Araştırma Makalesi / Research Article
Geliş Tarihi / Received: 02.08.2024
Kabul Tarihi / Accepted: 12.07.2025
Yayımlanma Tarihi /Published: 31.07.2025

Afet ve Risk Dergisi 8(2), 2025, (630-643)
Journal of Disaster and Risk 8(2), 2025, (630-643)
e-ISSN: 2636-8390
DOI: 10.35341/afet.1526785

Determining CBRN Risk Perceptions and Preparedness Levels and Related Factors of Emergency Health Services Personnel: Tekirdağ Provincial Example

Firdevs Artcı Adak[1], Ebru İnal Önal[2], Edip Kaya[3]

Abstract

Emergency medical services personnel are among the first responders in the event of a CBRN incident. The aim of this study is to determine the CBRN risk perceptions, preparedness levels, and related factors of emergency medical personnel working in Tekirdağ district. The study was conducted with 142 participants. A socio-demographic questionnaire consisting of 30 items and a scale measuring risk perception and preparedness for CBRN hazards were used. The participants' responses were transferred to the SPSS 21.0 software, and validity of the measurements was tested through confirmatory factor analysis. As the data were found to be normally distributed across all independent variables, differences between two group means were analyzed using t-tests, and ANOVA were used for variables with more than two categories. In the bivariate analysis, the mean risk perception score of personnel who had participated in CBRN duties was found to be significantly higher than those who had not ($p=0.03$). Moreover, participants with one year or less of experience had significantly lower mean risk perception scores compared to other groups ($p<0.001$). Additionally, those who reported having sufficient knowledge about CBRN and those who stated they knew their responsibilities during CBRN incidents had significantly higher preparedness scores (respectively; $p<0.001$ and $p=0.04$). Finally, the Pearson correlation analysis revealed a statistically significant relationship between the CBRN risk perception score and the preparedness score ($r=0.393$, $p<0.001$). It is suggested that practical training and drills may be increased to enhance the capacity of personnel in responding to CBRN events. The study findings suggest that practical training and drills may be increased to enhance the preparedness of emergency health services personnel for CBRN hazards. It should also be noted that efforts to increase personnel's CBRN risk perception will also positively contribute to their preparedness.

Keywords: CBRN, Emergency Medical Services, Personnel, Risk Perception, Preparedness

1. INTRODUCTION

The term CBRN refers to hazards that may arise from chemical, biological, radiological, and nuclear agents. These substances have the potential to harm human health, negatively impact the environment, and disrupt ecological balance. CBRN incidents are defined as events in which such agents are released into the environment, either intentionally or accidentally, resulting in serious

[1]Master's Student, ÇOMU Graduate Education Institute, Depart. of Interdisciplinary Risk Manage. of Natural Disasters, Çanakkale Corresponding auther e-mail: firdevs_artci96@hotmail.com ORCID: 0009-0009-1665-8644
[2]Asst. Prof. Dr., Çanakkale Onsekiz Mart University, Faculty of Health Sciences, Emergency Aid and Disaster Management, Çanakkale e-mail: ebruinal@comu.edu.tr ORCID: 0000-0002-7247-5326
[3]Asst. Prof. Dr., Ağrı İbrahim Çeçen Uni., Vocational School of Health Services, Department of Disabled Care and Rehabilitation, Ağrı e-mail: edkaya@agri.edu.tr ORCID: 0000-0002-0715-0154

Bu makaleye atıf yapmak için / To cite this article
Artcı Adak, F., İnal Önal, E., Kaya, E., (2025). Determining CBRN Risk Perceptions and Preparedness Levels and Related Factors of Emergency Health Services Personnel: Tekirdağ Provincial Example. *Afet ve Risk Dergisi*, 8(2), 630-643.

threats to public health and environmental systems. These types of incidents carry a high level of risk in terms of response and management and require a multidisciplinary approach to preparedness and intervention (URL 1).

The areas affected by CBRN incidents are classified into three primary zones based on the level of exposure risk and their functional roles: the "hot zone," where direct exposure to hazardous substances occurs; the "warm zone," which serves as a transitional area for decontamination procedures; and the "cold zone," designated as a safe area (Ortatatlı et al., 2015). The scope of practice for personnel working in emergency health services is strictly confined to the cold zone, where all interventions are to be performed within this designated safe area. According to relevant regulations, it is not permissible for healthcare workers to engage in tasks such as sample collection in either the hot or warm zones (Republic of Türkiye Ministry of Health, Regulation on the Duties Regarding Chemical, Biological, Radiological, and Nuclear Hazards, 2025).

In Türkiye, the response process to CBRN incidents is coordinated by the Ministry of Health and implemented through a multi-agency collaboration, primarily involving the Disaster and Emergency Management Authority (AFAD, 2025) and other relevant institutions. The General Directorate of Emergency Health Services assesses potential CBRN threats and ensures the deployment of first response teams through provincial health directorates. To prepare healthcare personnel, including the National Medical Rescue Teams (UMKE) and ambulance services, theoretical training programs are provided. These are supplemented with practical exercises, aiming to ensure that health professionals remain in a constant state of readiness (Republic of Türkiye Ministry of Health, Regulation on the Duties Regarding Chemical, Biological, Radiological, and Nuclear Hazards, 2025).

