

### Preparation and Volunteering Level Determination for CBRN: The Case of Gümüşhane Province

#### KBRN İçin Hazırlılık ve Gönüllülük Düzeyi Belirleme Çalışması: Gümüşhane İli Örneği

##### Abstract

The term CBRN refers to situations that are harmful and dangerous for humans and the environment caused by the deliberate or accidental spread of chemical, biological, radioactive, nuclear materials. CBRN agents used as weapons of mass destruction since ancient times; As a result of being active in the wars that have been going on for a long time and the development of weapon technology, it has been an extremely deterrent force for the countries of the world and terrorist organizations. These agents, which may cause harm to living things, the environment, even future generations, are important risk factors for each of us. Health teams and all organizations involved in rescue operations are expected to be ready for these agents to respond to any CBRN exposure. In this study; the risk perceived by the health workers and university students associated with CBRN during emergency preparedness, rescue, readiness to respond to a CBRN event were investigated. As a result, the perceived risk (3.71) in a five-point Likert rating was found to be slightly higher than willingness-volunteering (3.41) and use of personal protective equipment (3.36). It was concluded that people who are expected to participate in the CBRN intervention team should receive CBRN training and that their expected use of personal protective equipment and volunteerism should be increased.

##### Öz

Eski zamanlardan günümüze kadar kitle imha silahı olarak kullanılan KBRN (Kimyasal, Biyolojik, Radyolojik ve Nükleer) ajanları; uzun süre devam eden savaşlarda etkin olması ve silah teknolojisinin gelişmesi sonucunda dünya ülkeleri ve terör örgütleri için son derece caydırıcı bir güç unsuru olmuştur. Canlılara, çevreye ve hatta gelecek nesillere zararları olabilecek bu ajanlar her birimiz için önemli risk unsurudur. Herhangi bir KBRN maruziyetine karşı olaya müdahale edecek sağlık ekipleri ve kurtarma operasyonunda yer alabilecek tüm organizasyonların bu ajanlara hazır olması beklenmektedir. Bu çalışmada; bir KBRN olayı için acil yardım, kurtarma ve müdahaleye hazır oluşluk aşamasında KBRN ile ilişkilendirilen Gümüşhane İli sağlık çalışanları ve üniversite öğrencilerinin algıladığı risk, kişisel koruyucu ekipman kullanımı, istek- gönüllülükleri araştırılmıştır. Sonuç olarak beşli likert derecelendirilmesinde algılanan riskin (3, 71), istek-gönüllülükten (3, 41) ve kişisel koruyucu ekipman kullanımından (3, 36) az da olsa daha yüksek olduğu görüldü. KBRN müdahale ekibinde yer alması beklenen kişilerin KBRN eğitimleri alması ve bu doğrultuda beklenen kişisel koruyucu ekipman kullanımı ve gönüllülüklerinin artması gerektiği kanaatine varılmıştır.

##### Introduction

Using Chemical, Biological, Radiological and Nuclear (CBRN) agents, it has been aimed to reduce the combat power of the enemy, especially wars, conflicts, riots, terrorist and dictator actions, poisoning and executions, to make the enemy ineffective, to haunt the enemy and to break the resistance of the enemy (Sezigen, 2009).

Weapons of Mass Destruction (WMD); It has four different formats: Chemical, Biological, Radiological and Nuclear (CBRN), and refers to all kinds of equipment (ballistic missiles, airplanes, long-range cannons, letter envelopes, etc.) used to carry and launch them, as well as non-conventional weapons. CBRN agents have been named "Weapons of Mass Destruction" because

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##### Keywords

CBRN 1, Weapons of Mass Destruction 2,  
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they have more lethal effects than conventional weapons. Conventional weapons are clearly distinguished from WMD with their destructive potential and deterrence nature resulting from this feature (Kiremitçi, 2014). Besides, the term CBRN; CBRN substances; It is also defined as the process of spreading by intent, accidental or natural disasters, and the occurrence of effects that harm humans and the environment (MEB, 2011; AFAD, 2014). The term HAZMAT (hazardous materials) is used for the accidental release of a hazardous substance or exposure to toxic industrial material (Calder & Bland, 2018).

