



Knowledge and Attitude of Iranian Red Crescent Society Volunteers in Dealing with Chemical Attacks

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ABSTRACT

Objective: To evaluate the knowledge, attitude, and preparedness of Mahabad Red Crescent Society volunteers in dealing with chemical attacks.

Methods: This prospective cross-sectional study was conducted on 120 Red Crescent Society volunteers in Mahabad City, Iran, during 2014-2015. The knowledge of the volunteers was evaluated and rated using a questionnaire as poor, moderate, and good. Also, the attitude of the volunteers towards the chemical attacks and their preparedness were rated as appropriate and inappropriate using a questionnaire. Data were analyzed using the SPSS software version 21.

Results: From a total of 120 volunteers, 62.5% were males. The mean age of the volunteers was 32.0±8.2 years. None of the volunteers had adequate knowledge regarding management of the consequences of chemical terrorist attacks. Only 10 volunteers (8.3%) had appropriate attitude and 7 (5.8%) stated their preparedness for being sent to the crisis zone. Also, 116 volunteers (96.7%) declared that Mahabad Red Crescent Society has an inappropriate level of preparedness to encounter chemical terrorism attacks and release of chemical agents related to petrochemical industrial chlorine resources into the water and wastewater.

Conclusion: The findings of the present study show poor knowledge and inappropriate attitude of Mahabad Red Crescent Society volunteers, and rescuers in encountering probable chemical attacks and industrial accidents. Furthermore, the Red Crescent Society had an inappropriate level of preparedness in the field of chemical terrorism from the viewpoint of the studied volunteers.

Keywords: Chemical terrorism; Knowledge; Civil defense; Rescue work; Chlorine.

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Introduction

Today, the threat posed by chemical weapons (CWs) for countries not at war and the threat of

bioterrorism and chemical terrorism are at a state of emergency for most countries. Because of easy preparation and physico-chemical properties of these materials, terrorist groups use them as a weapon

of massive destruction. Events such as the terrorist attack by a Japanese cult in the Matsumoto city and the Tokyo subway system are a few examples of this problem [1-4].

Modern CWs were widely used during the World War I to achieve military and political objectives. Mass production and deployment of CW agents in war became a possibility. The birth of modern CWs was ushered in by the German gas attack with chlorine on 22 April 1915 at Ypres, Belgium [5-7]. Chlorine and phosgene both affect the pulmonary system and therefore are called pulmonary agents (choking agents). Choking agents injure an individual mainly in the respiratory tract, i.e. in the nose, throat, and particularly, the lungs. In extreme cases, membranes swell, the lungs become filled with liquid and death results from lack of oxygen; thus, these agents choke the unprotected individuals. Fatalities of this type are referred to as "dry-land drownings" [8-12]. Both chlorine and phosgene is used in many chemical industrial processes, making the control of these compounds difficult, and these can be used as a devastating low-technology weapon in the hands of terrorists [13]. Chlorine gas is primarily a respiratory irritant. It is extremely irritating to the mucous membrane, the eyes and respiratory tract. Contact with chlorine in 14-21 ppm for half an hour is dangerous and the threshold limit value of chlorine is 1 ppm or 3 mg/m³ of air [14-18].

The prolonged symptoms intolerable to patient might lead to possibilities of pulmonary embolism, denudation of alveolar and bronchial epithelium, pulmonary edema, chemical pneumonitis, alveolar disruption and, as a rare complication, pneumomediastinum. This rare complication needs to be understood for providing immediate care to the victims in a proper way. In the case of acute exposure, it may lead to acute lung injury and/or acute respiratory distress syndrome due to which 1% of the patients might die. Humidified oxygen and inhaled β -adrenergic agents are appropriate therapies for victims with respiratory symptoms while assessments are underway. Inhaled bicarbonate and systemic or inhaled glucocorticoids also have been reported anecdotally to be beneficial. However, it is still at an experimental level and requires further clinical evidence prior to its universal utility [19].

Under normal circumstances, if 10 tons of chlorine gas released into the air in the range of 2 kilometers from the source concentration of 140 ppm and within 5 kilometers, concentration of about 15 ppm will be created and becomes cleared according to population density in major cities of the disaster [20]. Events associated with the chlorine gas leak were reported at Haji Bunder hazardous cargo warehouse in the Mumbai Port Trust, India. Leakage of chlorine gas from cylinders of 50 tons was also reported in Astara City, Iran. As well, chlorine leak accident occurred at a water treatment station in Tehran, Iran [19-21].