The Ministry of Health ensures that the initial healthcare teams arriving at the incident site intervene safely by utilizing personal protective equipment and are responsible for conducting triage and stabilizing vital signs at the scene (Republic of Türkiye Ministry of Health, Regulation on the Duties Regarding Chemical, Biological, Radiological, and Nuclear Hazards, 2025). In CBRN incidents, injured individuals should not be transferred to hospitals without undergoing proper decontamination. If decontamination is not performed, there is a significant risk that the patient's life may be lost during transportation due to ongoing exposure. Additionally, failure to implement safety measures may lead to secondary contamination among healthcare personnel. Therefore, medical teams are required to use personal protective equipment such as CBRN-protective clothing, masks, and thick rubber gloves when providing medical intervention (Republic of Türkiye Ministry of Health, Algorithm for the Approach to Chemical and Biological Threats, 2025). In this context, designated reference hospitals have established CBRN-specific decontamination units and emergency response clinics, and the relevant personnel have been equipped with the necessary training in accordance with established protocols (Republic of Türkiye Ministry of Health, Regulation on the Duties Regarding Chemical, Biological, Radiological, and Nuclear Hazards, 2025).

Personnel at the 112 Health Command and Control Center (HCCC) perform their duties in accordance with the Emergency Health Services Regulation and other relevant legislation. Emergency calls are subjected to a preliminary assessment as stipulated in Article 19 of the Regulation, during which detailed information such as the type of incident, location, number of patients or casualties, and the circumstances surrounding the event are obtained and recorded. In line with Article 20, appropriate response teams are dispatched based on the nature of the incident. In cases where patient transfer is required, the organization of the transfer is carried out in accordance with Article 22 of the Regulation, ensuring that the patient is transported to the nearest or most appropriate hospital, and that the receiving emergency department is informed accordingly (Republic of Türkiye Ministry of Health, Emergency Health Services Regulation, 2025)

Tekirdağ province, where this study was conducted, has five hospitals equipped with CBRN units, namely Çerkezköy State Hospital, Çorlu State Hospital, Tekirdağ Dr. İsmail Fehmi Cumalıoğlu City Hospital, and Kapaklı State Hospital. Among these, the CBRN units in four hospitals are currently active, whereas the unit at Kapaklı State Hospital is inactive (URL 2).

CBRN incidents can potentially lead to the breakdown of the healthcare system, primarily due to the initial response team's failure to take necessary precautions, inadequate personnel to address the incident, and an overload on the healthcare system. For instance, in a terrorist attack that occurred in Japan in 1995, 24 liters of the chemical sarin were deployed in a subway station. In response to this incident, 1364 emergency response personnel and 131 ambulances were swiftly mobilized. However, as the nature of the active ingredient was initially unknown, rescue teams did not employ personal protective equipment. Consequently, in the initial stage, 649 victims were transported to hospitals without proper decontamination. Subsequent analysis revealed that 135 rescue team members at the scene and 110 hospital personnel responding to contaminated cases exhibited symptoms related to sarin toxicity. The aftermath of this attack resulted in a total of 3938 individuals poisoned, with 12 fatalities (Yanagisawa et al., 2006). The 2013 Belgian train derailment further demonstrated the importance of the role of emergency responders in CBRN incidents. On the night of May 4, 2013, a freight train carrying butadiene, triethylaluminum, and acrylonitrile (ACN) derailed in the town of Wetteren, Belgium, triggering a major chemical incident. Several cars transporting ACN exploded, leading to a large fire. Due to thermal decomposition of ACN, toxic gases such as hydrogen cyanide (HCN) and nitrogen oxides were released into the environment. To prevent additional explosions from cars containing butadiene and triethylaluminum, firefighters extinguished the fire and used water to cool the unaffected tank wagons. However, the extinguishing water partially drained along the railway and infiltrated the sewage system, further contributing to the spread of ACN contamination. The incident involved the release of toxic gases and contamination of the environment due to improper handling of extinguishing water. As a result, emergency responders and residents faced significant health risks, with biomonitoring revealing elevated levels of toxic biomarkers among responders (Van Nieuwenhuyse et al., 2014; De Smedt et al., 2014). These incidents highlight the importance of emergency response teams' roles in protecting not only their own health but also public health and the environment in CBRN incidents. Therefore, it is vital that emergency response teams are aware of the risks associated with CBRN incidents, as well as being knowledgeable and prepared for CBRN incidents, including personal protective equipment, systematic decontamination procedures, and robust site safety management.

The Tekirdağ Province, where this study was conducted, is particularly vulnerable to CBRN events due to its proximity to Istanbul, prevalence of agricultural and tourism zones, active trade, developed industries, and the presence of the North Anatolian Fault Zone traversing through Tekirdağ Province (Tekirdağ Industry and Technology Provincial Directorate, 2020). Consequently, healthcare personnel engaged in emergency healthcare services within Tekirdağ Province should be adequately prepared for potential CBRN events in the event of a disaster. The primary objective of this study is to assess the CBRN risk perceptions, preparedness levels, and associated factors among emergency healthcare personnel operating in Tekirdağ Province.

2. METHOD

2.1. Research Model

This study aims to determine the CBRN risk perceptions, preparedness levels, and associated factors of personnel employed in emergency health services using a descriptive research design.