In the study on "Transforming Defense, National Security in the 21st Century" conducted in the United States of America in 1997; it is expressed as "Weapons of Mass Destruction, generally chemical, biological, nuclear weapons and missiles capable of carrying them. In some cases, it includes radiological weapons". The use of weapons of mass destruction or the threat of using mass destruction weapons are weapons that can cause pollution, causing a change in the objectives, phase, and direction of operation of the operation with a large amount of casualties (Erdurmaz, 2003; IAEA & WHO, 1996).

The use of CBRN substances is very common, especially in the energy sector and in the health field, but these substances can pose significant risks for living things even when used on behalf of humanity. In particular, chemicals used and stored in industry, flammable and explosive materials, and nuclear power plants, although their use is to help and serve humanity, accidents and carelessness can result in major disasters (Sezigen, 2009). In addition to all these negative reasons, their usage areas for humanity, especially in the medicine and energy sector, have led to the acceptance of these agents in today's world. In addition to all these negative reasons, their usage areas for humanity, especially in the medicine and energy sector, have led to the acceptance of these agents in today's world.

Although CBRN agents have different properties in themselves; capable of causing maximum damage to the opposing enemy, causing turmoil, intimidation, or destruction during a war or conflict; high toxicity, colorless, odorless, heavier than air, its structure does not easily deteriorate, not held by masks, Resistant to air, water, chemicals, the mode of action, prevention and treatment methods are unknown, easy and cheap productions, weapons used and carried with necessary precautions. CBRN agents each have different effects and properties. Usage areas, purposes, ways of action, if any, protection methods differ.

CBRN events leave long and deep painful scars beyond the normal range of human experience. The common feature among CBRN events is 'contamination' and 'lethality' that require special preparation in terms of increased awareness, use of personal protective equipment, detectors, decontamination assistance, and special medical support measures. Such events result in a larger population in situations of panic and fear and affect their morale (Sharma, 2010).

There is little evidence of optimal management of CBRN events, but any intervention should be based on proven traditional concepts. Inter-agency and international understanding and communication are essential to optimize response and increase capability and capacity. Studies, which include the development of clear doctrine and standard operating procedures, and then the implementation of response scenarios by all response teams, are critical to achieving readiness (Holdsworth et al., 2012).

Management of mass casualty incidents due to covert attacks involving CBRN agents or man-made accidents involving them requires general preparedness and risk reduction at all levels, including the development of an effective response mechanism. For this, contingency planning, capacity building in terms of providing basic infrastructure, trained human resources, equipment, development of coordination, implementation mechanisms are required (Bhardwaj et al., 2010).

It is understood that there are CBRN events in most of the events requiring crisis management, therefore, crisis centers to be established will have to deal with several crises (for example, both natural disasters and CBRN events caused by the disaster). To manage the conditions in the event of exposure to CBRN agents, a comprehensive knowledge and analysis capability of these agents is required. In this study, Gümüşhane and Kelkit State Hospital healthcare professionals who will intervene in any CBRN incident and Gümüşhane University students who are expected to take part

in the intervention phase in their professional lives, as a result of the findings obtained by conducting a questionnaire: Determining volunteerism levels and knowledge, it was aimed to correctly evaluate and interpret the expectations and results in this regard.

## 1. Method

In the event of a possible CBRN agent exposure; It is expected that health personnel and field students who will intervene in professional life will be equipped with CBRN. In this study, the perceived risk, personal protective equipment usage, volunteering levels of the CBRN team were studied.

The study was applied to a sample group which was determined by a random sampling method among the Gümüşhane State Hospital, Gümüşhane-Kelkit State Hospital Medical Staff, Gümüşhane University Students (Nursing, First and Emergency Aid, Emergency Aid and Disaster Management, Occupational Health and Safety Departments). The sample of this descriptive and inferential study was composed of 540 people between 02 March and 20 March 2015. The data of 130 questionnaires were filled out and 410 questionnaires were analyzed.

When the survey questions preparing, literature research had been searched (MEB, 2011; Belli, 2014; Stevens et al., 2010). Survey reliability was provided with Cronbach's alpha ( $\alpha=0.917$ ). Face validity was provided by asking 10 academics.

In the questionnaire, firstly information about the purpose and scope of the research was given. In the second part, questions related to demographic characteristics and questions about whether CBRN training was taken were asked. There are 15 questions.