The events of chemical terrorism carried out

by the members of Aum Shinrikyo, the Japanese doomsday cult, in Matsumoto city (1994) and the Tokyo subway system (1995) caused 11 cases of death and thousands of hospitalization cases [22]. Also, the Islamic State of Iraq and Syria insurgents are now using suicide bombs laden with chlorine gas, a significant expansion in terrorism [19]. Since the Organization for the Prohibition of Chemical Weapons suspects the risk of chemical terrorist attacks anywhere in the world [23], the risk of recurrence of a terrorist chemical attack and the use of chlorine by terrorist groups have become a real concern among rescue task forces. Decreasing postdisaster morbidity and mortality depends on sufficient resources and acceptable levels of knowledge, attitude, and preparedness among rescue task forces [24-26]. In Iran, Red Crescent Society is the most important organization in dealing with probable terrorist attacks. Nevertheless, at the time of chemical terrorist attacks, personnel, rescuers or volunteers may have to confront difficulties such as medical management of chemical casualties as well as working with limited equipment and in unknown environments [27].

To date, there is no precise information regarding knowledge, attitude, and preparedness of Iranian relief task force volunteers in management of probable chemical terrorist attacks. Therefore, the aim of this study was to evaluate knowledge, attitude, and preparedness levels of Iranian Red Crescent Society personnel, or volunteers in dealing with chemical terrorist attacks and release of chlorine gas from storage tanks in order to plan a rapid response in emergency situations.

Materials and Methods

Study Design and Setting

In this prospective cross-sectional study, knowledge, attitude, and preparedness levels of Mahabad (Northwest Iran) Red Crescent Society volunteers were evaluated during 2014-2015. The data were collected using a questionnaire; the reliability of the questionnaire was verified using a 40-case pilot study and the test-retest method ($r = 0.76$). Also, the expert panel confirmed face, criterion, and content validity of the questionnaire. The first part of the questionnaire included three questions regarding demographic data such as age, sex, and education (Table 1) and the second part included three fields: volunteers' knowledge of attacks with chlorine gas (twelve questions, Table 2), volunteers' attitude to participate in rescue teams at the time of chemical attacks (ten questions, Table 3), and the preparedness of Red Crescent Society in dealing with chemical attacks from volunteers' viewpoint (eight questions, Table 4).

Study Population

The studied population included volunteers who

Table 1. Demographic characteristics of the 120 participants from Iran red crescent society.

Characteristics	Frequency (%)
Age	32±8.2
20-29	75 (62.5%)
30-39	33 (27.5%)
≥40	12 (10.0%)
Gender	
Men	75 (62.5%)
Women	45 (37.5%)
Education	
Diploma	34 (28.3%)
Associate's degree	25 (20.8%)
Bachelor's degree	52 (43.3%)
Master's degree and higher	9 (7.5%)

had passed at least one rescue course (consisting of 4 different 2-day workshops) in disaster management. One hundred and twenty volunteers were selected using simple random sampling. Volunteers who did not want to participate or filled out the forms incompletely were excluded.

Ethical Statement/Approval

The protocol of this study was approved by the local ethics committee of Red Crescent Society and the researchers adhered to the principles of Helsinki Declaration. The informed written consent form was signed by the volunteers.

Statistical Analysis

The required sample size was determined to be at least 77 cases considering the 72% prevalence ($p=0.72$) of poor knowledge, $\alpha=0.05$, and desired precision of 0.1 ($d = 0.1$) [24].

Data were analyzed using SPSS 21.0. The quantitative data were reported as mean and standard deviation, and the qualitative ones were reported as

frequency and percentage. Each positive answer to the questions gained 1 point, while negative answers received 0 points. Therefore, the maximum achievable scores for knowledge, attitude, and preparedness were 12, 50, and 8, respectively. The knowledge score 0-4 was considered as poor, 5-8 as moderate, and 9-12 as good knowledge. In addition, the attitude score ≤ 25 was defined as inappropriate and score >25 as appropriate attitude. The preparedness level was rated inappropriate if preparedness score was 0-4 and appropriate if it was 5-8.

Results

One hundred and twenty volunteers of Iranian Red Crescent Society were asked to answer the questions (62.5% male). Mean age of the volunteers was 32±8.2 years (range, 20-51 years). Thirty-four (28.3%) of the participants had diploma, 25 (20.8%) had associate degree, 52 (43.3%) had bachelor's degree, and 9 (7.5%) had master's degree or higher (Table 1). None of the volunteers had any information regarding diagnostic and therapeutic procedures and management of chemical warfare agents.