2.2. Population and The Sample of The Research

The research population consists of 503 healthcare personnel employed in Tekirdağ province, whose roles are defined by the Emergency Health Services Regulation. This group includes first responders and rescue teams in the CBRN Service category, comprising individuals with past or current experience in emergency healthcare. A total of 153 personnel actively participated in the study, representing approximately 30% of the targeted group. However, a total of 142 individuals were included in the final analysis after accounting for exclusions due to missing data, extreme values, and normality issues.

2.3. Data Collection Tools and Data Collection Process

Data for this study were collected through an online platform, specifically Google Forms, administered by the researcher from December 5, 2022, to July 25, 2023. The dissemination of the survey to participants was facilitated by the education unit manager. Prior to participation, explicit consent was obtained from respondents through a preliminary information form designed by the researcher, emphasizing the voluntary nature of their involvement.

A survey, exclusively crafted for this study by the researcher (consisted of 30 questions), and the Risk Perception and Preparation for CBRN Incident Scene Hazards Scale developed by Yücel (2019), were used for data collection.

2.4. The Survey

This meticulously developed survey instrument consists of 30 comprehensive questions. These queries explore participants' socio-demographic characteristics including age, gender, education level, marital status, employed unit, and years of employment. Additionally, the form delves into participants' specific attributes related to their prior engagement in CBRN incidents, as well as their participation in CBRN training.

2.5. The Risk Perception and Preparation for CBRN Incident Scene Hazards Scale

The Risk Perception and Preparedness Scale for CBRN Incident Scene Hazards, developed by Yücel in 2019 (Yücel, 2019), consists of three distinct sections. The first section comprises 14 items designed to assess participants' risk perceptions regarding chemical, biological, and radiological agents, including explosives and risk waves that may occur at the incident scene. The second section also consists 14-items regarding participants' CBRN preparedness such as; intervention procedures, understanding of hot and cold zones, risk reduction strategies, intervention techniques, and personal protective measures. Both sections of the scale use a 5-point Likert scale for evaluation. Responses are scored as follows: strongly disagree = 1 point, disagree = 2 points, no opinion = 3 points, agree = 4 points, and strongly agree = 5 points. There is no reverse scoring applied in the survey. The total score for each section ranges from a minimum of 14 to a maximum of 70. To calculate the final result, an arithmetic mean is determined by dividing the total score by the number of items. The resulting mean score changes within a range of 1 to 5. The Cronbach Alpha value, computed for the two sections combined (28 items), demonstrated a robust reliability coefficient of 0.944.

The final section consists of a 10-question information and knowledge measurement form covering aspects such as CBRN warnings, medications for exposure, and decontamination methods. However, the validity and reliability of this section was not evaluated by Yücel (2019) and only the frequency values of the questions were evaluated in that study. For that, this section was excluded from the current research.

2.6. Ethical Approval

The study followed the principle of voluntary participation, and participants received comprehensive information about the study's scope and purpose through an informed consent form. Explicit consent was obtained from all participants. To ensure ethical conduct, written

approval was obtained from both the Çanakkale Onsekiz Mart University Graduate Education Institute Scientific Research and Publication Ethics Committee (Decision dated 17.11.2022, numbered 19/19) and the Tekirdağ Provincial Health Directorate.

2.7. Data Analysis

The data analysis process began with transferring responses from 153 emergency health services personnel to the SPSS 21.0 program. After examining the data for missing values, extreme values, and normality, nine individuals were excluded, and the analysis was carried out with the remaining 142 individuals.

During the preliminary analysis, adjustments were made to certain independent variables, requiring categorization. For example, the 'widow' (N=3) and 'divorced' (N=4) options for marital status were combined with the 'single' category due to the limited number of responses. Similarly, observations with a master's degree (N=6) were excluded from the analysis of variance, and comparisons were conducted between high school, associate degree, and undergraduate categories.

In the variable indicating familiarity with responsibilities during a CBRN incident, 25 healthcare personnel selected 'I don't know,' 11 chose 'I'm not sure,' 91 responded with 'I partially know,' and 15 indicated 'I completely know.' For parametric tests, options of 'I don't know' and 'I am not sure' were combined, and 'I partially know' and 'I completely know' were grouped due to imbalances and insufficiencies in the number of observations in these categories.

Additionally, the category representing the last 10 years in the CBRN-related training time variable was excluded from the analysis, with average comparisons between groups made exclusively within the categories of the last year, the last three years, and the last five years.

The construct validity of the measurements derived from The Risk Perception and Preparation for CBRN Incident Scene Hazards Scale which administered to emergency healthcare personnel within the study was assessed through confirmatory factor analysis (CFA). Given that the survey data was collected on a 5-point Likert scale, the Diagonally Weighted Least Squares Method (DWLS) was employed in the CFA application, as it does not necessitate the assumption of normality. The CFA analyses were conducted using the LISREL program, and the outcomes are concisely presented in Table 1.

Table 1. Conformity Indices Obtained From CFA (Çokluk et al., 2010)

Goodness Harmony Index	Acceptable Limit	Risk Perception Regarding CBRN Hazards	Preparedness for CBRN
X^2/sd	<5 Avarage <3 Good	514.42/77=6.68	778.73/77=10.10
CFI	>0.90	0.998	0.917
NNFI	>0.90	0.997	0.902
AGFI	>0.90	0.957	0.898
RMSEA	<0.08	0.027	0.237

Upon examination of the fit indices and criteria in Table 1, it is evident that the Risk Perception of CBRN Hazards data aligns well with the tested structure. Furthermore, factor loadings were found to surpass the threshold of 0.30, indicating satisfactory construct validity.