Participants were asked to respond to each statement by their views. The options used in the scale were arranged according to the Likert-type five-point rating. SPSS 17 package program was used for data analysis.

All participants who attend the survey gave answers according to their ideas and their own. Options that are used at analysis were arranged according to the Likert style (5 degrees). When the data was analyzing, SPSS 17 pocket program was used.

The suitability of the data obtained with the measurement of the normal distribution was examined in each group by the Kolmogorov Smirnov test. The arithmetic mean and standard deviation were evaluated by number, mean, percentage. Student's t-test using gender, institution, marital status, One-way ANOVA test was used to evaluate age, educational status, income level.

## 2. Results

The questionnaire was applied to 410 students from Gümüşhane State Hospital, Gümüşhane - Kelkit State Hospital, Gümüşhane University. Of the 410 participants, 270 were female (65.9%) and 140 were male (34.1%). Considering the marital status of the participants, it was found that 51 people were married (12.4%) and 359 people were single (87.6%). When the age groups of the participants were taken into consideration, it was found that 345 people were in the 18-25 age range (84.1%), 43 people were in the 26-34 age range (10.5%), 20 people were in the 35-45 age range (4%, 9%)., 2 people were in the 46-55 age range (0.5%), and lastly, 1 person was in the 56-year-old range (0.5%). 410 people participated in the study, 26 high school (6.3%), 232 associate degree (56.6%), 126 undergraduates (30.7%), 15 graduate (3.7%), 11 doctorates (2.7%).

Considering the institution and student status of 410 people, 103 people (25%, 1) worked in hospitals and 307 people (74.9%) were university students.

Considering the working years or student years of 410 participants, 338 people (82.4%) were 1-2 years, 43 people (10.5%) were 3-4 years, 10 people (2.4%) 5-6 years, 4 people (1%) work for 7-8 years, 15 people (3.7%) work for 9 years and over.

Besides, 175 people (42.7%) of 410 people participated in the study received CBRN training, 235 people (57.3%) did not receive CBRN training. 4 out of 175 people who received CBRN training (1%) During the course organized by national education, 3 people (0.7%) During military training, 3 people (0.7%) In a training given by a private institution, 125 people (30.5%) 39 people (9.5%) received CBRN training from other institutions during university education. Analysis of variance

(two related tests) was performed by independent groups. In the Paired Sample T-Test analysis; In the table, the perceived risk is higher than the use of personal protective equipment and willingness. However, to determine whether this difference is a coincidence or a real success indicator, when looking at the Paired Samples Test table, The Sig.value is = 0.001

**Table 1. Paired Samples Statistics of Perceived Risk, PPE, Willingness-Volunteering**

		Mean	N	Std. Deviation	Std. Error Mean	Min	Max
Pair 1	Perceived Risk	3.7123	409	0.78746	0.03894	1.00	6.00
Pair 2	PPE	3.3564	409	0.67936	0.03359	1.00	5.69
Pair 3	Willingness-Volunteering	3.4128	410	0.76338	0.03770	1.00	6.33

The difference between perceived risk and the use of personal protective equipment was statistically significant at  $p < 0.05$ . There is no significant difference between perceived risk and willingness and voluntariness, and the difference between personal protective equipment and willingness to volunteer is at  $p > 0.05$ .

**Table 2. Paired Samples Correlations of Perceived Risk, PPE, Willingness-Volunteering**

		N	Correlation	Sig.	Mean	Std.D.	t	Sig. (2-tailed)
Pair 1	Perceived Risk & PPE	409	0.311	0.001	0.35590	0.86514	8.320	0.001
Pair 2	PPE & Willingness-Volunteering	409	0.326	0.001	-0.05533	0.84076	-1.331	0.184
Pair 3	Willingness-Volunteering & Perceived Risk	410	0.328	0.001	-0.29854	0.89874		-6.726

The perceived risk in CBRN events, the use of personal protective equipment, and whether there was a statistically significant relationship between willingness and willingness were evaluated using the K Related test. Arithmetic averages are taken; perceived risk, use of personal protective equipment, and willingness to volunteer. ( $p < 0.05$ ).

