Hospital preparedness for chemical threats

- A pilot study among emergency medicine staff in Gothenburg, Sweden

Lovisa Nilsson
Master Thesis of Medicine
2014

Hospital preparedness for chemical threats

- A pilot study among emergency medicine staff in Gothenburg, Sweden

Lovisa Nilsson

Master thesis in Medicine 30hp

Supervisor: Amir Khorram-Manesh, MD, PhD
Secondary supervisor: Bruria Adini Wiesel, MD

Institution of Clinical Sciences
PKMC, Prehospital Disaster Medicine Centre

UNIVERSITY OF GOTHENBURG

Programme in Medicine
Gothenburg, Sweden 2014

Table of Contents:

Abstract

"Hospital preparedness for chemical threats - A pilot study among emergency medicine staff in Gothenburg, Sweden"

Introduction: An impendent exposure to hazardous materials has become a reality worldwide. Increasing numbers of transportations with loaded chemical agents, the increasing risk of contamination due to an accident and the use of chemicals in conflicts or terror events, may all result in a disastrous outcome. These events should be managed medically. Hospital preparedness is an important component of a successful management of such events.

Aim: To identify hospital staff´s preparedness for chemical threats in Gothenburg, Sweden and to investigate how training affects the knowledge and the willingness to report to work during a chemical event. We also aim to compare the willingness of the Swedish healthcare staff to report to work, to that of the Israeli staff.

Method: A validated questionnaire for assessing knowledge and readiness to report to work in a chemical major incident, already used in Israel, was used to study the level of knowledge and readiness among Swedish emergency staff in Gothenburg.

Results: The overall level of knowledge was low. There was a positive statistically significant correlation between higher knowledge and participation in any chemical warfare (CW) training program (P= 0.000). Participation in any CW training program also showed positive and statically significant correlation to a higher willingness to report to work during a CW (P= 0.036).

Discussion: There is a need for improved knowledge concerning chemical threats and its management among the healthcare staff in Gothenburg. Such improvement may be obtained

by initiation of training programs. Additional knowledge may also improve staff´s self-confidence to manage a CW event and report to work during such potential occurence.

Conclusions: The emergency staff members should be offered regular educational opportunities, targeted to improve their knowledge and willingness to report to work during chemical events.

Key words: hospital preparedness, chemical events, report to work, knowledge.

Introduction

All around the world, an impendent exposure of hazardous materials has become a reality [1]. Every day large amounts of trains, trucks and ships transport toxic chemical agents to distance locations, risking leakage of toxic materials, should an accident occur [2]. Chemical accidents, are statistically the second most rising disastrous event in recent decades [3]. One element that complicates the management of chemical events is the variation of their potential presentation, as poisonous vapours, aerosols, liquids or in solid form [4, 5]. Knowledge regarding the characteristics of these specific agents, their impacts on human and appropriate treatment is vital for healthcare services [6]. As part of CBRNe (Chemical, Biological, Radiological, Nuclear and explosive), chemicals are a threat we must handle [7].

Some commonly used hazardous agents are phosphor compounds, usually used as pesticides, but also against undesirable herbs and fungus. This agent may be easily disseminated and a contaminated individual will display signs and symptoms such as diarrhoea, blurred vision, respiratory distress, unconsciousness and cramps. The treatment consists of decontamination and respiratory support combined with injection of atropine as an antidote [8]. Another well-known agent is chlorine that currently is used as a disinfectant in drinking water, sewage plants and household cleaning products. Any accident leading to leakage may spread and affect the exposed community by causing lung irritation, acute respiratory distress syndrome or even death [7, 9].

Chemical agents may also be used in conflicts or as a terrorist act, affecting thousands of innocent individuals, who will then need urgent, life-saving medical services. Terrorism is the most increasing disastrous event [3] and since 11 September 2001, poses a constant threat that every country should be aware of [10, 11]. Historically, the first use of hazardous materials in

a larger scale was reported in World War I, with chlorine and mustard gas. Nerve agents were used in the Iraq-Iran conflict in the 1990th and in 1995 in the Japanese terrorist attack with the nerve agent sarin, in a subway in Tokyo [5]. It paralyses the respiratory muscles by affecting the respiratory centre [12], causing hallucinations and ataxia and may also cause bradycardia, hypotension and circulatory failure [5]. Sulphur mustard can rapidly cause eye symptoms, ulcerating skin lesions and severe damage to the airways and bone marrow. In Genéve, 1992, every States Parties agreed in a convention aimed to prohibit the use chemical weapons and to chemically disarm, by destroying any stockpile of chemical weapons [13].

An individual exposed to these agents presents a challenge for the healthcare system. However, exposure of a ***large group*** of people to chemical agents may paralyze the overall healthcare system due to lack of vital resources, such as ventilators and dialysis machines [14]. This type of event may potentially also require structured and effective evacuation of hundreds of people from a contaminated area, and demands knowledge and skills in the use of personal protection gears and decontamination processes [3]. In order to handle such a situation, the healthcare system and personnel should be prepared and trained, both within and outside the hospitals.

Different parts of the world are exposed to diverse threats and risks. While Sweden is a country that has not been subjected to large disasters, conflicts or terrorism, other countries have been more exposed to such hazards (e.g. Flooding of Bangkok in Thailand [15], Fukoshima in Japan [16] and conflicts and mass casualty events in Israel [17].) Preparedness for emergencies should be based on specific risk assessment initiated specifically for each country; however, as some risks are global, ***all countries*** are required to build and retain at least a minimal level of emergency preparedness that will enable provision of an immediate response for potential threats.

In Sweden, every municipality has a unit responsible for the preparedness to a major incident [18]. In Gothenburg, this unit is the Prehospital Disaster Medicine Centre (PKMC), which is responsible for creating and updating a preparedness plan for the Region of Västra Götaland. This plan serves as the basis and foundation for the local preparedness at the hospitals [14]. Such preparedness plans foresee the common risks in the governing area, based on a risk and vulnerability analysis. One specific risk in Gothenburg, Sweden is the comprehensive handling of hazardous materials. The railway, which crosses the heart of the city, daily transports flammable, explosive chemical agents [7]. In total, over 3 million tons of hazardous materials are transported through the Swedish railways [3]. Through the great harbour of Gothenburg, 50% of the one million containers shipped to Sweden are transported, and many of these containers consist of chemical pesticides. It is of great importance that these containers be correctly marked, but this marking rule is not always appropriately followed thus entailing a high risk for the community and loading workers [19]. In Stenungsund, close to Gothenburg, the Swedish petrochemical industry is located and produces hard plastic, synthetic fibre and detergents with a high risk to develop into chemical threats, should something unfortunate occur [20].

The antagonistic use of hazardous agents is also a potential threat in Sweden; in December 2010 the first attempts of a suicide bombing occurred in the capital of Sweden. Fortunately, no one was injured. Such terrorists attacks may also be targeted to the country´s transportation routes, as non-complicated mechanisms designated to cause maximal damage to the community [7]. Although the Swedish government, in its assessment in 2013 did not identify any urgent risk for terrorist acts against Swedish interests, the Swedish Security Service has already raised the risk level for Sweden to a higher level in 2010, from low (=2) to a higher grade (=3) on a five-grade scale [7, 21]

A disaster, whether natural or man-made, can affect a community for a very long time and result in high morbidity and mortality [22]. The main purpose of disaster preparedness is thus, to minimize the physical and psychological consequences following a severe event [23]. Therefore, it is of great importance that all medical and healthcare facilities are prepared to manage all potential disastrous events including chemical incidents [6, 24]. Knowledge, skills and abilities are valuable to all hospital staff when assisting in a disaster or public health emergency. However, the most important unit in the hospitals in any emergencies is most probably, the emergency department [25]. Effective preparedness may be achieved through planning and training [6]. Considering the contribution of the emergency medicine personnel to the outcome of such events, the present study focuses on this group of staff.

The willingness for international collaboration and the opportunity to share each other's lessons learned and experiences is of great value for the development of effective preparedness [17]. In 2013, an evaluation of the preparedness of the healthcare staff in Beer-Sheva, Israel, was initiated by a group at Ben-Gurion University of the Negev. This study raised the interest of the main author to implement a similar study in Gothenburg by guidance from PKMC and collaborations from Beer-Sheva. Comparative studies between two cities in different countries (Tehran and Stockholm) concerning the non-structural safety at hospitals have formerly been conducted [26], but did not involve the preparedness of the hospital healthcare staff. Although Bo Brismar has earlier described the disaster preparedness in Sweden and other European countries in general, to the best of our knowledge no study has ever evaluated the preparedness of the Swedish emergency healthcare staff for chemical threats before [27].

Purpose

To evaluate the state of preparedness and the level of knowledge among Swedish emergency healthcare staff in Gothenburg, with respect to management of chemical threats. We also aimed to evaluate the willingness of the same group, to report to work during a chemical warfare (CW) event, and compare it to that of the Israeli staff, as presented in a recent study that was conducted in Beer-Sheva.

Scientific issue

1. What is the level of knowledge concerning hospital preparedness for chemical threats among emergency healthcare staff in Gothenburg, Sweden? Have the staff members participated in any training and education for chemical events?

2. How is the willingness to report to work in a chemical warfare event, among the healthcare staff in Gothenburg, Sweden compared to that of the healthcare staff in Beer-Sheva, Israel?

3. How does training affect the level of knowledge respectively the willingness to report to work in an event of chemical warfare?

Medical relevance

A chemical threat is a growing challenge world-wide; thus, every country must be prepared for managing such a situation. The knowledge concerning chemical threats and the preparedness required in order to manage its medical consequences, is a lifesaving responsibility of healthcare managers. Policies and standard operating procedures need to be well developed and regularly practiced.

Method

Material and Methods

A questionnaire for assessing knowledge concerning chemical agents used as warfare, was developed and used in a study in Beer-Sheva, Israel at Ben-Gurion University of Negev, in October 2013. In this project an English version (Appendix A) of the validated questionnaire was used, to study the level of knowledge of Swedish emergency healthcare staff at hospitals in Gothenburg. The English version of the questionnaire was delivered by the Israeli supervisors (from Hebrew to English) to prevent potential misunderstanding of the nature of questions by Swedish partners if translated in Sweden.

This questionnaire consists of general questions regarding each individual with respect to their preparedness, resources, and medical knowledge to manage patients in a chemical event. Most of the queries, with exceptions for two specific war-related questions, were transferable to Swedish investigation.

The questionnaire consisted of three parts, where the first part had 15 demographic questions concerning the ***background*** of the healthcare worker and the working place (gender, year of birth, occupation and participation in training programs or other education activities focusing on Chemical Warfare events.) The second part of the questionnaire consisting of eight questions examined the ***feelings and perceptions*** of the participant, and the last component included eight multiple-choice questions regarding specific ***knowledge*** of chemicals, symptoms, treatment and protective means.