Concerning the CBRN Incident Preparedness measurement results, the model-data fit closely approaches acceptable limits across the majority of indices. Moreover, the factor loadings of all items, exceeding 0.80, were deemed indicative of robust construct validity.

The reliability of the obtained results from both measurement tools was assessed using the Cronbach alpha coefficient. The reliability of the survey data on Risk Perception for CBRN Hazards and Preparedness for CBRN Incidents was calculated as 0.71 and 0.85, respectively.

The normality of the scores obtained from the measurement tools was assessed by examining the kurtosis and skewness coefficients for both the overall scores and each category of independent variables. Büyüköztürk (2011) suggests that if the kurtosis and skewness coefficients remain within the ±1.0 limit, the scores can be considered as not deviating excessively from normality. Given that the kurtosis and skewness values for The Risk Perception and Preparedness Scale for CBRN Hazards scores fell within these specified limits, it was concluded that the data met the assumption of normal distribution.

Given the observed normal distribution in all independent variables, differences between group averages for variables with two categories were analyzed using the t-test, while average differences among groups for variables with three or more categories were scrutinized via ANOVA. The homogeneity of group variances was assessed using the Levene test, and in instances where the Levene test yielded significance, the degrees of freedom were recalculated for the pertinent variables.

Following ANOVA, for results indicating significant differences between group averages at the 0.05 alpha level, the impact on the independent variable was further examined using the eta-square ($\eta 2$) statistic, as suggested by Büyüköztürk (2011). The eta-square, also known as effect size, elucidates the proportion of total variance in the dependent variable that the independent variable explains. It ranges between 0.00 and 1.00, with interpretations suggesting a small effect size for $\eta 2=0.01$, a medium effect size for $\eta 2=0.06$, and a large effect size for $\eta 2=0.14$

Additionally, the associations between the Risk Perception of CBRN Hazards and Preparation for CBRN Hazards were investigated using Pearson correlation analysis, as the variables exhibited normal distribution characteristics.

3. RESULTS

The research included emergency medical personnel with ages ranging from 18 to 48, with an average age of 29.43±6.16. Among the participants, 56.3% (80 individuals) were women, 55.6% (79 individuals) were single, and 42.3% (60 individuals) had associate degrees. A significant portion of the participants, 49.3% (72 individuals), were paramedics. In terms of professional experience, 40.1% of the participants (57 individuals) reported working for a period ranging from 6 to 10 years (refer to Table 2).

Among the participants, 76.8% (109 individuals) indicated they had received training on CBRN, while 16.2% (23 individuals) reported participating in any CBRN-related exercises. A notable of participants (38%, 54 individuals) mentioned their involvement in a previous CBRN incident. Interestingly, only 21.1% (30 individuals) believed they possessed sufficient knowledge about CBRN, and a mere 10.6% claimed to be fully aware of their responsibilities in the event of a CBRN incident (refer to Table 2).

Of those who received CBRN training, 67.6% (96 individuals) reported that they received it from the Provincial Health Directorate. Within this group, 33.8% (48 individuals) received training in the last year, and 24.6% (35 individuals) received training in the last 3 years. Participants involved in CBRN incidents predominantly reported their participation in biological agent incidents. Among these respondents, 28.9% (41 individuals) stated that patients at the scene were not decontaminated, and 16.2% (23 individuals) highlighted a lack of coordination between the emergency health services team and other institutions. Additionally, 28.2% of those involved in CBRN incidents expressed feeling only partially competent. Furthermore, 22.5% (32 individuals) mentioned that their personal protective equipment during interventions was only partially suitable.

The results from the Risk Perception and Preparation for CBRN Incident Scene Hazards Scale indicate that emergency healthcare personnel scored an average of 4.51 (SD = 0.35) on CBRN Risk Perception, while their average score on CBRN Preparedness was 3.77 (SD = 0.60) (refer to Table 2).

Table 2. Distrubition of participants according to some socio-demographic charachteristics

Variables	**Group**	**Frequency**	**Percentage**
Gender (n=142)	Female	80	56.3
	Male	62	43.7
Marital status (n=142)	Married	63	44.4
	Single	79	55.6
Educational status (n=142)	High School	21	14.8
	Upper Secondary Education	60	42.3
	University	55	38.7
	Master's Degree	6	4.2
Occupation	EMT	51	35.9
	Paramedic	70	49.3
	Nurse	6	4.2
	Other*	15	10.6
Work experience** (n=142)	≤1 year	21	14.8
	2-5 years	34	23.9
	6-10 years	57	40.1
	≥ 11 years	30	21.1
Training status related to CBRN (n=142)	Yes	109	76.8
	No	33	23.2
Participation status in a CBRN related drill (n=142)	Yes	23	16.2
	No	119	83.8
Having sufficient knowledge about CBRN (n=142)	Yes	30	21.1
	No	112	78.9
Knowledge of responsibilities when a CBRN incident occurs (n=142)	I don't know	25	17.6
	I am not sure	11	7.7
	I partially know	91	64.1
	Yes, I know	15	10.6
Involvement status in CBRN incident (n=142)	Yes	54	38.0
	No	88	62.0
	Mean	**SD**	**Min-Max**
Age	29.43	6.16	18-48
Risk perception regarding CBRN hazards	63.11	4.83	48-70
Preparedness for CBRN	52.77	8.43	35-70

*: Midwife (n=3), Health Officer (n=3), Doctor (n=2), Driver (n=3), Technician(n=2), Anesthesia Technician (n=2)
**: All participants were employed in the field of emergency medical services at the time of study.