**Table 3. Correlation NPar Test Descriptive Statistics**

	N	Mean	Std. Deviation
Perceived Risk	409	3.7123	0.78746
PPE	409	3.3564	0.67936
Willingness-Volunteering	409	3.4117	0.76399

Confirmatory factor analysis (standardized regression coefficients) to find the relationship between perceived risk and use of personal protective equipment and willingness to volunteer showed a weak positive relationship.

**Table 4. Non-Standardized Regression Coefficients**

	Est.	Std. Error	Critical Value	Sig. Level
Perceived Risk → PPE	0.265	0.056	4.733	0.001
Perceived Risk → Willingness-Volunteering	0.262	0.050	5.273	0.001

## Discussion

CBRN threat; CBRN substances are deliberately spread by accident or natural disasters, resulting in harmful effects on humans and the environment. When we look at the literature, there are many studies on CBRN agents, there are different definitions among them, and although they are different in many ways, when we look at their use purposes and effects, it has been observed that it continues to exist from past to present with WMD. Since the ancient times of history, chemical and biological agents have been used with various information about the use of different methods, with the development of technology diversified radioactive resources and nuclear weapons have become uncontrollable WMDs.

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The two major world wars and the subsequent cold war period led to the brutal use, storage, technological development of CBRN agents. With the end of the Cold War, the whole world has been focusing on the CBRN agents, which are crucial forces to be ready for possible war scenarios (Özgür, 2006).

When studies on CBRN agents are examined; It has been observed that there is literature information that can be reproduced as CBRN agents, their characteristics, application areas, mechanisms of action, protection from CBRN agents, decontamination methods, emergency and hospital plans for CBRN.

Since the ambulance team and hospital emergency services will be the first responders to the people exposed to CBRN agents, in such unusual situations, the capacity and facilities of the emergency services where rapid action can save lives are increased; plans are needed to ensure the safety of patients and staff (Balicer et al., 2006).

In 2003, as a result of a study which included 500 hospitals in the USA and examined the preparations of the hospitals for mass injuries, 97.3% of the hospitals were examined for natural disasters, 85.5% for chemical incidents, 84% and 8% for bioterrorist attacks, has a plan for nuclear or radiological events (Niska & Burt, 2005).

In 2006, the study in the US state of Mississippi revealed that 89.2% of state hospitals had written intervention plans, 75.7% had decontamination units, and 91.9% of hospitals were unable to identify and recognize CBRN agents (Bennett, 2006).

Higgins et al.; In a study conducted with the participation of 116 hospitals in Kentucky, USA, in 2002, it was determined that hospitals were generally prepared in areas such as admission, triage, diagnosis, treatment, evacuation of the wounded, but they were not equally prepared for the detection, decontamination, treatment of CBRN injured (Higgins et al., 2004).

Sixty-six contaminated casualties were admitted to St Luke's hospital following a terrorist attack on March 20, 1995, in which the sarcophagus was used on the Tokyo subway. 23% of hospital personnel who intervened in the wounded were exposed to secondary contamination. Similarly, 135 (9.9%) of 1363 emergency medical technicians who intervened CBRN casualties at the scene were exposed to secondary contamination and received treatment (Okumura et al., 2005).

In addition to the studies in which hospitals and hospital staff were affected by CBRN incidents and institutions were shown to be ready for such studies, CBRN incidents and their effects were also studied. Kim-Farley et al.; They used the HICS system in their planning to intervene in a bioterrorist attack that could be accomplished by the use of smallpox virus, a biological warfare agent of the category "A" and they were able to provide a more organized, rational and systematic response to operate command, control, coordination activities (Kim-Farley et al., 2003).

In 2009, Sezigen created a behavioral model that could be applied by TSK Military Hospitals to demonstrate effective intervention in CBRN-induced mass injuries, the organizational structure required in military hospitals, minimum facilities and capabilities, standards for institutional coordination and training, and intervention principles (Sezigen, 2009).

Studies conducted in 2006 have shown that most healthcare workers who are critical to emergencies, terrorist attacks, natural disasters, or events affecting public health, such as the epidemic, are reluctant to work (Balicer et al., 2006).