Ethics

There was no patient-related information in this study.

Data collection procedures

Between the dates 2014-04-01 to 2014-10-08, the questionnaires were disseminated to 180 Swedish emergency healthcare staff, at four healthcare units at the three hospitals of Sahlgrenska University Hospital, in Gothenburg (see below). The units had four weeks to reply to the questionnaires. An informative letters was included, explaining the purpose of the study. In some units, the main author also had the opportunity to visit a staff meeting and shortly present the project. All participants were informed and consented to be involved in this study of their free will. All questionnaires were delivered anonymously.

The four units and the number of questionnaires that were disseminated; Emergency department, Östra Hospital, 30 questionnaires, Medical emergency ward, Sahlgrenska Hospital, 60 questionnaires, Surgery Trauma unit, Sahlgrenska Hospital, 30 questionnaires, Emergency department, Mölndals Hospital, 60 questionnaires.

Statistical methods

The results of the questionnaires were analysed by SPSS software (version 22). Frequencies, crosstabs and additional statistical test such as χ^2-test with Fishers exact test were performed. The alternative "not relevant" was excluded in the χ^2-test.

Literature review

Articles published between 1991-2014, were searched using: PubMed, Google scholar and BGU search engines. Relevant articles were chosen by the first author and if needed by an expert in the field. The keywords used were: disaster medicine, hospital preparedness, chemical events, chemical warfare, chemical weapons, health care workers, hospital staff, willingness, report to work, knowledge, knowledge sense, attitude of the health personnel.

Courses

The main author has attended two regional one-day-courses at Prehospital Disaster Medicine Centre (PKMC) in Gothenburg, in order to acquire relevant knowledge about the subject and regional organization. The first course provided education about the basics of disaster preparedness and the second focused on emergency care during events of chemical agents.

Result:

Population

A total of 57 out of 180 (32%) respondents answered the questionnaire (37% were males and 63% females). Among the participants, 23% were physicians, 68% nurses, 2% management and maintenance staff and 7% others (often assistant nurses). Mean age of the participants was 38.0 ± 12.4 years (mean ± SD), median 32 years, ranging from 23-66 years. The number of years working at current hospital was 8.7 ± 9.8 years (mean ± SD), median 5 years. The number of years working in current position was 7.2 ± 9.2 years (mean + SD), median 3 years. Approximately 47% of the participants worked in Medical emergency wards, Sahlgrenska Hospital, 23% were from the emergency department at Östra Hospital, 11% from Surgical Trauma unit, Sahlgrenska Hospital and 19% from the emergency department at Mölndal Hospital.

The obtained results are presented in Appendix B. Following are the main results:

Part A -Background

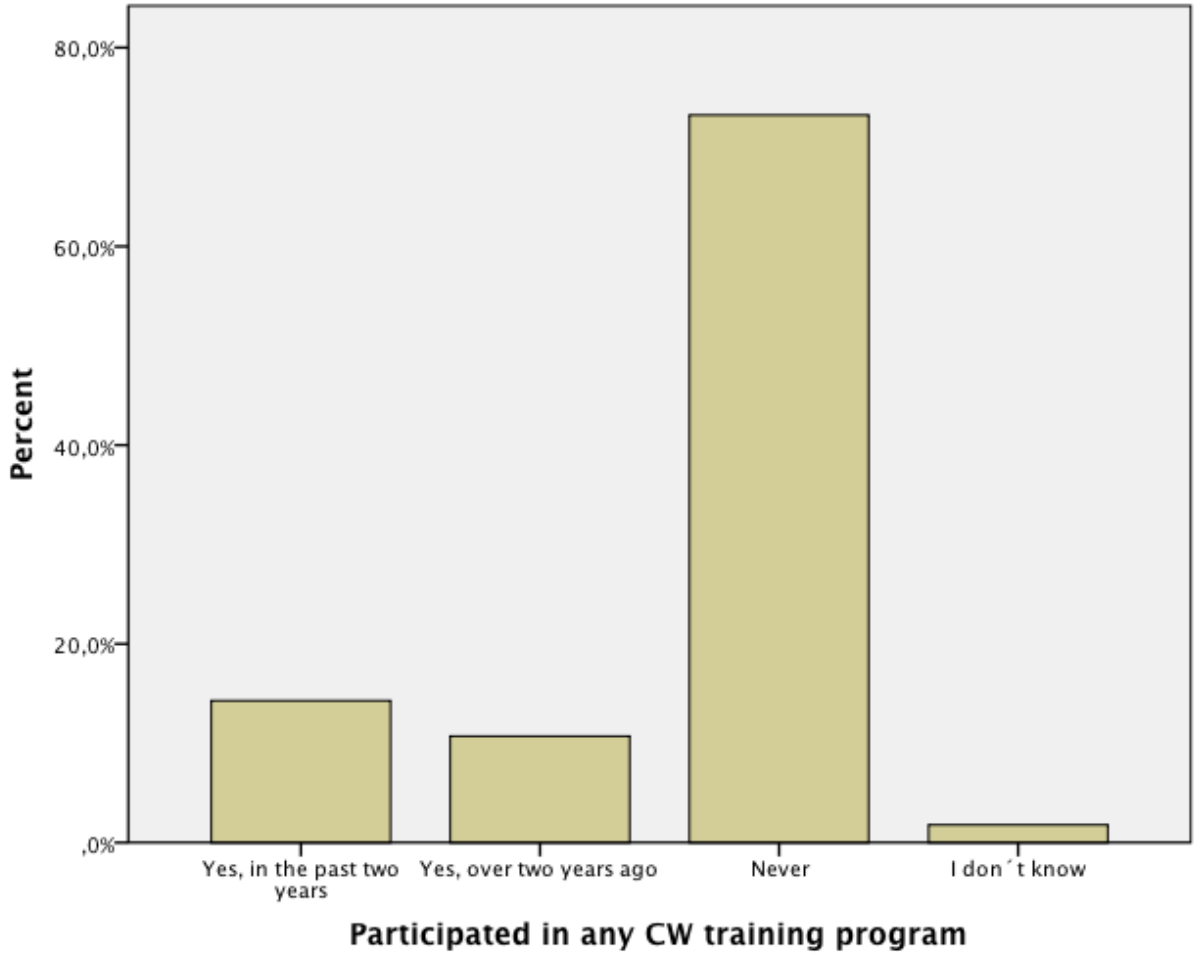
Items & Defined roles

Around 28% of the hospital staff states their residency have a bomb shelter or Residential Secure Space, 30% had food and water to be used in an emergency, 5% had equipment for sealing and protection of infrastructure, 84% had a medicine kit and first aid equipment and 12% of the participants answered that they do not have any of these items at their disposal. Of the participants only 4% had their own CBRNe mask. Around 82% of the respondents neither knew their role in a treatment site for CBRNe victims, nor found this question relevant.

Education

Around 14% of the respondents have participated in CW training programs within the past two years and 11% have participated in a course over two years ago, while 72% have never participated in any CW programs (Figure 1).

Figure 1: Shows the amount of respondents participating in any CW training program.



About 18% of the respondents have participated in CW simulation exercises at one point of time, while 81% have never participated in any such training modes.

Approximately 13% of the respondents participated in some forms of preparation to a CW event, such as seminars, lectures or workshops within the last year. 6% of the participants had studied some reading materials, while 77% were not involved in preparatory activities for a CW event. In general, the participants were not widely exposed to information relating to CW (TV, Internet, scientific articles etc.).

Part B -Feelings and Perceptions

Perception of your role

Only 28% of the respondents perceived their role in managing a chemical event as vital. The same rate of respondents (28%) also perceived that their hospital was prepared to provide an effective response for an event involving a chemical event. Only 9% of the participants were well familiar with their role in the hospital´s response model during a CW event.

Protective means

Only 6% of the participants were well proficient in the utilization of the protective means used in a CW event. Only 21% believed that the protective garments and means would prevent them from being contaminated in a CW event.

Report to work

The decision whether to report to work during a CW event was to a large and very large extent influenced by the concern for one´s own health (55%) and the welfare of family members (60%). The professional obligation to provide care for patients was also found to be a great influence (60%), while the fear of losing the job was low; only 8% thought this was an important factor in making the decision. Adequate family function was presented as an important factor, where 67% found this relevant to their decision to report to work during a CW event.

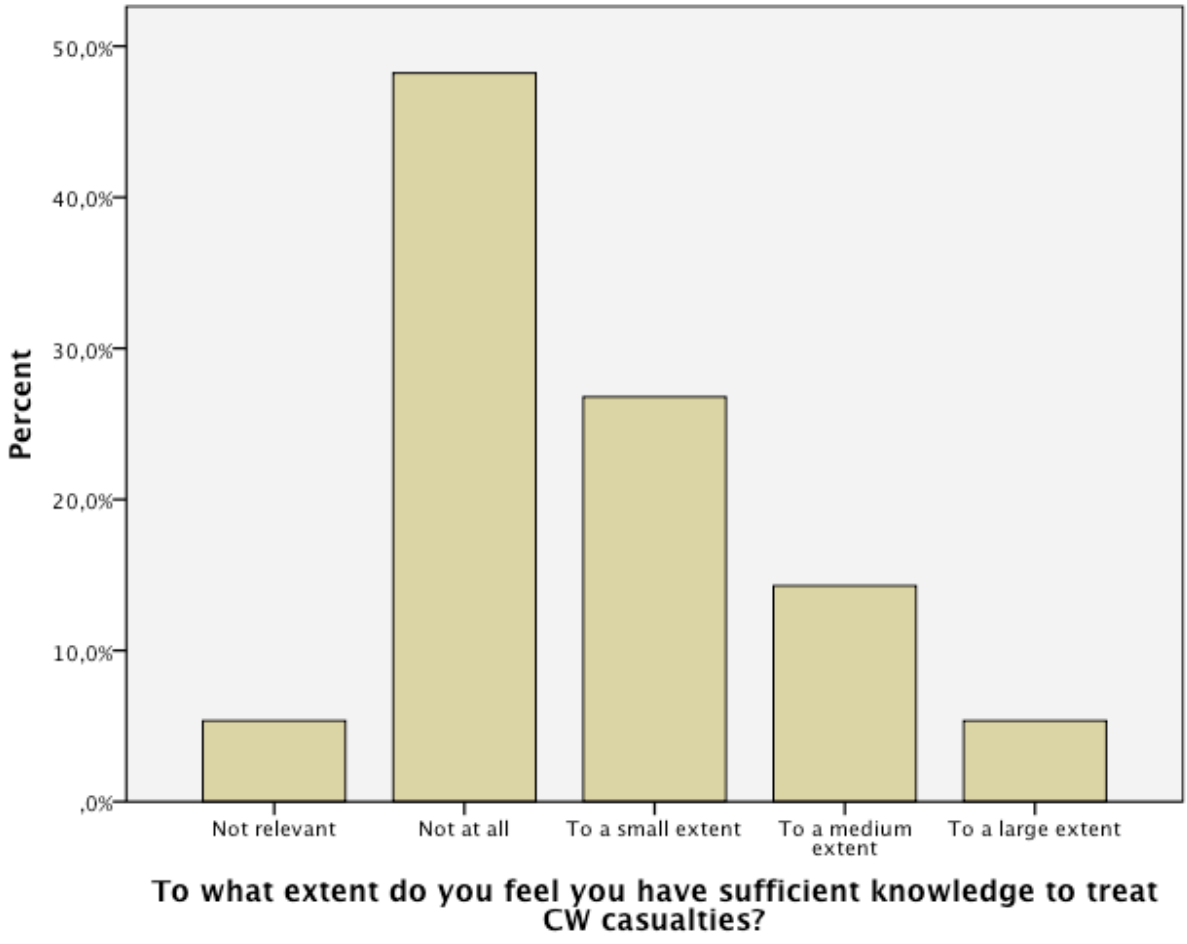
The willingness to report to work during a confrontation period, when conventional rockets are launched was low (16%). The belief in their colleagues to report to work was even lower (7%). The willingness to report to work during a confrontation period in which chemical warfare agents were used was also low (18%) and the belief of the colleagues' willingness was 9%. Only 16% were willing to treat a chemically contaminated patient.