Table 3 demonstrated binary analyses between dependent variables (CBRN risk perception and CBRN hazards preparedness) and independent variables. The analyses revealed that work duration and participation in a CBRN-related task had statistically significant relationship with CBRN risk perception ($p<0.001$ and $p=0.03$ respectively). Additionally, the relationship between receiving training on CBRN and CBRN risk perception approached statistical significance ($p=0.06$). Notably, the average risk perception towards CBRN Hazards among emergency health services personnel who participated in a CBRN task (4.58) was found to be statistically significantly higher than the average of personnel who did not participate (4.46) ($t = 2.24$; $p = 0.03$). This participation in a CBRN task was observed to explain 3% of the total variance in the risk perception scores of emergency medical personnel towards CBRN Hazards ($\eta 2 = 0.03$).

Furthermore, the average risk perception towards CBRN Hazards demonstrated statistically significant differences among emergency healthcare personnel with varying years of experience: ≤1 year (4.28), 2-5 years (4.56), 6-10 years (4.54), and ≥11 years (4.54) ($F=3.74$; $p<0.001$). Subsequent Scheffe testing pinpointed the difference between healthcare personnel with one year or less of experience and those with other years of experience as the origin of this disparity. In summary, the average risk perception of CBRN hazards among emergency healthcare personnel with ≤1 year of experience is lower than other experience categories, while the averages for those with 2-5 years, 6-10 years, and ≥11 years are similar. Furthermore, the years of work experience were found to explain 8% of the total variance in the risk perception of emergency health services personnel towards CBRN hazards ($\eta 2 = 0.08$). Notably, the average risk perception of emergency health services personnel who received training on CBRN regarding CBRN hazards was 4.55, compared to an average of 4.37 for personnel who did not receive training. However, the observed difference between the risk perception averages of personnel who received and did not receive training on CBRN was not statistically significant ($t = 1.96$; $p = 0.06$). Additionally, no statistically significant relationships were found between the variables of gender, educational status, marital status, participation in CBRN-related drills, having sufficient knowledge about CBRN, knowing his/her responsibilities when a CBRN incident occurs, and risk perception.

Findings regarding CBRN preparedness revealed a statistically significant relationship between participants' CBRN preparedness and self-reported having sufficient knowledge about CBRN, and knowing his/her responsibility in case of a CBRN hazards. Findings revealed that individuals who reported having sufficient knowledge about CBRN hazards demonstrated a significantly higher mean preparation score (4.23) compared to those who indicated insufficient knowledge (3.64) ($t=5.17$, $p<0.001$). Additionally, participants who were partially aware of their responsibilities during CBRN incidents scored higher in preparedness (3.83) than those uncertain or unaware of their responsibilities (3.59), with this difference being statistically significant ($t=2.05$, $p=0.04$). When the preparedness scores of emergency healthcare personnel for CBRN incidents were examined in relation to gender, the mean preparedness scores for female and male personnel were found to be similar. Likewise, no significant difference was observed in preparedness scores between personnel who had participated in a CBRN-related mission and those who had not. Within the scope of this study, no statistically significant relationship was identified between years of professional experience and preparedness for CBRN incidents. The mean preparedness score for those who had received training on CBRN hazards was 3.82, compared to 3.61 for those who had not received such training. However, the observed difference in preparedness scores between the trained and untrained personnel was not statistically significant ($t=1.69$; $p=0.09$). Furthermore, no statistically significant relationships were found between preparedness scores and other variables such as age, marital status, or educational level of the emergency healthcare personnel.

Finally, a Pearson correlation analysis was conducted to predict relationship between age, CBRN risk perception and preparedness for CBRN hazards. Findings revealed that there was a

statistically significant positive correlation between two scores (r=0.393, p<0.001). However, no relationship was found between age and CBRN risk perception and preparedness for CBRN hazards scores (respectively; r=0.059, p=0.487 and r= -0.049, p=0.559).

Table 3. Factors related to participants' CBRN risks perception and CBRN preparedness