A survey of 136 EMTs and health workers in Monmouth County, New Jersey in 2014 showed no significant difference in perceived risk, but lack of knowledge of CBRN led to a low level of volunteerism and an urgent need to respond (Belli, 2014).

Studies have shown that there is not enough information and experience on CBRN and that all organizations that will intervene in the event should be supported with training. The necessity of preparing CBRN preparation and response plans has been demonstrated by exposure to incident response teams.

The study aims are to determine the perceived risk of employees who intervene in the CBRN case, their use of personal protective equipment, willingness to combat CBRN agents because of their importance in emergency and disaster management, the lack of studies on this issue.

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The questionnaire was applied to 410 people who were working as a result of the literature search for the health personnel of Gümüşhane State Hospital, Kelkit State Hospital, Gümüşhane University Students (Nursing, Paramedic, Emergency and Disaster Management, Occupational Health and Safety Departments).

In light of the results, the perceived risk (3.71) is higher than the willingness-volunteer (3.41) and personal protective equipment use (3.36). Multiple regression analysis was performed between perception level, willingness, willingness to use personal protective equipment evaluated by a 5-point Likert method, a weak positive relationship was observed between them.

When the demographic findings were evaluated, it was observed that there was no statistically significant difference in perceived risk and willingness. In terms of the use of personal protective equipment, women, married, long-term employees; It was observed that they were more sensitive than male, single and short-term working individuals and there was a statistical difference between them.

There was no statistically significant difference between educational status and willingness. The perceived risk and personal protective equipment use of associate degree graduates and students were found to be higher than the undergraduate and graduate graduates and students, and there was a statistical difference between them. When the level of knowledge is examined, it is found that associate degree and master's degree is more equipped than the degree. These results showed that CBRN training requires continuity and the importance of regular training, exercises, awareness-raising activities against these threats.

The tendency towards CBRN weapons is pushing countries to look for ways to protect themselves from these agents. KBRN weapons designed for use must always be equipped against weapons. Countries should develop state policy on this issue and the necessary training and preparations should be carried out in a controlled manner to raise public awareness (Kılıç, 2006).

### **Conclusion**

CBRN agents are important risk factors for both the use of WMD and their beneficial use for both communities and the environment and countries should be prepared for these agents. These agents, which can result in disasters, can have unpredictable consequences.

The possibility of a combination of terrorism and weapons of mass destruction is evident in today's world. In addition to the measures to be taken against countries with defense systems and CBRN agents, all organizations involved in the health sector and the intervention phase should be prepared for these dangerous agents at any time and ensure that different disciplines work together effectively. In CBRN exposure, public, private sector, non-governmental organizations, individuals should support the process by performing their duties on a human and professional basis. Health institutions and organizations involved in the intervention phase are exposed to disasters due to their purpose and service areas. They must have the necessary training and equipment to manage CBRN-containing disaster health. In this study aimed to determine the perception levels, use of personal protective equipment, the willingness of knowledge of health personnel and individuals who are expected to be included in the intervention team to intervene CBRN agents, this survey aimed to determine knowledge level in Gümüşhane province was slightly higher than the willingness and willingness and personal protective equipment usage seen. Besides, it was observed that the survey participants had more information about nuclear agents, then biological agents, radiological agents, finally chemical agents.