Around 74% of the respondents expressed being highly concerned to work as healthcare worker in a CW event while 71% felt “fear”, 58% anxiety, 67% pressure, 62% sadness, 72% danger, 16% optimism, 9% satisfaction and finally 16% expressed pleasure.

Knowledge

Regarding the level of knowledge, 48% of the participants felt that they “not at all” had sufficient knowledge to treat CW casualties and 26% “to a small extent” (Figure 2).

Figure 2: Shows the extent of the self-rated knowledge.

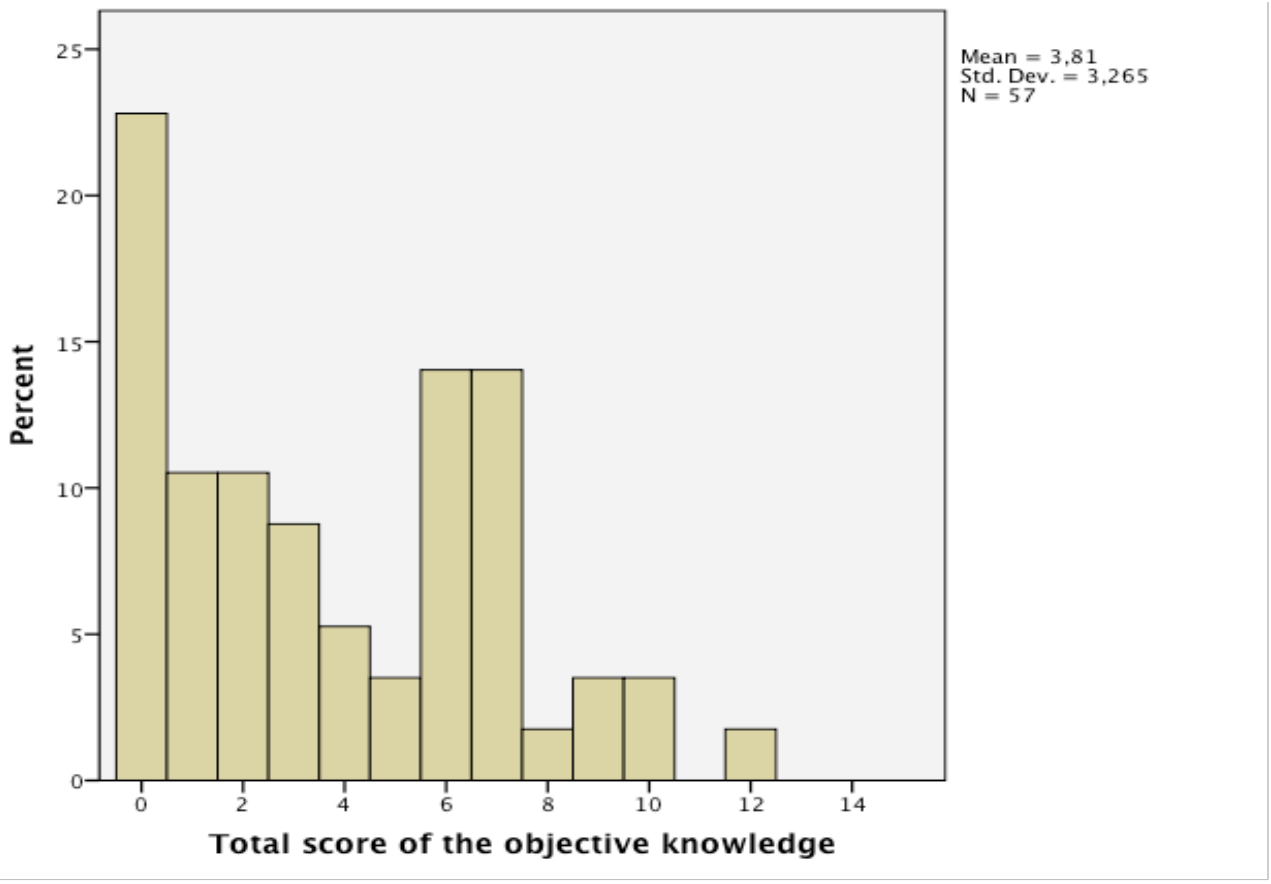


In situations when patients might ask questions about events involving CW agents, 40% of the healthcare staff felt that they “not at all” were able to answer these questions and only 4% were well prepared to answer questions. Only 7% felt highly secure with being at work during an event involving a CW. Around 25% valued their ability as a caregiver to treat patients who are injured as a result of a CW event, as highly professional.

Part C -Knowledge

The objective knowledge component consisted of 15 questions and thus, a maximal score of 15 could be obtained. The overall mean knowledge score of the participants score was 3.8 ± 3.3 (mean + SD) correct answers, the median 3.0. Among the participants, 13 of them received 0 correct answers. One participant received 12 correct answers *(Figure 3).*

Figure 3: Number of correct answers in the objective questions of knowledge.



Divided in groups 44% of the participants received 0-2p, 18% received 3-5p, 30% received 6-8p, 9% received 9-12p.

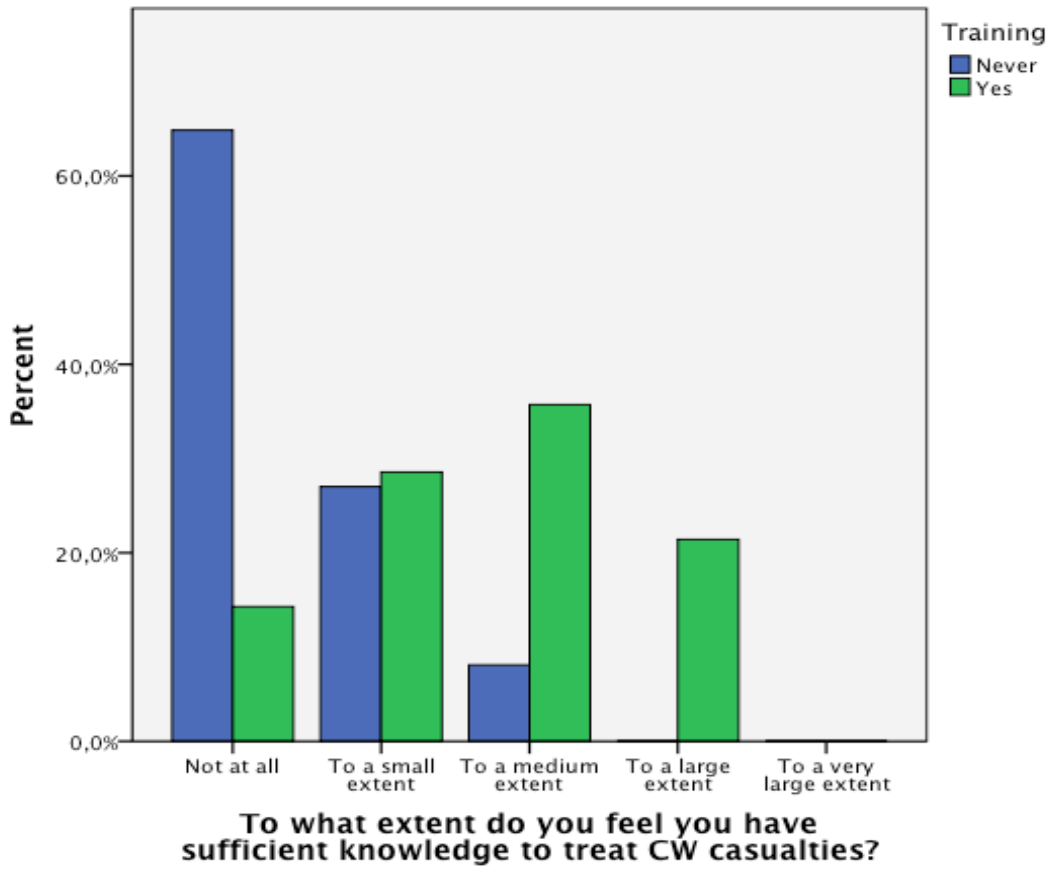
Comparison of variables, by crosstabs and χ2-test

Correlations of variables could be described by the use of crosstabs and using the χ2-test, a significant correlation can be presented. Here follows some correlations found:

1. CW Training program (anytime) – Self-rated knowledge

Among the staff that has formerly participated in any type of CW training programs, 14% felt that they ”not at all” had sufficient knowledge to treat CW casualties compared to 21% that felt they had sufficient knowledge. Among the staff that has “never” has participated in any CW training program, 65% felt that they ”not at all” had sufficient knowledge to treat CW casualties and none felt they have sufficient knowledge. A positive correlation was displayed between participation in training programs and perception of a higher level of knowledge was found. This result was statistically significant (p=0.000), (Figure 4).

Figure 4: Compares the self-rated sufficiency in knowledge between staff participating in training and those who never had.



2. CW training program (date) - Self-rated knowledge

A positive correlation was also found regarding an overall higher knowledge among staff participation in a recent CW training program. 25% of the staff that have participated in a

training program “in the past two years”, compared to 33% that participated “over two years ago”, rated their knowledge “to a small extent”, 50% of the staff that have participated in a training program “in the past two years”, compared to17% that participated “over two years ago”, rated their knowledge “to a medium extent”, This correlation was statistically significant (p=0.000).