Variables			CBRN Risk Perception		CBRN Preparedness	
	Category	**N**	**Mean (SD)**	**p Value**	**Mean (SD)**	**p Value**
	Female	80	4.52 (0.3)	0.72	3.79 (0.6)	0.60
	Male	62	4.50 (0.4)		3.74 (0.6)	
Educational status *	High School	21	4.64 (0.4)	0.15	3.68 (0.6)	0.11
	Associate Degree	60	4.50 (0.3)		3.68 (0.6)	
	University	55	4.47 (0.3)		3.82 (0.6)	
Marital status	Married	63	4.53 (0.3)	0.54	3.77 (0.6)	0.96
	Single	79	4.49 (0.4)		3.77 (0.6)	
Work duration *	≤1 year	21	4.28 (0.4)	**<0.001** Difference:≤1 year	4.03 (0.6)	0.16
	2-5 years	34	4.56 (0.4)		3.69 (0.6)	
	6-10 years	57	4.54 (0.3)		3.77 (0.6)	
	≥ 11 years	30	4.54 (0.3)		3.68 (0.6)	
Participation status in a CBRN related task	Yes	54	4.58 (0.2)	**0.03**	3.80 (0.5)	0.60
	No	88	4.46 (0.4)		3.75 (0.7)	
Status of receiving training related to CBRN	Yes	109	4.55 (0.3)	**0.06**	3.82 (0.6)	0,09
	No	33	4.37 (0.5)		3.61 (0.7)	
Participation status in drills related to CBRN	Yes	23	4.55 (0.3)	0.56	3.91 (0.6)	0.22
	No	119	4.50 (0.4)		3.74 (0.6)	
Having sufficient knowledge about CBRN	Yes	30	4.51 (0.5)	0.92	4.23 (0.6)	**<0.001**
	No	112	4.50 (0.3)		3.64 (0.5)	
Perception of know his/her responsibilities in CBRN incidents	I don't know/ I am not sure	36	4.53 (0.4)	0.72	3.59 (0.6)	**0.04**
	I partially know/ I know	106	4.50 (0.3)		3.83 (0.6)	

* ANOVA

4. DISCUSSION

In this study, the aim was to determine the Chemical, Biological, Radiological, and Nuclear (CBRN) risk perceptions and preparedness levels of emergency healthcare personnel in Tekirdağ province, along with the associated factors. Additionally, the potential relationship between risk perception and preparedness level was investigated.

4.1. CBRN Risk Perception and Associated Factors

Statistically significant relationships were observed in the analysis between CBRN risk perception and participation in a CBRN-related task, as well as years of work experience. Additionally, the relationship between receiving CBRN-related training and CBRN risk perception approached statistical significance (p=0.06).

The average risk perception towards CBRN hazards was significantly higher among emergency healthcare personnel who participated in a CBRN-related task compared to those who did not participate. This contrasts with Yücel's study, which found no significant difference in risk

perception levels between those who participated in CBRN-related interventions and those who did not (Yücel, 2019). The heightened risk perception among those involved in CBRN incidents is anticipated, given the critical understanding of the severity of the situation. It is worth noting that the lack of significant findings in Yücel's study may be attributed to differences in the study group, design, and other factors related to the examination of all CBRN first response teams.

The risk perception of CBRN hazards among emergency medical services personnel with one year or less of experience in this critical role is notably lower than that of other groups. This aligns with the broader findings of our study, revealing a significant difference in risk perception towards CBRN threats among personnel with varying years of work experience. It is anticipated that individuals with fewer years of employment may possess a diminished understanding of CBRN events, leading to a lower risk perception. Consequently, they may be less inclined to engage in CBRN training opportunities and participate less frequently in CBRN events. According to the findings of the study by Jansson et al. (2020), the duration of service in ambulance care was identified as a factor significantly associated with a higher level of professional competence.

Contrary to expectations, this study did not reveal a statistically significant relationship between receiving CBRN training and CBRN risk perception. However, our study results approached statistical significance. Paton and his colleagues have underscored that CBRN training enhances the knowledge and skills of personnel, concurrently reducing risks by enhancing the institution's CBRN response capabilities (Paton, Violanti, Johnston, Burke, & Clarke, 2012). It is anticipated that individuals receiving CBRN training would comprehend the gravity of the situation, resulting in heightened risk perceptions. Nevertheless, trainees' self-confidence and risk perception may be compromised due to their awareness of self-protective measures. Another potential explanation for the lack of significance in our study may be the limited size of our study group.

No statistically significant relationships were found between the variables of age, gender, educational status, marital status, participation in CBRNrelated drills, self-reported having sufficient knowledge about CBRN, awareness of responsibilities during a CBRN incident, and risk perception. Moreover, in correlation analysis, no association was identified between CBRN knowledge scores and CBRN risk perception. In alignment with the present study, Eyison et al.'s investigation on healthcare professionals found no significant differences among participants concerning age, gender, and education (Eyison et al., 2020). Similarly, Tazeaslan's (2021) study did not reveal a significant statistical difference regarding the risk perception of CBRN hazards among those participating in drills. It was anticipated that drills would elevate risk perception by ensuring personnel comprehend the gravity of the issue. However, the insufficiency and ineffectiveness of drills in our working group might have hindered the development of sensitivity on this matter. Insufficient studies exist to ascertain the CBRN risk perception and related factors among emergency healthcare personnel. Therefore, there is a need for increased research to determine CBRN risk perception and its related factors within the personnel working in emergency health services. Risk perception necessitates multifaceted and comprehensive investigations.

4.2. CBRN Preparedness and Associated Factors

The average score of the CBRN incident preparedness survey was found to 3.77. In Yücel's study, the author of the scale employed in this research, participants exhibited a high average preparedness for CBRN events (3.71) consistent with current study (Yücel, 2019). A systematic review conducted by Veenema et al. In 2019 underscored that nurses generally perceive themselves as well-prepared for nuclear and radiation events (Veenema et al., 2019). However, a compilation study by Smith and Hewison (2012) covering research from 1996 to 2010 found that nurses' preparedness, attitudes, and perceptions regarding bioterrorism events were generally low.

