For non-infected EMTs, who demonstrated higher RP, targeted training programs could reinforce their knowledge and behaviors while incorporating stress management techniques, such as mindfulness or resilience workshops, to mitigate the risk of anxiety or panic. This balance between RP and mental health protection should be a key consideration in designing future intervention programs. Furthermore, a study has suggested that RP regarding a specific infectious disease directly reduces the likelihood of being infected by it [17]. Therefore, a high RP of COVID-19 among EMTs may lead to protective behaviors such as wearing masks, washing and disinfecting hands, disinfecting ambulance surfaces, using personal protective equipment, and implementing other preventive measures against this disease. Future interventions could explore optimizing RP without compromising mental well-being, potentially through tailored educational campaigns or psychological support systems.

Strengths and limitations of the study

This study possesses several noteworthy strengths. It identifies RP as a factor associated with COVID-19, thereby establishing a valuable foundation for future comparative and interventional research. A particularly significant strength is its focus on frontline emergency responders, a group that plays a critical role in epidemic containment yet has received limited attention in the context of RP assessment. The study's implications extend beyond EMTs, offering insights applicable

to broader HCP populations, making its contributions more impactful for healthcare policy and preparedness strategies. Specifically, the results of this study can assist healthcare authorities in designing appropriate interventions to enhance RP among EMTs. Furthermore, by identifying gaps in RP, this research highlights opportunities for targeted training programs that can be integrated into standard EMS protocols, ultimately leading to a more resilient emergency response system. These findings may also contribute to increasing the preparedness of EMTs in adopting protective behaviors against future infectious diseases, especially during biological disasters. Ultimately, policymakers in the Ministry of Health can use these results to make effective plans for managing infectious diseases.

However, this study also faces certain limitations. One limitation was that the current study was conducted solely on the RP of EMTs in South Khorasan province, which may restrict the broader applicability of the findings to regions with different healthcare infrastructures, EMS protocols, or epidemic exposure levels. Additionally, using a questionnaire as a self-reporting tool presents another limitation, as it may lead to bias in expressing attitudes and assessments. Self-reported data are inherently subject to recall and social desirability bias, potentially influencing the accuracy of responses regarding RP. Another limitation is the potential selection bias, as participation in the study was voluntary, and there may have been systematic differences in who chose to respond. Furthermore, another limitation of this research is the cross-sectional study design, which means that the results are only relevant to the specific time when the data were collected, and changes in preparedness and RP over time were not considered. It is also important to note that the study was conducted in 2021, and since then, RP may have evolved due to new variants, widespread vaccination campaigns, or shifts in public health policies. A longitudinal approach could provide deeper insights into how RP evolves with ongoing training, policy changes, and real-world exposure to infectious disease outbreaks.

Conclusions

EMTs, due to their position at the forefront of dealing with biological disasters, are not only at high risk of contracting such diseases but can also unintentionally become vectors for their transmission to family and community. Therefore, assessing RP among this group plays a key role in controlling and preventing the spread of biological disasters. The findings of this study indicated that EMTs infected with COVID-19 had a significantly lower RP than their uninfected counterparts. This reduced awareness of COVID-19 risks likely contributed to their infection, highlighting the critical role of RP in disease prevention. This underscores the urgent need for continuous training programs that not only enhance awareness but also foster a culture of sustained adherence to protective measures among EMTs. This highlights the importance of designing and implementing targeted educational interventions to enhance the awareness and RP among this group of HCPs. By integrating such interventions into routine training protocols, healthcare systems can build a more resilient emergency workforce, capable of responding effectively to future outbreaks. Adopting these approaches can prevent the further spread of infectious diseases and assist policymakers and health sector managers in improving preventive strategies. Ultimately, these findings emphasize the need for effective intervention programs that will lead to the improvement of HCPs' preparedness in addressing future health disasters. Future research should explore the long-term impact of these interventions on EMTs' RP and behavioral adaptation in various epidemic and pandemic scenarios.

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Author contributions
The initial idea and design of the study were proposed by the first and corresponding author, while data collection, analysis, and interpretation were carried out by the second and third authors. All authors were involved in the initial drafting or revision of the manuscript and accept responsibility for the accuracy and integrity of the content upon final approval of the present article.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the ethical principles of the Helsinki Declaration. Ethical approval was obtained from the Ethics Committee of Birjand University of Medical Sciences (Approval Code: IR.BUMS.REC.1399.436). Prior to the study, all participants were provided with comprehensive written and verbal information about the research, and written informed consent was obtained from each participant. Participation was entirely voluntary, and participants had the right to withdraw from the study at any time.

Consent for publication
The article does not include any personal details of participants, and as such, obtaining consent for publication is not required.

Competing interests
The authors declare no competing interests.

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