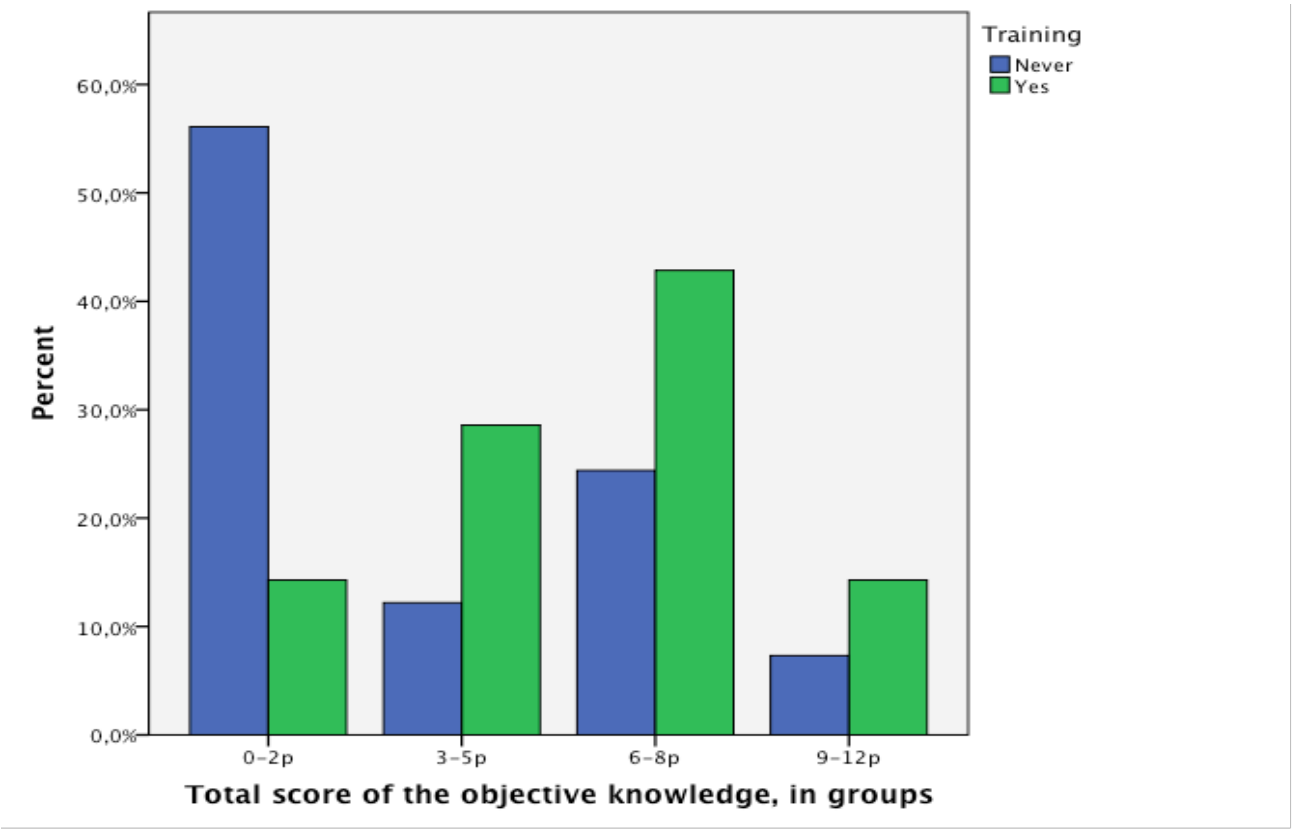
3. CW simulation exercise - Self-rated knowledge

Another positive correlation was found between high knowledge and participation in an exercise simulating a CW event. A staff member that has participated in any of these simulations had a higher knowledge than those who had never participated in such training programs (38% vs. 0 % stated knowledge in large extent). This correlation was found to be statistically significant (p=0.001).

4. Participation in any training program – Objective knowledge

Among staff that had participated in any CW training program, 14% scored 0-2p, 29% scored 3-5p, 43% scored 6-8p and 14% scored 9-12p. Among the staff that had ”never” participated in any CW training program, 56% scored 0-2p, 12% scored 3-5p, 24% scored 6-8p and 7% scored 9-12p (Figure 5). This result was statistically significant (p=0.032).

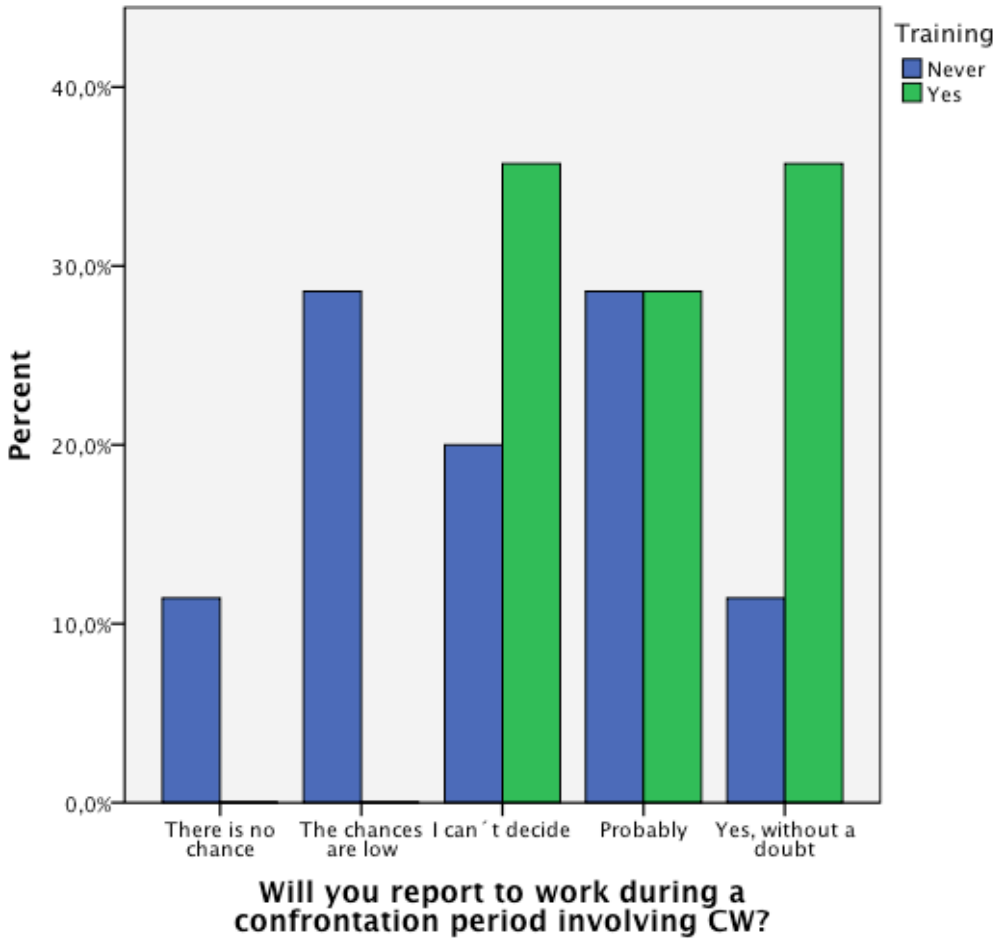
Figure 5: Comparison of the objective knowledge between staff participating in training and those who never had.



5. Participation in any CW training program – Report to work during a period involving CW

A positive correlation was found between participation in any CW training program and a higher willingness to report to work during a period involving CW, compared to those who had never have participated in training programs (36% vs. 11% willingness). This correlation was statistically significant (p=0.036), (Figure 6).

Figure 6: Compares the result of the willingness to report to work between staff participating in training and those who never had.



6. Participation in any CW training program – Treat a patient with chemical agents on his body

A positive correlation was found between staff that had participated in any CW training program and higher willingness to treat a chemically contaminated patient, compared to staff that never participated in a CW training (43% vs. 8%). This correlation was found statistically significant (p=0.006).

7. Utilization of protection means – Self-rated knowledge

Another positive correlation was found between higher knowledge and higher proficiency in the utilization of protective means used in a CW event. Among the participants that felt they

“not at all” were proficient in the utilization of protection, 69% also felt they “not at all” had sufficient knowledge to treat CW casualties. Among the participants that felt they “to a medium extent” were proficient in the utilization of protection, 83% also felt they “to a medium extent” had sufficient knowledge to treat CW casualties. This result was found statistic significant (p=0.000).

8. Professional obligation to provide care for the patients - Report to work during a period involving CW.

There was a tendency (not statistically significant) that staff with a higher feeling of professional obligation to provide care for the patients were more willing to report to work during a CW event. Of the participants who answered “yes, without a doubt” they will report to work, 80% also reported their professional obligations to a “large extent” or “very large extent”, compared to 10% who reported their professional obligation to “ not at all” or “ to a small extent”.

9. Gender – Report to work during a period involving CW.

Among the males 21% were willing to report to work during a period involving CW. Among the females 19% were willing to report to work. The difference was not statistically significant.

10. Age group – Report to work during a period involving CW.

In the age group of 21-30 years, 16% were willing to report to work. In the age group of 51+ years 27% were willing to report to work. The result was not statistically significant.

11. Self-rated knowledge - Report to work during a period involving CW.

There was a tendency (not statistically significant) between lower self-rated knowledge and

lower willingness to report to work during a period involving CW. 90% of the participants who answered, “the chances are low” they will report to work, also felt they “not at all” have sufficient knowledge.

12. Preparedness of the hospital - Report to work during a period involving CW.

There was a tendency (not statistically significant) that staff members who reported on a higher willingness to report to work during a CW, had a greater trust in the preparedness of the hospital, to provide an effective response to an event involving a CW. 64% of the participants who believed the hospital was prepared “to a large extent”, compared to 22% who believed the hospital ”not at all” was prepared, also thought they “probably” or “yes, without a doubt” will report to work.

Comparative result of the Israeli study, in Beer-Sheva

A sum of 484 out of 686 medical, administrative and technical staff that the questionnaire was sent to answered it (70% response rate). 78.5% of the respondents expressed a high willingness to present to work during a chemical warfare event. It was found that among the staff, men reported a greater willingness to present to work during a chemical warfare event compared to women (93.1% vs 72.2% respectively, p=0.000). Among the age group of 55 and older, the willingness was significantly higher relative to other age groups (91.6% at the age group 55+ compared to 66.7% at the age group 18-24, p=0.000). A higher willingness to present to work was found among medical staff and support units with a high level of knowledge compared to those with moderate-low level of knowledge (84.7% vs 69.3%, respectively, p=0.000), and among staff with a high perception of knowledge compared to those with medium-low perception of knowledge (95.8% vs 69.2% respectively, p=0.000). Moreover, a greater willingness to present to work during a chemical warfare event was found

among staff with a high perception of trust in their workplace preparedness, personal protective equipment and function of their colleagues, compared to those with a medium-low perception of trust (93.1 % vs 66.4% respectively, p=0.000). The main factors that were found significantly influencing the decision to present to work were: professional commitment to treat patients and casualties (OR = 2.32 (1.563-3.453), p=0.000) and appropriate family function during a chemical warfare event (OR = 2.19 (1.499-3.200), p=0.000).

