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Knowledge and awareness levels of health personnel in a university hospital regarding CBRN and disasters

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ABSTRACT

Aims: Chemical, biological, radiological, and nuclear (CBRN) threats and natural or man-made disasters are among the serious risks faced by contemporary societies. The aim of this study was to evaluate the level of knowledge and awareness of health personnel working in a university hospital on CBRN and disasters and to examine the effectiveness of existing training programs.
Methods: This cross-sectional study included doctors, nurses, and other health personnel working in a university hospital. We used a questionnaire as a data collection tool to measure the level of knowledge about CBRN and disasters.
Results: The total number of participants was 295. The majority were aged between 26 and 35 years (n=118, 40.0%), and more than half were male (n=163, 55.3%). Most participants were university graduates (n=171, 58.0%), intern doctors (n=91, 30.8%) and nurses (n=70, 23.7%). A significant proportion worked in the emergency department (n=132, 44.7%) and had less than one year of professional experience (n=106, 35.9%). Only 43.7% (n=129) reported being informed about the hospital disaster plan, and just 30.8% (n=91) had received training on CBRN. Awareness and preparedness levels were notably higher among nurses and emergency department personnel.
Conclusion: The majority of healthcare personnel lacked adequate knowledge and training regarding CBRN threats and disaster preparedness. Targeted and routine educational interventions are necessary to enhance hospital-based disaster response.
Keywords: CBRN, disaster management, health personel, knowledge level

INTRODUCTION

One of the biggest threats facing societies today is chemical, biological, radiological and nuclear (CBRN) hazards and natural and man-made disasters. These situations pose a major problem, especially for health systems, and show that hospitals play a key role in disaster management.

The term CBRN, which is formed by the initials of CBRN events, refers to events that cause people and the environment to fall into dangerous or harmful situations with the deliberate use of CBRN substances or their spread as a result of an accident.[1] CBRN agents have a frightening effect on human health, nature, and other living things living in nature.[2] Hazards that can be created by CBRN agents can be toxic substances that can enter the body through respiration, digestion, and skin and cause death and harmful effects, as well as microorganisms that can cause disease, poison, and kill living things can be called biological hazards.[3]

When a CBRN incident occurs, life or death is usually determined within the first few minutes after the onset of the incident. The medical knowledge and expertise of the teams that will intervene in CBRN are critical for the results.[4]

The preparedness and awareness of hospitals and healthcare personnel against disasters is of extreme importance to ensure continuity of service in emergencies. In this case, the level of knowledge and awareness about CBRN threats and disaster management directly affects the capacity of healthcare personnel to respond effectively.

It is critical to provide appropriate and timely emergency intervention to people exposed to CBRN agents. In order for health professionals to be able to combat such threats, they should have competencies such as an introduction to CBRN, triage, intervention procedures, decontamination procedures, crime scene management, management of psychosocial effects, communication, reporting the incident, performing quarantine practices and leading major public health emergencies.[5]

This study was carried out to determine the level of knowledge and awareness of health personnel working in a university hospital about CBRN and disasters and to examine the effectiveness of existing training programs.

METHODS

Ethical Approval

The study was planned in accordance with the principles of the Declaration of Helsinki since it was a retrospective

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observational study. Approval was obtained from the Balıkesir University Health Sciences Non-interventional Researches Ethics Committee (Date: 5.11.2024, Decision No: 2024/182).

Study Design and Setting

This cross-sectional study was conducted at Balıkesir University Hospital between November 1, 2024, and February 1, 2025. The research aimed to evaluate the knowledge and awareness levels of healthcare personnel regarding disasters and CBRN threats. The study population included all healthcare staff working at the university hospital. A simple random sampling method was used, and 295 participants were included in the study. Inclusion criteria comprised nurses, physicians, interns, technicians, pharmacists, administrative staff, and other healthcare workers employed at the hospital or recently graduated from the institution. Personnel who declined to participate were excluded.

Data Collection Tools and Procedure

Data were collected using a structured 25 item questionnaire administered both face-to-face and via Google Forms. The questionnaire included sections on demographic characteristics (age, gender, profession, years of experience), knowledge of hospital disaster plans, participation in disaster and CBRN-related training and drills, and self-assessment of preparedness. The survey items were developed in line with current literature and reviewed by field experts.

Questionnaire Development

The questionnaire used in this study was developed based on a review of relevant literature on disaster preparedness and CBRN awareness. To ensure content validity, the draft version was reviewed by three experts in emergency medicine and public health. Prior to full-scale implementation, a pilot test was conducted with 20 healthcare workers to assess clarity and comprehension. Feedback obtained during this phase was used to revise the questionnaire accordingly.

Variables

The dependent variable was the level of knowledge and awareness regarding disaster and CBRN preparedness. Independent variables included age, gender, profession, years of professional experience, and prior participation in trainings or drills.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to summarize the data. Comparisons between groups were performed using the t-test for normally distributed variables and the Wilcoxon test for non-parametric data. A p-value of <0.05 was considered statistically significant.