Knowledge

None of the volunteers had knowledge of diagnostic and therapeutic methods at the time of encountering chemical warfare, antidotes, and the principles of treatment for chlorine victims. The volunteers also had no knowledge about LC50 and LD50 units for chlorine and other chemical agents of war and were not familiar with the NATO standard code of chemical warfare agents, including the Immediately Dangerous to Life or Health (IDLH) conditions, Emergency Response Planning Guidelines (ERPGs), and emergency response areas of pollution (hot zone, warm zone and cold zone).

Table 2. The questions queried about the volunteers' knowledge of the respective organization about chemical attacks.

The questions	No (%)	Yes (%)
Knowledge		
Classification of chlorine gas from chemical agents	38 (31.6)	82 (68.3)
The way of contact and influence in a person exposed to chlorine gas	61 (50.8)	59 (49.1)
NATO familiar with the standard code of chemical warfare agents and especially NATO standard code to detect chlorine gas under study	120 (100)	0 (0.0)
Understanding the use of chlorine in everyday life	0 (0.0)	120 (100)
Understanding the definition of LC50 and LD50 units in chemical warfare agents and especially its approximate value for chlorine	120 (100)	0 (0.0)
Knowledge of color and smell of chlorine used to diagnose it	98 (81.6)	22 (18.3)
Understanding the definition of IDLH unit in chemical warfare agents and especially its approximate value for chlorine	120 (100)	0 (0.0)
Familiarity with ERPG in the event of chemical accidents and explosions	120 (100)	0 (0.0)
Are you familiar with diagnostic and therapeutic methods at the event of encountering chemical warfare agents?	120 (100)	0 (0.0)
Familiarity with triage, search and rescue techniques and first encounters and the victims of an accident with chlorine gas or chemical terrorism	57 (47.5)	63 (52.5)
Re-familiarity with the triage and decontamination of victims of an accident with gas at a field hospital in areas with emergency response	120 (100)	0 (0.0)
Familiarity with the area emergency response to vector masks, and removing personal protective equipment and clothing	120 (100)	0 (0.0)

Table 3. The questions queried about the volunteers' attitude of the respective organization about chemical attacks.

The questions	Strongly agree	I agree	No idea	Opposite of	Very opposite
Attitude					
Are you committed to staying at work at the event of a chemical attack?	3 (2.5)	4 (3.3)	0 (0.0)	33 (27.5)	80 (66.6)
Do you tend to care and treat the probable victims at the event of a chemical attack?	0 (0.0)	3 (2.5)	52 (43.3)	52 (43.3)	13 (10.8)
Do you tend to cooperate with your respective organization in passive defense (anti-chemical) plans?	0 (0.0)	0 (0.0)	0 (0.0)	60 (50.0)	60 (50.0)
If the personal protective clothing and complete isolation equipment are supplied, do you tend to work (able to take a role) in the area contaminated with chemical agent?	3 (2.5)	7 (5.8)	32 (26.6)	31 (25.8)	47 (39.1)
Do you tend to participate in workshops and conferences related with passive defense (chemical agent)?	17 (14.1)	45 (37.5)	8 (6.6)	12 (10.0)	38 (31.6)
Do you tend to pass university courses or in-service training courses with the content of anti-chemical defense?	0 (0.0)	2 (1.6)	30 (25.0)	4 (35.0)	46 (38.3)
Do you have the required preparedness to be sent out to the zone of crisis if you are needed at the event of a chemical attack in any part of the country?	5 (4.1)	5 (4.1)	12 (10.0)	16 (13.3)	82 (68.3)
Your view regarding the rescue teams readiness to intervene when an incident or chemical crisis takes place?	51 (42.5)	4 (3.3)	5 (4.1)	57 (47.5)	3 (2.5)
Your view regarding the training of rescue teams to intervene when an incident or chemical crisis takes place?	20 (16.6)	13 (10.8)	25 (20.8)	27 (22.5)	35 (29.1)
Your view of the tasks involved in chemical accidents and Red Crescent organization's policy?	7 (5.8)	4 (3.3)	63 (52.5)	19 (15.8)	27 (22.5)

Table 4. The questions queried about the volunteers' preparedness of the respective organization about chemical attacks.