Discussion

This study emphasizes on ***a need for improvement in management of chemical threats*** among healthcare staff in Gothenburg, which can be done by improving the basic knowledge [28]. Knowledge, however, must be transformed to skills and ability to perform. Thus, higher knowledge about chemicals and their impact on human's health, increases the willingness to report to work, raises motivation in obtaining skills, enables the utilization of right protective measures, and all together increases staff´s self-confidence to treat all victims with higher ability [29, 30]. The high grade of proficiency must then be maintained by exposure to the reality or by training/simulation.

In this study, the knowledge was analysed both through the participant´s self-rating and the objective result of the questions concerning signs, symptoms and management of a chemical event. Both results confirm the low grade of knowledge in this group of healthcare staff, as shown in other studies [29]. Furthermore, this study presented a statistically significant correlation between higher knowledge and higher proficiency in the utilization of protective means, which is important for the appropriate management of chemical events. Due to the seldom occurrences character of chemical accidents and warfare, management of chemical events is not part of the healthcare routine. However, they must be effectively managed should they occur.

Providing an appropriate response requires capacity that should be based on skills and based on the knowledge. It is logical to assume that willingness of getting involved will be higher if there is enough knowledge, skills and ability [30]. In this study, the Swedish staff´s willingness to report to work during a confrontation period in which chemical agents were used, was much lower than that of Israeli staff and around 23% of Swedish staff could not decide whether to report to work or not. Is it due to the fear of getting hurt or not having

enough knowledge to give the best possible care? Greater knowledge brings more useful skills and expertise in these events, which increases staff´s self-confidence and motivation to report to work [31]. The greater knowledge probably also influences staff´s emotional and practical stability and increases their ability to manage casualties in a chemical event [31]. A tendency was seen in both studies between higher level of knowledge to treat CW casualties and higher willingness to report to work [31].

In a disasterous situation, hospitals will receive many injured, while their capacity might be limited. Hospital preparedness is a key factor in successful management of a major incident [6, 22]. Disasters cannot be prevented, but they can be mitigated and one way to mitigate is to increase the preparedness in all hospitals that receive hundreds of injured. In such chaotic situations there should be plans, structure and resources to handle the situation. A well prepared hospital not only increases its reputation, but also the confidence of its employees. In both studies there was a positive correlation (not statistically significant in this study) between higher expressed willingness to report to work and a higher trust in the preparedness of the hospital to provide an effective response to a CW event. Staff feeling credence to the preparedness of their hospital, may probably worry less about the lack of their own security and are more willing to report to work during a CW event.

In both Swedish and Israeli studies male subjects showed higher willingness to report to work, however, whether this result is due to family structure or uneven distribution of gender, remains to be studied. Higher age also influenced the willingness to report to work. The greatest willingness to report to work during a confrontation period involving CW (21%) was found in the eldest age group ($\geq$51). The same result was obtained by the Israeli researcher (92% $\geq$ 55). This might probably be due to the fact that staff over 50 years had accumulated years of experience and rely on their knowledge and experience. One may speculate that

professional obligation may increase the willingness to report to work. Although we could just show a tendency in correlation between high feelings of professional obligation and high willingness to report to work during a CW event in our study, it was indicated as one main factor influencing the decision to present to work in the Israeli study. An explanation for these differences in willingness is probably because Israel is continuously on alert for different events [17], while Sweden is not.

Education, that brings self-confidence, knowledge, skills and ability, increases the readiness of individuals to get involved in management of all disastrous events [22]. Some countries are exposed to major incidents and disasters, while others are less exposed or not exposed at all. Nevertheless, there is a need to establish preparedness even for occurrences that are infrequent or rare [28]. Worldwide, many countries invest significant amounts of budgets, resources and time to improve their emergency preparedness. One way to gain an improvement is through training and education [7]. According to the Swedish National Board of Health and Welfare, Swedish counties shall plan for further education and professional development of the healthcare staff. Counties are also responsible for theoretical and practical qualification of the staff and are expected to plan for regular training [23]. This kind of planning and education will increase the competency of staff, as shown in other studies [24, 32]. Although training may represent a limiting factor [22], it can identify all deficiencies that needs to be repaired.

In this study we could show statistically significant and positive correlation between ***higher knowledge*** concerning treatment of CW casualties, ***higher willingness to treat a chemically contaminated patient*** and ***higher willingness to report to work*** and participation in any CW ***training***. Recent training, closer to the event, offers a higher knowledge and willingness to be part of managing organization, as was shown in a recent study [33]. These results present the

positive impact of training/simulation on the knowledge, ability and skills of all staff and consequently their higher confidence to be involved in a real emergency situation [6, 11, 25, 28, 29, 31, 34]. Training and or simulation may be one way to improve preparedness for all risks events in general, bur particularly for chemical events in Gothenburg.

There are many training models, however simulation training has been recommended as a highly appropriate model in disaster education, since discussion-based activities such as workshops and table-top exercises alone are inadequate for the hospital disaster preparedness [22]. Using various scenarios, multidisciplinary teams can be trained in various events and find out each other´s capacity, ability and limitations [35, 36]. This will also lead to a better risk assessment and resource utilization [37, 38].

Conclusions

In conclusion, this study shows that there is a lack in proficiency, education and willingness of emergency medical staff in Gothenburg, to act in a chemical event. Thus, there is a need for education, information and training in order to accomplish a successful management of a chemical event if that should happen. Therefore an exhortation of this study, to the Swedish healthcare system, is to offer every emergency staff member regular training and education opportunities, to improve their knowledge and willingness to report to work in chemical events. This must be done in cooperation with the managers of the hospitals and with support from the National Board of Health and Welfare.

Implication

The result of this study can be beneficial for the hospitals and the emergency medical staff, when preparing disaster plans and in order to avoid negative outcomes of with an

unpredictable chemical incident.

Methodological considerations

Limitations

The most important limitation of this study was the small number of respondents, which makes all the statistical analyses less reliable. This is a failure since the result lacks some important elements about the target population, such as the original number of the population, their gender, age and profession. Such deficiencies in our result make it hard to do any drop-out analyses. To improve the outcome we should first have chosen our population concerning the lacked elements mentioned above. In this way we had a better possibility to go back and analyse the missing number of respondents, their characteristics etc. However, due to some factors such as frequent investigation, working overload and initial resistance for participation, we had to change our strategy and deliver all questionnaires to the units instead of individual delivery. This change our methods to so called “waiting room surveys”, which is known to be less reliable, but it is easier to collect data including the participant´s personal data.

The reasons for the low rate of answers in this study could be several. Many of the healthcare staff found the questionnaire used, really difficult to understand due to two reasons; firstly, the questions were specific about chemical warfare event, and not general chemical events such as transport accidents, which are more common in Sweden. Secondly, the questionnaire was in English, which made it hard to understand both questions and alternative answers. The manager of one unit reported difficulties in motivating emergency staff to answer this questionnaire, due to the language and the lack of reality in their daily work. We used an English version of the questionnaire since translating it from Hebrew to English and then to Swedish could create new anticipations and interpretation and thus a high risk of losing its

originality. Therefore the original version was translated from Hebrew to English by the Israeli main authors, to avoid misunderstandings in the character of questions.

In future studies a larger population sample is needed, this may be done with a questionnaire in Swedish, with more adapted questions to the Swedish context. Another thing we could not afford to do in this study was to evaluate the level of knowledge using the same questionnaire, before and after a course in chemical events, to further investigate the effect of training. This would be of great value for future studies in Sweden.

Strengths

One strength of this study was the originality of the questionnaire. It was validated and used before in a recent study, which made it more reliable and comparable with a new study.

Populärvetenskaplig sammanfattning (svenska)

Användningen av farliga ämnen har ökat dramatiskt de senaste decennierna och idag utsätts vi för en överhängande risk för exponering av dessa ämnen. I Sverige är det största hotet det stora antalet transporter med kemikalier som färdas på infrastrukturen genom våra städer.

Olyckor med dessa farliga ämnen kan leda till stora konsekvenser för människorna i de drabbade områdena. Ett annat riskområde där kemikalier kan användas som vapen, är terrorism. Denna hotbild har ökat även i Sverige och varje land måste ha en beredskap som fungerar när det krävs.

Olika kemikalier har olika egenskaper och påverkar människan på skilda sätt. Ämnen som t.ex. klor och fosforföreningar kan drabba andningsorganen, vilket kan kräva avancerad behandling med t.ex. respirator och om stora skaror patienter drabbas samtidigt kan det skapas kaos på sjukhuset om utrustningen inte räcker till och organisationen på sjukhuset fallerar.

Kunskapen om dessa farliga ämnen, deras påverkan på kroppen och rätt sorts behandling är avgörande bitar för patientens tillstånd. Akutsjukvården är den del av sjukhuset som först möter patienten, varför ett korrekt och effektivt omhändertagande här är av största vikt för den drabbades tillfrisknande.

Syftet med denna studie var att undersöka beredskapen för kemiska händelser hos akutvårdspersonal på Sahlgrenska Universitetssjukhus i Göteborg.

En tillförlitlig enkät delades ut till sjukvårdspersonal på fyra akutvårdsavdelningar, med frågor angående kunskap om farliga ämnen och hur beredskapen såg ut om en kemisk händelse skulle inträffa. Denna enkät var även underlag för en liknande studie som gjordes förra året i Israel, Beer-Sheva.

Resultatet visade att kunskapen och beredskapen för kemiska händelser och kemisk krigsföring på Sahlgrenska Universitetssjukhus var låg. Ett starkt samband mellan sjukvårdspersonal som deltagit i utbildning inom detta område och en högre kunskapsnivå visades. I studien fanns även ett tydligt samband mellan en högre kunskapsnivå hos sjukvårdspersonal och en högre villighet att komma till arbetet under en period av krigsföring med farliga ämnen.

Dessa resultat visar att träning och utbildning ökar akutvårdspersonalens beredskap för kemiska händelser, varför denna studie hoppas kunna uppmana sjukvårdsledningen att erbjuda sin personal utbildning för att fördjupa sin kunskap och beredskap inom detta viktiga område, samt hoppas denna studie kunnat ha ökat intresset hos sjukvårdspersonalen att förbereda sig inför kemiska händelser.