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**Appendix\*\*\***

<b>(6) No Answer, (5) I totally agree, (4) I agree, (3) I partially agree, (2) I don't agree, (1) I totally disagree</b>								
<b>If you are experiencing a CBRN event and are exposed to CBRN substance, check the following.</b>								
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>Mean</b>
<b>1</b>	I'm more quickly and easily impressed by my work.	9.0	9.2	26.5	23.1	26.5	5.4	3,32
<b>2</b>	If any symptoms have not been developed yet, I think that family members and friends will be at risk.	5.6	10.0	19.2	31.9	31.4	1.7	3,69
<b>3</b>	I think my colleagues will be at risk if any symptoms have not been developed yet.	7.1	10.0	20.7	35.8	23.6	2.7	3,51
<b>4</b>	I'm more exposed to the CBRN incident at work.	8.0	9.7	19.5	25.1	31.6	5.8	3,45
<b>5</b>	I'm more likely to be exposed and sick while doing my job.	4.4	9.5	16.1	26.5	40.1	3.2	3,79
<b>6</b>	I think my family and friends will be affected if I get sick.	6.3	4.6	15.8	31.6	39.9	1.5	3,90
<b>7</b>	If I'm sick, I think my colleagues will be impressed.	6.8	5.8	15.8	32.4	36.0	2.9	3,76
<b>8</b>	If I'm sick, I may die.	9.2	12.7	22.4	21.4	26.5	7.5	3,21
<b>9</b>	I was involved in a real disaster response.	42.8	15.1	4.6	6.1	6.8	24.3	1,46
<b>Tick the following considering the personal protective equipment to be used during the CBRN incident response.</b>								
<b>1</b>	Personal protective equipment is available at my location.	17.8	11.4	23.4	20.7	16.3	10.2	2,76
<b>2</b>	I was trained in personal protective equipment.	12.7	13.9	21.2	26.8	20.4	4.9	3,14
<b>3</b>	I used one of the personal protective equipment.	21.4	15.1	15.1	19.0	20.4	8.8	2,76
<b>4</b>	I often use the personal protective equipment that should be used when doing my job. (like mask, gloves)	8.5	8.0	10.0	29.5	41.5	2.4	3,80
<b>5</b>	I will use it if I'm given personal protective equipment.	5.8	4.4	11.7	24.8	50.1	2.9	4,00
<b>6</b>	I think the equipment is not comfortable.	14.4	19.2	24.8	18.5	12.4	10.5	2,63
<b>7</b>	I think personal protective equipment prevents me from doing my job.	28.5	26.0	23.4	11.2	6.3	4.4	2,28
<b>8</b>	I don't believe that personal protective equipment will protect me.	32.1	26.8	20.4	8.5	8.0	3.9	2,22
<b>9</b>	I think personal protective equipment will reduce my working efficiency.	29.0	29.9	22.1	9.7	6.3	2.7	2,26
<b>10</b>	I have personal protective equipment where I work.	6.1	9.2	21.2	26.8	21.7	14.8	3,04
<b>11</b>	There is a decontamination unit at the place where I work.	17.8	14.8	15.3	17.3	12.7	21.7	2,26
<b>12</b>	I got the necessary training on decontamination.	18.2	14.6	14.1	22.1	20.4	10.0	2,82
<b>13</b>	I always use the necessary personal protective equipment during the intervention.	10.0	5.4	18.6	30.3	30.3	5.4	3,49
<b>When a CBRN event occurs in your location, consider your volunteering and willingness to work and mark the following.</b>								
<b>1</b>	Personal protective equipment is available at my location.	17.8	11.4	23.4	20.7	16.3	10.2	2,76
<b>2</b>	I was trained in personal protective equipment.	12.7	13.9	21.2	26.8	20.4	4.9	3,14
<b>3</b>	I used one of the personal protective equipment.	21.4	15.1	15.1	19.0	20.4	8.8	2,76
<b>4</b>	I often use the personal protective equipment that should be used when doing my job. (like mask, gloves)	8.5	8.0	10.0	29.5	41.5	2.4	3,80
<b>5</b>	I will use it if I am given personal protective equipment.	5.8	4.4	11.7	24.8	50.1	2.9	4,00
<b>6</b>	I think the equipment used is not comfortable.	14.4	19.2	24.8	18.5	12.4	10.5	2,63
<b>7</b>	I think personal protective equipment prevents me from doing my job.	28.5	26.0	23.4	11.2	6.3	4.4	2,28
<b>8</b>	I don't believe that personal protective equipment will protect me.	32.1	26.8	20.4	8.5	8.0	3.9	2,22
<b>9</b>	I think personal protective equipment will reduce my working efficiency.	29.0	29.9	22.1	9.7	6.3	2.7	2,26
<b>10</b>	I have personal protective equipment where I work.	6.1	9.2	21.2	26.8	21.7	14.8	3,04
<b>11</b>	Decontamination unit where I work.	17.8	14.8	15.3	17.3	12.7	21.7	2,26
<b>12</b>	I got the necessary training on decontamination.	18.2	14.6	14.1	22.1	20.4	10.0	2,82
<b>13</b>	I always use the necessary personal protective equipment during the intervention.	10.0	5.4	18.6	30.3	30.3	5.4	3,49

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