RESULTS

As seen in Table 1, most participants were young adults (predominantly 26-35 years old) and over half were male. A large majority had at least a university-level education. Intern doctors and nurses together constituted more than half of the sample, and nearly 45% of respondents were employed in the emergency department. Notably, fewer than half of all participants were familiar with their hospital's disaster plan, and only a small minority (13.9%) had an assigned duty within that plan.

Overall, formal training in disaster preparedness was limited among the staff. Only 30.8% of participants had ever received any CBRN-specific training, and 41.4% had participated in a disaster preparedness training of any kind. This indicates that the majority of respondents lacked prior training on these critical topics. Approximately 44.7% reported that emergency drills were conducted in their organization.

Despite these training gaps, about two-thirds of the participants (66.8%) reported being familiar with the hospital's emergency color code system. However, detailed knowledge related to CBRN response was much lower; only 30.8% of respondents knew the specific symptoms and treatment protocols for chemical warfare agents. Moreover, merely 20.0% of participants considered themselves adequately informed about disaster preparedness and management. Consistently, roughly 80% acknowledged that they lacked sufficient information on disaster preparedness. The vast majority of respondents expressed that trainings should be provided to improve disaster response readiness; most suggested that disaster and CBRN training should be conducted on a routine basis (preferably annually) and indicated a preference to receive these trainings from emergency medicine specialists (Table 1).

Table 1. Participant demographics and hospital disaster plan awareness (n=295)

Characteristic	Category	n (%)*
Age group	18-25 years	115 (39.0%)
	26-35 years	118 (40.0%)
	36-45 years	41 (13.9%)
	>45 years	21 (7.1%)
Gender	Male	163 (55.3%)
	Female	132 (44.7%)
Highest education level	Primary school	15 (5.1%)
	High school	37 (12.5%)
	University degree	171 (58.0%)
	Master's degree	50 (16.9%)
	PhD	22 (7.5%)
Profession	Intern doctor	91 (30.8%)
	Nurse	70 (23.7%)
	Resident physician	50 (16.9%)
	Attending physician	25 (8.5%)
	Other (technicians, etc.)	59 (20.0%)
Department	Emergency department	132 (44.7%)
	Other departments	163 (55.3%)
Years of experience	<1 year	106 (35.9%)
	≥1 year	189 (64.1%)
Aware of hospital disaster plan	Yes	129 (43.7%)
	No	166 (56.3%)
Has assigned role in plan	Yes	41 (13.9%)
	No	254 (86.1%)

Table 2 highlights significant gaps in disaster preparedness and CBRN training. The majority of healthcare personnel in this study had not received any formal education or training specific to CBRN incidents or disaster management, and fewer than half had ever participated in a general disaster preparedness training. Notably, only about one-fifth of respondents felt that they were adequately informed to handle disaster situations. While a large proportion of staff were familiar with the hospital's emergency color code system, far fewer had knowledge of specific response protocols for CBRN events (approximately 30% reporting such knowledge). These findings underscore the need for regular training and education initiatives. Consistently, most participants advocated for routine (annual) disaster preparedness training, preferably delivered by emergency medicine specialists, reflecting a clear recognition of the need to improve personal and institutional preparedness. (Table 2).

Table 2. CBRN training and disaster preparedness indicators among participants (n=295)

Training/preparedness aspect	Yes (n, %)	No (n, %)
Received any CBRN-specific training	91 (30.8%)	204 (69.2%)
Ever attended any disaster preparedness training	122 (41.4%)	173 (58.6%)
Hospital conducts regular emergency drills	132 (44.7%)	163 (55.3%)
Familiar with emergency color code system	197 (66.8%)	98 (33.2%)
Knowledge of chemical agent protocols	91 (30.8%)	204 (69.2%)
Feels adequately informed for disaster response	59 (20.0%)	236 (80.0%)
Informed of own disaster response duties	76 (25.8%)	219 (74.2%)

CBRN: Chemical, biological, radiological and nuclear

DISCUSSION

Hospitals are facilities where uninterrupted healthcare delivery is essential.[6] During disasters or CBRN events, the already high workload significantly increases. In such situations, healthcare professionals are expected to maintain service continuity, with the primary goal being to protect both the health of affected individuals and the safety of healthcare workers.

Given the inevitability of disasters and CBRN incidents, healthcare workers must maintain a constant state of readiness. Fung et al.[7] found that while 97% of nurses felt unprepared for disasters, they acknowledged the importance of preparedness. Adequate knowledge and awareness among healthcare personnel facilitate rapid organization, reduce chaos, and ensure continuity of care. Competence in managing CBRN and disaster scenarios significantly contributes to lowering morbidity and mortality rates.[8]

In total, the majority of the participants stated that they did not have information about hospital disaster plan. This situation shows that there is a lack of awareness about hospital disaster plan. It is seen that a wider awareness study is needed for the effective implementation of hospital disaster plan. The age group with the highest awareness of hospital disaster plan is 26 to 35 years old.