The questions	No (%)	Yes (%)
Organization preparation		
Has your organization held retraining workshops and seminars in the field of chemical defense and search and rescue in chemical accidents?	120 (100)	0 (0.0)
Has a recorded and official instruction, proclamation, or training course been explained on how to intervene in chemical warfare and industrial accidents?	118 (98.3)	2 (1.7)
Does the organization you serve provide the required financial supports for you at the time of encountering chemical attacks?	119 (99.2)	1 (0.8)
Does the organization you serve consider your worries and concerns about the security of yourself and your family at the time of facing chemical and bioterrorist attacks?	110 (91.7)	10 (8.3)
Does the central organization (in Tehran) consider your concerns and needs at the time of educational and strategic planning for preparedness against chemical and biological attacks?	97 (80.8)	23 (19.2)
Do you believe material and spiritual encouragements by the upper management are necessary for better performance (quantitatively and qualitatively) at the event of chemical accidents and a biological emergency?	95 (79.2)	25 (20.8)
Does the organization have enough personal protective equipment and has it provided some relief for the team?	120 (100)	0 (0.0)
Does the organization have enough chemoprophylaxis for society in the case of chemical accidents and has it provided a biological emergency?	114 (95.0)	6 (5.0)

In general, none of the volunteers had good knowledge of confronting the chemical attacks with chlorine and other chemical warfare agents (Table 2).

Attitude

Seven cases (5.8%) stayed at work during a chemical attack. Twenty cases (16.6%) declared that they would participate if protective equipments were available. Moreover, 3 cases (2.5%) were willing to take care of the probable victims of chemical attacks. Only 30 volunteers (25.0%) had an appropriate attitude and 90 (75.0%) had inappropriate attitude

toward participation in chemical terrorism relief task forces (Table 3).

Preparedness

Based on the volunteers' answers, no training workshops and seminars had been held so far regarding chemical defense and the search and rescue tasks in chemical disasters. One of the participants (0.8%) stated that the Red Crescent Society provided the required financial supports for facing chemical and bioterrorist attacks. Two cases (1.7%) declared that recorded instructions, guidelines, or

training courses had been explained by the central organization. Moreover, 10 cases (8.3%) expressed that the members of the respective organization had considered their worries and concerns about the security of their own selves and their families at the time of facing chemical and bioterrorist attacks. Twenty-three cases (19.2%) believed that the central organization considered the personal requirements during educational planning for preparedness against bioterrorist and chemical attacks. From the viewpoint of 116 (96.7%) volunteers, Mahabad Red Crescent Society had inappropriate preparedness to encounter biological and chemical attacks (Table 4). The preparedness level of volunteers was poor after a practical test with the mask M9A1 and personal protective clothing manufactured by Milad Factory, Iran, so that none of the rescuers in action had proper knowledge and preparedness in the field of masking under 9 seconds and going through a zero level of protection in less than 8 minutes to the mission-oriented protective posture (MOPP) level four of the MOPP protection. Figure 1 shows the preparedness status of Mahabad Red Crescent Society to encounter chemical attacks and biological emergency from the volunteers' viewpoints.

Discussion

The findings of this study show that none of the queried Iranian Red Crescent Society volunteers had good knowledge about management of chemical attacks. Seventy-five percent had inappropriate attitude, and 96.7% believed that preparedness of Mahabad Red Crescent Society is poor about encountering chemical attacks. The findings of the present study are in accordance with related previous studies [28-30] in this regard. Cone *et al.*, [31] evaluated hospitals in Philadelphia, USA, and the results showed that the personnel did not have complete and enough preparation and knowledge

necessary to manage chemical and biological attack victims. According to the studies supporting the results of this study, it is clear that all health services, medical and relief, namely Red Crescent Society of Islamic Republic of Iran need to provide HAZMAT (hazardous materials) rapid reaction forces in order to deal with CBRN (chemical, biological, radiological and nuclear) incidents. Tan *et al.* stated that in most countries, the majority of medical facilities are not prepared to treat the large number of CBRN victims [32]. Rokach *et al.*, [33] reported that in the case of chemical accidents, the situation is unknown and even scary for the majority of employees and teams of health care centers. The element of fear originates lack of awareness, even in the developed countries in this field. Also, higher knowledge of rescuers increased their tendency to respond to bioterrorist and chemical attacks. Thus, training the volunteers is of high importance in order to increase their willingness for relief in contaminated areas. Holding different scientific seminars and symposiums and fitting different training plans in the field of chemical terrorism as optional courses into syllabuses of universities and responsible organizations can be a worthy donation to elevate the knowledge level of society's experts.