Acknowledgement

Thanks to all the participants and directors of the emergency hospital units of Gothenburg, who made this research possible. Thanks to the supervisors Amir Khorram-Manesh and Bruria Adini Wiesel for your valuable guidance and helpfulness. Thanks to Johan Aremyr for your great help and useful knowledge. Thanks to PKMC for letting the main author conduct this project in cooperation with you and for giving the opportunity to participate in your appreciated courses. Thanks to Emma and Malin for your daily encouragement this semester. Thanks to Tomas for your constant support and inspiration.

References

1. Szinicz L. History of chemical and biological warfare agents. Toxicology. 2005;214(3):167-81.

2. Hermelin J. Kemiska olyckor : katastrofmedicin. Stockholm: Huvudavd. 5, FOA; 1984.

3. Lennquist S. Katastrofmedicin. Stockholm: Liber; 2009.

4. Informed. **R**-PPS. Chemical Threats http://www.ready.gov/chemical-threats [updated 09/19/201320140303].

5. Zilker T. Medical management of incidents with chemical warfare agents. Toxicology. 2005;214(3):221-31.

6. Kenar L, Karayilanoglu T. Medical preparedness against chemical and biological incidents for the NATO Summit in Istanbul and lessons learned. Prehospital and disaster medicine. 2006;21(4):268-71.

7. LänsstyrelsenDaniel Gillesén RS. Fortsatt utveckling inom CBRNE-området i Västra Götalands län. Länsstyrelsen i Västra Götalands län, enheten för skydd och säkerhet. 2013.

8. Ulf Andersson SA. Behandlingsanvisningar vid händelser med kemiska ämnen. Prehospitalt och Katstrofmedicinskt Centrum, Västra Götalandsregionen; 2011 Jan.

9. Cohle SD, Thompson W, Eisenga BH, Cottingham SL. Unexpected death due to chloramine toxicity in a woman with a brain tumor. Forensic science international. 2001;124(2-3):137-9.

10. Hagby M, Goldberg A, Becker S, Schwartz D, Bar-Dayan Y. Health implications of radiological terrorism: Perspectives from Israel. Journal of emergencies, trauma, and shock. 2009;2(2):117-23.

11. Ganesan K, Raza SK, Vijayaraghavan R. Chemical warfare agents. Journal of pharmacy & bioallied sciences. 2010;2(3):166-78.

12. Försvarsmakten (total försvarets skyddscentrum) K, FOI. Kemiska stridsmedel, beskrivningar Toxiska ämnen C-bibliotek Faktasamling CBRN http://www.faktasamlingcbrn.foi.se/filer/c_sidor/2/1.html [updated 2008-12-1920140303].

13. Utrikesdepartementet. Konventionen mot kemiska vapen (CWC) 2009-06-172009 [updated 2014-08-25]. Available from: http://www.regeringen.se/sb/d/12026.

14. Regional katastrofmedicinsk plan för Västra Götalandsregionen [Internet]. 2011.

15. Joob B, Wiwanitkit V. 2011 big thai floods: problems in nuclear medicine. World journal of nuclear medicine. 2014;13(1):71.

16. Walsh L, Zhang W, Shore RE, Auvinen A, Laurier D, Wakeford R, et al. A Framework for Estimating Radiation-Related Cancer Risks in Japan from the 2011 Fukushima Nuclear Accident. Radiation research. 2014.

17. Adini B, Peleg K. On constant alert: lessons to be learned from Israel's emergency response to mass-casualty terrorism incidents. Health affairs (Project Hope). 2013;32(12):2179-85.

18. Regeringskansliet. Lag (2006:544) om kommuners och landstings åtgärder inför och vid extraordinära händelser i fredstid och höjd beredskap Svensk författningssamling 2006:544, : Sveriges Riksdag; 2006 [2014-10-01]. Available from: http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-2006544-om-kommuners-oc_sfs-2006-544/.

19. Persson A. Farliga kemiska ämnen i containrar (Heldagsseminarium 15maj): Karolinska Institutet; 2014 [2014-03-18]. Available from: http://ki.se/imm/heldagsseminarium-farliga-kemiska-amnen-i-containrar-15-maj.

20. SPBI. Petrokemiska industrins miljöpåverkan: Svenska Petroleum & Biodrivmedel institutet. Available from: http://spbi.se/miljoarbete/oljeprodukters-miljopaverkan/petrokemiska-industrins-miljopaverkan/.

21. Säkerhetspolisen. Förhöjt terrorhot mot Sverige. Säkerhetspolisens årsbok 2010. 2010:26.

22. Klima DA, Seiler SH, Peterson JB, Christmas AB, Green JM, Fleming G, et al. Full-scale regional exercises: closing the gaps in disaster preparedness. The journal of trauma and acute care surgery. 2012;73(3):592-7; discussion 7-8.

23. Socialstyrelsen. Katastrofmedicinsk beredskap Socialstyrelsens författningssamling. 2013;SOSFS 2013:22:12.

24. WHO. Public health response to biological and chemical weapons, WHO guidance -2nd ed. World Health Organization. 1970, 2004.

25. Reilly M, Markenson DS. Education and training of hospital workers: who are essential personnel during a disaster? Prehospital and disaster medicine. 2009;24(3):239-45.

26. Djalali A, Ardalan A, Ohlen G, Ingrassia PL, Corte FD, Castren M, et al. Nonstructural Safety of Hospitals for Disasters: A Comparison Between Two Capital Cities. Disaster medicine and public health preparedness. 2014:1-6.

27. Bo Brismar KE, Bengt Linder. DISASTER MEDICINE IN EUROPE – ORGANISATION

AND TRENDS. 2001.

28. Bistaraki A, Waddington K, Galanis P. The effectiveness of a disaster training programme for healthcare workers in Greece. International nursing review. 2011;58(3):341-6.

29. Corrigan E, Samrasinghe I. Disaster preparedness in an Australian urban trauma center: staff knowledge and perceptions. Prehospital and disaster medicine. 2012;27(5):432-8.

30. Rokach A, Cohen R, Shapira N, Einav S, Mandibura A, Bar-Dayan Y. Preparedness for anthrax attack: the effect of knowledge on the willingness to treat patients. Disasters. 2010;34(3):637-43.

31. Jasper E, Berg K, Reid M, Gomella P, Weber D, Schaeffer A, et al. Disaster preparedness: what training do our interns receive during medical school? American journal of medical quality : the official journal of the American College of Medical Quality. 2013;28(5):407-13.

32. Waeckerle JF, Seamans S, Whiteside M, Pons PT, White S, Burstein JL, et al. Executive summary: developing objectives, content, and competencies for the training of emergency medical technicians, emergency physicians, and emergency nurses to care for casualties resulting from nuclear, biological, or chemical incidents. Annals of emergency medicine. 2001;37(6):587-601.

33. Pemberton J, Rambaran M, Cameron BH. Evaluating the long-term impact of the Trauma Team Training course in Guyana: an explanatory mixed-methods approach. American journal of surgery. 2013;205(2):119-24.

34. Sharma M. Chemical, biological, radiological and nuclear training issues in India: A fresh perspective. Journal of pharmacy & bioallied sciences. 2010;2(3):275-80.

35. Burkle FM, Jr. The development of multidisciplinary core competencies: the first step in the professionalization of disaster medicine and public health preparedness on a global scale. Disaster medicine and public health preparedness. 2012;6(1):10-2.

36. Capella J, Smith S, Philp A, Putnam T, Gilbert C, Fry W, et al. Teamwork training improves the clinical care of trauma patients. Journal of surgical education. 2010;67(6):439-43.

37. Rubinshtein R, Robenshtok E, Eisenkraft A, Vidan A, Hourvitz A. Training Israeli medical personnel to treat casualties of nuclear, biologic and chemical warfare. The Israel Medical Association journal : IMAJ. 2002;4(7):545-8.

38. Vardi A, Levin I, Berkenstadt H, Hourvitz A, Eisenkraft A, Cohen A, et al. Simulation-based training of medical teams to manage chemical warfare casualties. The Israel Medical Association journal : IMAJ. 2002;4(7):540-4.

Appendix A: Madar R,. Effectivness of training & drills for hospital´s staff on

management of a chemical warfare incident. Master's thesis, Ben-Gurion University of the Negev. Oct 2013.

Appendix A: Questionnaire

Greetings,

The following anonymous questionnaire aims to evaluate knowledge, perceptions, and willingness to report to work among hospital personnel in a chemical warfare event.

The data gathered will be used solely for research purposes and improvement of emergency preparation.

We sincerely thank you for your response and cooperation.

The research team

The questionnaire is intended equally for both females and males

Part A – Background

1. **Gender**: 1) Male 2) Female
2. **Year of birth**: |_1_|_9_|___|___|
3. **Family Status**: 1- Single 2- Married 3- Divorced/Widowed 4- Other
4. **Number of children residing at home:** |___|___|
5. **What is your main profession (occupation)?**

   A. □ Physician B. □ Nurse C. □ Para-medical profession D. □ Paramedic

   E. □ Management and Maintenance F. □ Hospital Management G. □ Other
6. **Hospital in which you are employed: _____**
7. **The main department in which you work? (Please circle)**

   1. Emergency Room
   2. Hospitalization ward
   3. Pediatric Wing
   4. Intensive Care
   5. Ambulatory Clinics
   6. Operating Rooms
   7. Imaging
   8. Laboratories
   9. Pharmacy
   10. Management & administration
   11. Logistics
   12. Other
8. **The year of commencing work in the current hospital?** |__|__|__|__|

9. The year of commencing work in the current position ? |__|__|__|__|

10. What items from the following list are currently available in your residency? (more than one answer can be marked)

A. A bomb shelter or Residential Secure Space

B. Food and water to be used in an emergency

C. Equipment for sealing and protection of infrastructure

D. A medicine kit and first aid equipment

E. I don't have any of the above items at my disposal

11. Please mark the appropriate answer for each question

		Yes	No	Don't know/ not relevant
A.	Do you have a **personal Nuclear, Biological, Chemical (CBRNe) mask** in your possession?			
B.	Is there an intact **CBRNe mask** for each of your household family members?			
C.	[redacted]			
D.				
E.	Do you have a **defined role** in an admitting/ treatment site for CBRNe victims?			

12. In case you have a defined role in the admitting site for chemical warfare (CW) victims, what characterizes your position?

A. Manager or assistant manager of the site

B. A layman

C. I don't have a defined position

13. Please indicate the appropriate answer for each question:

		Yes, in the past two years	Yes, over two years ago	Never	I don't know or don't remember
A.	Have you participated in any **CW training program**?				
B.	Have you participated in the past in an **exercise** simulating a CW event?				