It has been determined that the average preparedness for Chemical, Biological, Radiological, and CBRN hazards among emergency healthcare personnel who are aware of their responsibilities during such incidents is statistically significantly higher than the average among healthcare personnel who lack this awareness. It is essential to note that this variable is subject to subjective evaluation. Therefore, future studies are recommended to augment this variable with elements grounded in measurable assessments.

No statistically significant relationships were identified between the variables of age, gender, educational status, marital status, length of service, participation in a CBRNrelated task, and involvement in a CBRN-related exercise with CBRN preparedness. In a study by Dinçer and Kumru (2021) which investigated the preparedness of healthcare personnel for disasters and emergencies, it was concluded that gender did not exhibit a significant association with the level of preparedness for disasters and emergencies, aligning with the findings of this study. Similarly, Tazeaslan (2021) did not observe a statistically significant difference in participants' age, education level, marital status, and preparedness for CBRN events in their study. Gül's (2022) study also failed to find a statistical difference based on age, marital status, and educational status. In contrast to this study, Dinçer and Kumru (2021) found that preparedness for disasters and emergencies was higher among participants with 6-10 years of experience in the hospital setting. The disparity between Dinçer and Kumru's study and the current research lies in their focus on the preparedness of healthcare personnel working in hospitals for disasters and emergencies, with their study group consisting of hospital employees.

The observed difference can be attributed to the fact that the 112 emergency health services personnel included in this study were more frequently involved in mass events, encountered more mass casualty cases, were more intensively engaged in fieldwork, and participated in events that created chaos compared to personnel working in hospitals. This distinction may have arisen due to the nature of their roles and responsibilities. In contrast to this study, Yücel's (2019) research identified a significant difference between participants' involvement in responding to CBRN-related incidents and their level of preparation. It is anticipated that the preparedness level of personnel engaged in CBRN-related duties would be higher; however, the similarity in averages in this study might be attributed to the ineffectiveness of current assignments.

Furthermore, past experiences of nurses in radiological events have been found to be influential in comprehending their roles in disaster preparation and response phases. It is underscored that clinical experience and previous training play pivotal roles in their readiness for future threats (Alder-Collins, 2013).

One of the most significant findings of this study is the statistically positive correlation identified in the conducted correlation analysis between CBRN risk perception and CBRN preparedness scores. Tazeaslan's (2021) study similarly found a statistically significant and positive relationship between risk perception of CBRN hazards and preparedness for CBRN events. Personal perception of risk is known as the most robust determinant of health behaviour change. Addressing high-risk perception towards disasters will enhance problem-solving, self-efficacy, and psychological recovery abilities, resulting in behavioural preparedness (Bishop et al., 2000; Millar et al., 1999). In a study investigating risk perceptions and adaptive behaviours related to heatwaves and climate change, individuals with good adaptive behaviourswere found to have a high perceived benefit and a high level of actionable scores (Akompab et al., 2013). Moreover, numerous studies suggest that personalizing risk perception will enhance preparedness behaviourin the context of disasters (Tekeli-Yesil et al., 2010; Spittal et al., 2008).

This study has some limitations. Due to the 24/7 provision of 112 emergency health services leading to a high workload and active staff, face-to-face research couldn't be conducted. Data related to the scale are limited to the information obtained from 142 health personnel at Tekirdağ 112 emergency health services. Additionally, the online nature of the study, rather than observation, may have led participants to fill out question forms without necessary care, imposing constraints on the study. Nevertheless, this descriptive study is crucial in determining the current situation of emergency health services personnel with significant roles in CBRN hazards, identifying shortcomings, and providing guidance for intervention services.

5. CONCLUSION

In the context of this study, it was ascertained that the levels of CBRN risk perception and preparedness among emergency health services personnel were elevated. While a significant correlation was identified between CBRN risk perception and involvement in a CBRN-related task, as well as years of service, no significant relationship was observed concerning CBRN-related training. Variables associated with CBRN preparedness include the belief in possessing knowledge about CBRN and understanding his/her responsibilities in the event of a CBRN incident. Furthermore, a statistically positive correlation was discerned between CBRN risk perception and CBRN preparedness scores. Firstly, personnel should be incentivized to partake in activities that may heighten their risk perception. Additionally, regular communication and clarification of responsibilities are imperative. It is crucial to develop educational content aimed at enhancing CBRN risk perceptions, particularly for newly recruited personnel.

REFERENCES

Akompab, D., Bi, P., Williams, S., Grant, J., Walker, A., Augoustinos, M. (2013). Heat Waves and Climate Change: Applying the Health Belief Model to Identify Predictors of Risk Perception and Adaptive Behaviours in Adelaide, Australia. International Journal of Environmental Research and Public Health, 10, 2164-2184; doi:10.3390/ijerph10062164

Alder-Collins, J. K. (2013). Courage and selflessness in professional actions: But are they enough? International Nursing Review, 60(2), 201-204. Doi:10.111

Bishop, B., Paton, D., Syne, G., Nancarrow B. (2000). Coping With Environmental Degradation: Salination as a Community Stressor. Network, Vol.12. s.1-15.

Büyüköztürk, Ş. (2011). Data Analysis Handbook for Social Sciences. Pagem Academy.