Only 13.9% of participants reported having duties related to the hospital disaster plan, indicating limited task distribution or insufficient staff awareness. Similarly, Cebeci et al.[9] found that just 5.95% of respondents were assigned roles within the plan. In the study of İytemür and Yeşil,[10] 48.8% of the participants stated that they knew their duties in the hospital disaster plan. Limited staff involvement in disaster management may lead to coordination issues during actual events. These gaps can be addressed through broader task distribution, targeted training, awareness initiatives, and regular drills. In our study, none of the resident physicians reported having a role in the hospital disaster plan. Similarly, Kaynak and Kutlu,[11] found that half of the participants were unaware of their designated locations, and one-third did not know their roles and responsibilities within the plan findings consistent with our results. These findings suggest imbalanced task distribution or limited engagement in disaster planning. To address this, both pre- and post-graduate training should be implemented, and resident physicians across all departments and seniority levels should be actively involved in the hospital disaster plan. Awareness of the hospital disaster plan is notably low among groups other than nurses, particularly interns and resident physicians. Since these groups have limited tenure due to graduation or reassignment, it appears that institutional efforts are primarily directed toward permanent staff.

Knowledge of the CBRN unit was highest among emergency department staff, which is critical as they are the first responders in CBRN crises. Expanding this awareness across all hospital units through comprehensive training programs is essential. Nurses represent the group with the highest awareness of the hospital disaster plan, likely due to their active role in patient care and crisis management. In contrast, awareness among intern doctors remains low. Similarly, Elazeem et al.,[12] in a study involving 400 hospital staff in Egypt, found overall in-hospital disaster awareness to be insufficient. Awareness can be increased by integrating approaches to disasters, hospital disaster plans, and CBRN training into medical education.

Most participants reported insufficient knowledge regarding disaster preparedness and management, and the majority stated they had not been informed about their specific roles and responsibilities during such events. Similar findings were reported by Özden and Yaman.[13] In this context, nurses had the highest self-reported competency in disaster management. Sustainable preparedness requires not only theoretical knowledge but also practical application. Increasing disaster drills and ensuring participation across all staff levels will enhance the practical implementation of disaster protocols.

Overall knowledge regarding emergency response plans and evacuation procedures was found to be low. In the study by Cebeci et al.,[3] only 39.62% of participants felt confident in their ability to take appropriate measures for patients and others during a disaster. These findings are consistent with our study. Greater emphasis should be placed on disaster preparedness during the training of younger healthcare professionals. Overall participation in drills remains low, with particularly limited involvement in CBRN exercises, highlighting a major gap in preparedness. Expanding the scope and frequency of drills especially to include the general

public and incorporating scenarios beyond earthquakes and fires can significantly enhance awareness and readiness.

The majority of participants preferred annual training on disaster and CBRN preparedness. Similarly, in the study by Garbutt et al.,[14] nurses expressed a clear need for disaster-related education. This preference highlights the necessity of adapting to evolving conditions and maintaining up-to-date knowledge. However, most participants reported no prior training, indicating a significant gap in both awareness and practical preparedness for disasters.

Higher education levels do not appear to significantly increase awareness of the hospital disaster plan, suggesting a weak link between education and preparedness. The lack of awareness among university graduates may indicate that this topic is not adequately covered in curricula. Hospital disaster plan training should be included in high school and university education, supported by public campaigns and awareness efforts. Canatan et al.[15] also highlighted the importance of having a disaster plan during emergencies. It was revealed that the participation in applied trainings increased each time and increased the awareness of the personnel towards disaster and raised their level of knowledge.

Among participants, fire drills had the highest participation rate. Similarly, Gülhan and Ersoy reported that fire training and drills had the highest attendance in their study.[16] Drills with wider participation can be conducted not only with fire but also with other different disaster scenarios.

Limitations

This study has several limitations that should be acknowledged. First, it was conducted in a single university hospital, which may limit the generalizability of the findings to other institutions or regions. Second, the data were based on self-reported questionnaires, which may introduce reporting bias or inaccuracies due to participants' subjective perceptions or recall errors. Future multi-center studies with objective assessments are recommended to validate and expand upon these findings.

CONCLUSION

This study showed that healthcare personnel had insufficient knowledge and preparedness regarding hospital disaster plans and CBRN issues. The lowest awareness was observed among interns and resident doctors, while nurses and emergency department staff had the highest. Participation in training and drills was also limited. These findings highlight the need for regular education, drills, and the integration of these topics into healthcare training programs to improve disaster and CBRN preparedness.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Balıkesir University Health Sciences Non-interventional Researches Ethics Committee (Date: 5.11.2024, Decision No: 2024/182).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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