14. Have you participated in any activities involving preparation for a CW event in the course of the last year? If so, which ones? (you can mark more than one answer)

A. Seminars, lectures, workshops on the subject of CW preparedness

B. Self-learning through the internet or other types of computer learning

C. Reading materials

D. Other _____

E. I have not participated in any relevant activities

15. To what extent have you **been exposed to information relating to CW** through each one of the following means, in the course of the past three years?

		To a very large extent 5	To a large extent 4	To a medium extent 3	To a small extent 2	Not at all 1	Not relevant 0
A.	Television						
B.	Internet						
C.	Newspaper						
D.	Radio						
E.	Conversations with peers						
F.	Lectures/ seminars						
G.	Scientific articles						
H.	Ministry of Health's / hospital's standard operating procedures						

Part B – Feelings and Perceptions

16. Your perception of your role in a chemical warfare event:

		To a very large extent 5	To a large extent 4	To a medium extent 3	To a small extent 2	Not at all 1	Not relevant 0
A.	To what extent do you estimate that **your role is vital** in managing this event?						
B.	To what extent do you believe that **the hospital** is prepared to provide an effective response to an event involving a CW?						
C.	How well are you familiar with **your role** in the hospital during a CW event?						

17. Your familiarity with the means of protection against a CW event:

		To a very large extent 5	To a large extent 4	To a medium extent 3	To a small extent 2	Not at all 1	Not relevant 0
A.	How **proficient** are you **in the utilization** of protection means used in a CW event?						
B.	To what extent, in your opinion, will **the protection means prevent your being contaminated** in a CW event?						

18. To what extent, in your opinion, will the following factors influence your decision to report to work in a CW event?

		To a very large extent 5	To a large extent 4	To a medium extent 3	To a small extent 2	Not at all 1	Not relevant 0
A.	The concern for **my health**						
B.	The concern for my **family members'** welfare						
C.	The need to care for an **injured family member**						
D.	My **professional obligation** to provide care for patients						
E.	**The fear of losing my place of work** if I will not report to duty						
F.	**The hospital's arrangement for my children**						
G.	**Organized transportation** to and from my place of work						
H.	**Allocation of protective means** (a chemical warfare protection kit)						
I.	The knowledge that the way to the hospital is **not contaminated by chemical warfare agent**						

19. To what extent, in your opinin, can your family adequately function when you are called to report to work during a CW event?

A. To a very large extent
B. To a large extent
C. To a medium extent
D. To a small extent

E. Not at all

F. Not relevant

20. Willingness to report to work during a confrontation period in which rockets with conventional warheads are launched:

		Yes, without a doubt 5	Probably 4	I can't decide 3	The chances are low 2	There is no chance 1	Not relevant 0
A.	Will you **report to work** during a confrontation period in which conventional rockets are launched?						
B.	In your opinion, will your **colleagues at work** report to work during a confrontation period in which conventional rockets are launched?						

21. Willingness to report to work and treat patients during a confrontation period in which chemical warfare agents are used:

		Yes, without a doubt 5	Probably 4	I can't decide 3	The chances are low 2	There is no chance 1	Not relevant 0
A.	Will **you report to work** during a confrontation period involving CW?						
B.	In your opinion, will your **colleagues at work** report to work during a confrontation period involving CW agents?						
C.	Will you **treat a patient** who has chemical agents on his body, and who has not been adequately decontaminated?						

D.	In your opinion, **will your colleagues at work treat a patient** who has chemical agents on his body and who has not been adequately decontaminated?						

22. Please indicate to what extent you feel the following <u>feelings</u> regarding your work as a healthcare worker in a CW event:

		To a very large extent 5	To a large extent 4	To a medium extent 3	To a small extent 2	Not at all 1	Not relevant 0
A.	Concern						
B.	Fear						
C.	Anxiety						
D.	Pressure						
E.	Sadness						
F.	Danger						
G.	Optimism						
H.	Satisfaction						
I.	Pleasure						

23. Please indicate your evaluation of your knowledge and competencies in an event involving CW agents:

		To a very large extent 5	To a large extent 4	To a medium extent 3	To a small extent 2	Not at all 1	Not relevant 0
A.	To what extent do you feel that you **have sufficient knowledge** available to treat CW casualties?						
B.	To what extent do you feel that you will **be able to respond to questions** that might be asked by patients/ their family members on the subject?						
C.	To what extent do you **feel secure**						

	with being at work during an event involving a CW?						
D.	To what extent do **you value your ability** as a caregiver to treat patients who are injured as a result of a CW event?						

Part C – Knowledge

24. What is the yellow line in a chemical warfare event?

A. A line separating the admitting sites for immediate versus ambulatory patients.

B. A line separating contaminated versus decontaminated patients.

C. A line separating the intubation site from other treatment sites.

D. A mark for ambulances indicating where to unload the victims.

E. I don't know

25. Combined victims are:

A. Injured people who have a conventional wound from exposure to chemical warfare agents

B. A mixture of pediatric and adult casualties.

C. A mixture of immediate and ambulatory casualties.

D. All of the above.

E. I don't know

26. What is the Aging Phenomenon that occurs with exposure to CW?

A. The period from exposure to the nerve gas until arrival at the hospital.

B. Bonding of the CW to Acetylcholinesterase is irreversible and cannot be reversed by medical care

C. The aging of nerve cells following damage from nerve gas.

D. All of the above.

E. I don't know

27. What is false regarding the injury mechanism of nerves following exposure to nerve gases?

A. It damages the central nervous system

B. It increases stimulation of secretion glands

C. It irreversibly inhibits the enzyme Acetylcholinesterase

D. It reversibly inhibits the enzyme Acetylcholinesterase

E. I don't know

28. Which medicine is not appropriate for treating patients exposed to chemical warfare agents?

A. Atropine

B. Toxogonin

C. Digoxin

D. Diazepam

29. What are the clinical symptoms of organic phosphorous poisoning?

A. Narrow pupils

B. Increased secretions, tears, and diarrhea

C. Bradycardia

D. All of the answers are correct.

E. I don't know

30. The signs of atropine poisoning are:

A. Blurred vision, dry mouth and mucous membranes, enlarged pupils and tachycardia.

B. Increased urination until loss of control, moist skin, and low body temperature.

C. Increased urination, narrow pupils, slow heartbeat, and increased secretions.

D. None of the answers are correct.

E. I don't know

32. For each of the following, please mark for each statement whether it's correct or incorrect

	Statement	Correct	Incorrect	I don't know
A.	Team protective gear includes: Protective suit, double gloves, a NBC mask and overshoes			
B.	A critical casualty will be transferred to a treatment site without decontamination			
C.	The treatment of a combined casualty will focus on his conventional injury			
D.	Triage is performed prior to decontamination to classify casualties to immediate, ambulatory and combined casualties			
E.	Dry decontamination using Fuller powder is intended only for combined casualties who cannot undergo wet decontamination			
F.	In a prolonged incident, removing the protective clothing in order to eat and drink is allowed in the decontaminated site			
G.	After undressing the casualties, team members do not need to wear any protective gear other than gloves			
H.	The personal protective kit can be hosed with water for cooling purposes			

We will be pleased to receive any comment/enlightenment pertaining to the knowledge and perceptions of the hospital staff involved in treating casualties during a chemical warfare event

_____

We thank you sincerely for your time and attention and your contribution for this important study.

Appendix B: The complete result of the questionnaire

Part A –Background

1. Gender:
-Male: 37%
-Female: 63%

2. Age group:
21-30: 37%
31-40: 28%
41-50: 14%
51-66: 21%

3. Family status:
-Single: 19%
-Married 51%
-Other: 28%

4. Number of children residing at home:
0: 67%
1: 23%
2: 9%
3: 2%

5. What is your main profession (occupation)?
-Physician: 23%
-Nurse: 68%
-Management and Maintenance: 2%
-Other: 7% (assistant nurse)

6. Hospital in which you are employed:
-Emergency Room, ÖS: 23%
-Medical emergency unit, MAVA/Avd 90, SS: 47%
-Surgery Trauma unit, Avd 137, SS:11%
-Emergency Room, MS:19%

7. The main department in which you work?
-Emergency Room: 44%
-Hospitilization ward: 53%
-Management & administration: 2%
-Other: 2%

8. The year of commencing work in the current hospital?
0-2 year: 39%
3-5 year: 14%
6-10 year: 16%
11-20 year: 12%
21-highest year: 18%
-999: 2%

9. The year of commencing work in the current position?
0-2 year: 42%
3-5 year: 18%
6-10 year: 19%
11-20 year: 5%
21-highest year: 14%
-999: 2%

10. What items from the following list are currently available in your residency? (more than one answer can be marked)

-A bomb shelter or Residential Secure Space: 28,1%
-Food and water to be used in an emergency: 29,8%
-Equipment for sealing and protection of infrastructure: 5,3%
-A medicine kit and first aid equipment: 84%
-I don´t have any of the above items at my disposal: 12.3%

11A. Do you have a personal Nuclear, Biological, Chemical (CBRNe) mask in your possession?
-Yes: 4%
-No: 84%
-Don´t know/ not relevant 12%

11B. Is there an intact CBRNe mask for each of your household family members?
-Yes: 0%
-No: 93%
-Don´t know/ not relevant: 7%

(11C-D: excluded from the Swedish questionnaire.)

11E. Do you have a defined role in an admitting/ treatment site for CBRNe victims?
-Yes: 19%
-No: 63%
-Don´t know/ not relevant: 18%

12. In case you have a defined role in the admitting site for chemical warfare (CW) victims, what characterizes your position?
-Manager or assistant manager of the site: 9%
-I don´t have a defined position: 77%
-999: 14%

13A. Have you participated in any CW training program?
-Yes, in the he past two years: 14%
-Yes, over two years ago: 11%
-Never: 72%
-I don´t know or don´t remember: 2%
-999: 2%

13B. Have you participated in the past in an exercise simulating a CW event?
-Yes, in the past two years: 4%
-Yes, over two years ago: 12%
-Never: 81%
-I don´t know or don´t remember: 2%
-999: 2%

14. Have you participated in any activities involving preparation for a CW event in the course of the last year? If so, which ones? (you can mark more than one answer)
-Seminars, lectures, workshops on the subject of CW preparedness: 13%
-Reading materials: 6%
-Other: 2%
-No: 77%
-999: 5%

15. To what extent have you been exposed to information relating to CW through each one of the following means, in the course of the past three years?