Çokluk, Ö., Şekercioğlu G., Büyüköztürk Ş. (2010). Multivariate Statistics for Social Sciences SPSS And LISREL Applications. (2). Ankara, Pegem Academy. P.271-272

De Smedt, T., Aerts, D., Cosemans, L., Van Nieuwenhuyse, A., et al. (2014). Biomonitoring of acrylonitrile exposure following a train derailment in Belgium. PubMed. https://pubmed.ncbi.nlm.nih.gov/25128591Yanagisawa, N., Morita, H., & Nakajima, T. (2006). Sarin Experiences İn Japan: Acute Toxicity and Long-Term Effects. Journal Of the Neurological Sciences 249, p. 76-85.

Dinçer, S., Kumru, S. (2021). Preparedness of Health Personnel for Disasters and Emergencies. Gümüşhane University Journal of Health Sciences, 32-43.

Disaster and Emergency Management Authority (AFAD), (2025). Turkey Disaster Intervention Plan. https://www.afad.gov.tr/kurumlar/afad.gov.tr/e_Kutuphane/Planlar/TAMP.pdf (Last Access: 8.5.2025)

Eyison, R., Pakdemirli, A., Aydın, E., Sayın Öztürk, A., Kiliç, Z., Demirbag, B., Ortatatli, M. (2020). Evaluation of the Medical Chemical, Biological, Radiological, and Nuclear Awareness Level of Emergency Healthcare Professionals Serving on Different Centres. Journal of Basic and Clinical Health Sciences, 174-179.

Gül, Ş. (2022). A Study on CBRN Awareness, Knowledge, Attitudes, and Behaviors of Adana 112 Provincial Ambulance Service Employees. Adana.

Jansson, J., Eklund, A., Larsson, M. and Nilsson, J. (2020), "Prehospital care nurses' self reported competence: a cross-sectional study", International Emergency Nursing, Vol. 52, pp. 1-7.

Millar, M., Paton, D., Johnston, D. (1999). Community Vulnerability to Volcanic Hazard Consequences. Disaster Prevention and Management. Vol.8. p.255-260

Ortatatlı, M., Sezigen, S., Ayan, H.A., Balandız, H., Kenar, L. (2015). Evaluation of Chemical, Biological, Nuclear, and Radiological Injuries in the Context of Terrorism. Turkish Clinics Journal of Forensic Medicine Special Topics, 1(2), 44–52.

Republic of Türkiye Ministry of Health, (2025) Regulation on the Duties Regarding Chemical, Biological, Radiological, and Nuclear Hazards. https://dosyamerkez.saglik.gov.tr/Eklenti/40533/0/kbrn-yonetmelik-2020pdf.pdf

Republic of Türkiye Ministry of Health. 2025. Regulation on Emergency Health Services. https://www.mevzuat.gov.tr/File/GeneratePdf?mevzuatNo=4798&mevzuatTur=KurumVeKurulusYonetmeligi&mevzuatTertip=5

Republic of Türkiye Ministry of Health. (2025). Algorithm for the Approach to Chemical and Biological Threats.

Smith, C., Hewison, A. (2012). Are Nurses Prepared to Respond to A Bioterrorist Attack: A Narrative Synthesis. Journal Of Advanced Nursing, 2597-2609.

Spittal, M. J., McClure, J., Siegert, R. J., Walkey, F. H. (2008). Predictors of Two Types of Earthquake Preparation: Survival Activities and Mitigation Activities. Environment and Behavior, 40(6):798-817.

Tazeaslan, Z. (2021). Evaluation of the Relationship Between Risk Perception and Preparedness of Emergency Health Service Workers for CBRN Threats. Master's Thesis.

Tekeli-Yesil, S., Dedeoglu, N., Tanner, M., Braun-Fahrlaender, C., Obrist, B. (2010). Individual Preparedness and Mitigation Actions for a Predicted Earthquake in Istanbul. Disasters, 34(4):910-930.

Tekirdağ Industry and Technology Provincial Directorate. (2020). Tekirdağ Province Industry Status Report 2020. Tekirdağ.

URL 1, https://www.mevzuat.gov.tr/MevzuatMetin/21.5.3033.pdf (Last Access: 8.5.2025)

URL 2, https://khgmacilveyurtdisisaglikdb.saglik.gov.tr/TR-87371/2022-yili-haziran-ayi-kbrn-arindirma-uniteleri-guncel-listesi.html (Last Access: 09.05.2025)

Veenema, T. G., Lavin, R. P., Bender, A., Thornton, C. P., Schneider Firestone, S. (2019). National Nurse Readiness for Radiation Emergencies and Nuclear Events: A Systematic Review Of The Literature. Nursing Outlook, 54-58.

Van Nieuwenhuyse, A., Aerts, D., De Smedt, T., Cosemans, L., Hoet, P., Nemery, B. (2014). Human biomonitoring after a train derailment involving acrylonitrile. Environmental Health Perspectives, 122(6), A150. https://doi.org/10.1289/ehp.1307991

Yanagisawa, N., Morita, H. ve Nakajima, T. (2006). "Sarin experiences in Japan: acute toxicity and long-term effects". Journal of the Neurological Sciences, 249 (1), 76-85.

Yücel, H. (2019). Evaluation of the Relationship Between Risk Perception and Preparedness Attitudes of Some Teams Serving in the First Intervention in CBRN Incidents: Example of Adana Province. Gümüşhane: YÖK.