Today, the threat of terrorist chemical attacks is found in most countries [23]. Nozaki *et al.*, [34] pointed out that following the terrorist attacks on the civilian population, a huge mass of stretcher patients and out-patients refer to the health centers, many of whom do not require medical assistance teams. Usually in such cases, there is no need to address pollution. However, since in some cases failure to decontaminate these patients causes the emission of pollution to other parts of the health care workers and therapists, in these situation, all patients should be triaged and, if necessary, decontaminated with simultaneous administration of antidotes. Fifty-two percent (52.5%) of the subjects in this study were

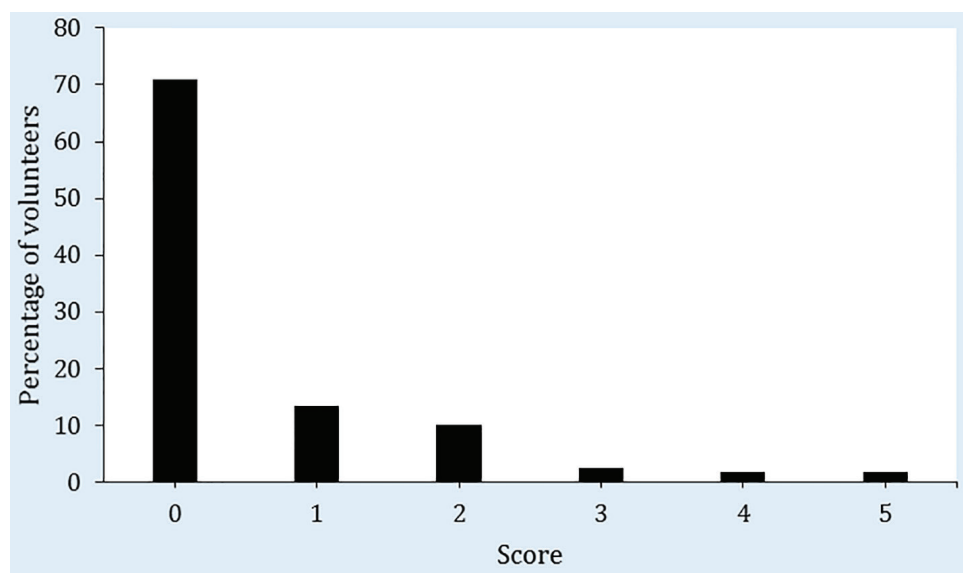


Fig. 1. The preparedness status of Mahabad Red Crescent Society to encounter chemical attacks and biological emergency from the volunteers' viewpoint.

familiar with victims triage criteria in such incidents. The findings of the Monov *et al.*, [35] study reveal that triage and decontamination of the basic elements of chemical defenses are necessary to protect the lives of victims exposed to chemical agents. Therefore, the knowledge of HAZMAT rapid response teams about triage criteria is considered very important in CBRN incidents; because before transferring the victims to cleaner health care centers, they should primarily be triaged based on the available medical resources and treatments. In Iran, Red Crescent Society along with military forces is on the frontline of biological and anti-chemical defense. They must provide necessary resources such as antidotes, antibiotics, antitoxins, and intensive care equipments such as ventilators. Chemical agents are able to create life-threatening diseases; so, at the time of biological and chemical attacks, quick and timely response is so important that even seconds can save thousands of lives. According to the results of the Bahreini Moghadam *et al.*, [36] study, the required facilities and equipments for defending against biological and chemical attacks must always be prepared and ready to work to prevent waste of time in such events.

Unfortunately, based on the viewpoint of the study

participants, we face with inappropriate preparedness of Mahabad Red Crescent Society in dealing with bioterrorist and chemical attacks, which requires special attention to be paid to improve it.

Finally, it is thought that enhancing the knowledge and attitude of health care providers and training them in the backbone field of CBRN defense can result in a better and more efficient battle against probable terrorist attacks.

In conclusion, the findings of the present study show poor knowledge and inappropriate attitude of Mahabad Red Crescent Society volunteers in encountering with probable chemical and biological attacks. Furthermore, the Red Crescent Society of this town had an inappropriate level of preparedness in the field of biological and chemical emergencies from the viewpoint of the studied volunteers.

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Conflict of Interest: None declared.

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