A: Television
-Not relevant: 7%
-Not at all: 35%
-To a small extent: 28%
-To a medium extent: 18%
-To a large extent: 9%
-To a very large extent: 2%

-999: 2%

B. Internet
-Not relevant: 9%
-Not at all: 39%
-To a small extent: 33%
-To a medium extent: 12%
-To a large extent: 5%
-999: 2%

C. Newspaper:
-Not relevant: 11%
-Not at all: 35%
-To a small extent: 33%
-To a medium extent: 11%
-To a large extent: 7%
-To a very large extent: 2%
-999: 2%

D. Radio:
-Not relevant: 9%
-Not at all: 53%
-To a small extent: 23%
-To a medium extent: 23%
-To a large extent: 4%
-999: 4%

E: Conversation with peers
-Not relevant: 7%
-Not at all: 58%
-To a small extent: 18%
-To a medium extent: 9%
-To a very large extent: 2%
-999: 7%

F: Lectures/ seminars
-Not relevant: 11%
-Not at all: 65%
-To a small extent: 12%
-To a medium extent: 5%
-To a large extent: 2%
-To a very large extent: 2%
-999: 4%

G: Scientific articles
-Not relevant: 11%
-Not at all: 72%
-To a small extent: 12%
-999: 5%

H: Ministry of Health's / hospital's standard operating procedures
-Not relevant: 9%
-Not at all: 68%
-To a small extent: 11%
-To a medium extent: 4%
-To a large extent: 4%
-999: 5%

Part B –Feelings and Perceptions

16. Your perception of your role in a chemical warfare event:

A. To what extent do you estimate that your role is vital in managing this event?
-Not relevant: 5%
-Not at all: 25%
-To a small extent: 19%
-To a medium extent: 21%
-To a large extent: 16%
-To a very large extent: 12%
-999: 2%

B. To what extent do you believe that the hospital is prepared to provide an effective response to an event involving a CW?
-Not relevant: 5%
-Not at all: 18%
-To a small extent: 16%
-To a medium extent: 32%
-To a large extent: 26%
-To a very large extent: 2%
-999: 2%

C. How well are you familiar with your role in the hospital during a CW event?
-Not relevant: 14%
-Not at all: 40%
-To a small extent: 26%
-To a medium extent: 9%
-To a large extent: 5%
-To a very large extent: 4%
-999: 2%

17. Your familiarity with the means of protection against a CW event:

A. How proficient are you in the utilization of protection means used in a CW event?
-Not relevant: 5%
-Not at all: 49%
-To a small extent: 28%
-To a medium extent: 11%
-To a large extent: 4%
-To a very large extent: 2%
-999:2%

B. To what extent, in your opinion, will the protection means prevent your being contaminated in a CW event?
-Not relevant: 9%
-Not at all: 32%
-To a small extent: 18%
-To a medium extent: 16%
-To a large extent: 19%
-To a very large extent: 2%
-999: 5%

18. To what extent, in your opinion, will the following factors influence your decision to report to work in a CW event?

A. The concern for my health
-Not relevant: 9%
-Not at all: 4%
-To a small extent: 14%
-To a medium extent: 16%

-To a large extent: 23%
-To a very large extent: 33%
-999: 2%

B. The concern for my family members' welfare
-Not relevant: 11%
-Not at all: 4%
-To a small extent: 11%
-To a medium extent: 14%
-To a large extent: 21%
-To a very large extent: 39%
-999: 2%

C. The need to care for an injured family member
-Not relevant: 11%
-Not at all: 5%
-To a small extent: 5%
-To a medium extent: 16%
-To a large extent: 21%
-To a very large extent: 39%
-999:4%

D. My professional obligation to provide care for patients
-Not relevant: 9%
-Not at all: 5%
-To a small extent: 4%
-To a medium extent: 21%
-To a large extent: 32%
-To a very large extent: 28%
-999: 2%

E. The fear of losing my place of work if I will not report to duty
-Not relevant: 14%
-Not at all: 32%
-To a small extent: 35%
-To a medium extent: 11%
-To a large extent: 4%
-To a very large extent: 4%
-999: 2%

F. The hospital's arrangement for my children
-Not relevant: 49%
-Not at all: 11%
-To a small extent: 7%
-To a medium extent: 12%
-To a large extent: 5%
-To a very large extent: 14%
-999: 2%

G. Organized transportation to and from my place of work
-Not relevant: 28%
-Not at all: 21%
-To a small extent: 19%
-To a medium extent: 19%
-To a large extent: 5%
-To a very large extent: 5%
-999: 2%

H. Allocation of protective means (a chemical warfare protection kit)
-Not relevant: 23%
-Not at all: 9%

-To a small extent: 4%
-To a medium extent: 19%
-To a large extent: 12%
-To a very large extent: 32%
-999: 2%

I. The knowledge that the way to the hospital is not contaminated by chemical warfare agent
-Not relevant: 14%
-Not at all: 4%
-To a small extent: 12%
-To a medium extent: 16%
-To a large extent: 21%
-To a very large extent: 32%
-999: 2%

19. To what extent, in your opinion, can your family adequately function when you are called to report to work during a CW event?
-Not relevant: 12%
-To a small extent: 12%
-To a medium extent: 5%
-To a large extent: 32%
-To a very large extent: 35%
-999: 4%

20. Willingness to report to work during a confrontation period in which rockets with conventional warheads are launched:

A. Will you report to work during a confrontation period in which conventional rockets are launched?
-Yes, without a doubt:16%
-Probably:23%
-I can´t decide:25%
-The chances are low:14%
-There is no chance: 9%
-Not relevant: 12%
-999: 2%

B. In your opinion, will your colleagues at work report to work during a confrontation period in which conventional rockets are launched?
-Yes, without a doubt: 7%
-Probably: 32%
-I can´t decide: 23%
-The chances are low: 18%
-There is no chance: 5%
-Not relevant:14%
-999: 2%

21. Willingness to report to work and treat patients during a confrontation period in which chemical warfare agents are used:

A. Will you report to work during a confrontation period involving CW?
-Yes, without a doubt: 18%
-Probably: 25%
-I can´t decide: 23%
-The chances are low: 18%
-There is no chance: 7%
-Not relevant: 9%
-999: 2%

B. In your opinion, will your colleagues at work report to work during a confrontation period involving CW agents?

-Yes, without a doubt: 9%
-Probably: 23%
-I can´t decide: 26%
-The chances are low: 25%
-There is no chance: 7%
-Not relevant: 9%
-999: 2%

C. Will you treat a patient who has chemical agents on his body, and who has not been adequately decontaminated?
-Yes, without a doubt: 16%
-Probably: 18%
-I can´t decide: 33%
-The chances are low: 11%
-There is no chance: 18%
-Not relevant: 4%
-999: 2%

D. In your opinion, will your colleagues at work treat a patient who has chemical agents on his body and who has not been adequately decontaminated?
-Yes, without a doubt: 12%
-Probably: 19%
-I can´t decide: 32%
-The chances are low: 14%
-There is no chance: 16%
-Not relevant: 5%
-999: 2%

22. Please indicate to what extent you feel the following feelings regarding your work as a healthcare worker in a CW event:

Concern:
-Not relevant: 7%
-Not at all: 2%
-To a medium extent: 16%
-To a large extent: 23%
-To a very large extent: 51%
-999: 2%

Fear:
-Not relevant: 9%
-To a small extent: 2%
-To a medium extent: 18%
-To a large extent: 32%
-To a very large extent: 39%
-999: 2%

Anxiety:
-Not relevant: 9%
-Not at all: 2%
-To a small extent: 4%
-To a medium extent: 25%
-To a large extent: 21%
-To a very large extent: 37%
-999: 4%

Pressure:
-Not relevant: 9%
-To a small extent: 2%
-To a medium extent: 21%
-To a large extent: 28%

-To a very large extent: 39%
-999: 2%

Sadness:
-Not relevant: 7%
-Not at all: 7%
-To a small extent: 5%
-To a medium extent: 18%
-To a large extent: 18%
-To a very large extent: 44%
-999: 2%

Danger:
-Not relevant: 7%
-Not at all: 2%
-To a small extent: 4%
-To a medium extent: 14%
-To a large extent: 26%
-To a very large extent: 46%
-999: 2%

Optimism:
-Not relevant: 16%
-Not at all: 23%
-To a small extent: 21%
-To a medium extent: 23%
-To a large extent: 12%
-To a very large extent: 4%
-999: 2%

Satisfaction:
-Not relevant: 21%
-Not at all: 28%
-To a small extent: 11%
-To a medium extent: 30%
-To a large extent: 7%
-To a very large extent: 2%
-999: 2%

Pleasure:
-Not relevant: 25%
-Not at all: 46%
-To a small extent: 12%
-To a medium extent: 12%
-To a large extent: 4%
-999: 2%

23. Please indicate your evaluation of your knowledge and competencies in an event involving CW agents:

A. To what extent do you feel that you have sufficient knowledge available to treat CW casualties?
-Not relevant: 5%
-Not at all: 48%
-To a small extent: 26%
-To a medium extent: 14%
-To a large extent: 5%
-999: 2%

B. To what extent do you feel that you will be able to respond to questions that might be asked by patients/ their family members on the subject?
-Not relevant: 5%

-Not at all: 40%
-To a small extent: 40%
-To a medium extent: 9%
-To a large extent: 4%
-999: 2%

C. To what extent do you feel secure with being at work during an event involving a CW?
-Not relevant: 7%
-Not at all: 40%
-To a small extent: 21%
-To a medium extent: 21%
-To a large extent: 5%
-To a very large extent: 2%
-999: 4%

D. To what extent do you value your ability as a caregiver to treat patients who are injured as a result of a CW event?
-Not relevant: 5%
-Not at all: 18%
-To a small extent: 32%
-To a medium extent: 14%
-To a large extent: 23%
-To a very large extent: 2%
-999: 7%

Part C –Knowledge

(In some question more than one answer is answered. Correct answer is marked with yellow.)

24. What is the yellow line in a chemical warfare event?
-A line separating the admitting sites for immediate versus ambulatory patients: 0%
-A line separating contaminated versus decontaminated patients: 21%
-A line separating the intubation site from other treatment sites: 2%
-A mark for ambulances indicating where to unload the victims: 0%
-I don't know: 74%
-999: 4%

25. Combined victims are:
-Injured people who have a conventional wound from exposure to chemical warfare agents: 19%
-A mixture of pediatric and adult casualties: 4%
-A mixture of immediate and ambulatory casualties: 2%
-All of the above: 19%
-I don't know: 58%
-999: 4%

26. What is the Aging Phenomenon that occurs with exposure to CW?
-The period from exposure to the nerve gas until arrival at the hospital: 4%
-Bonding of the CW to Acetylcholinesterase is irreversible and cannot be reversed by medical care: 2%
-The aging of nerve cells following damage from nerve gas: 7%
-All of the above: 2%
- I don't know: 83%
-999: 4%

27. What is false regarding the injury mechanism of nerves following exposure to nerve gases?
-It damages the central nervous system: 9%
-It increases stimulation of secretion glands: 14%
-It irreversibly inhibits the enzyme Acetylcholinesterase: 11%
-It reversibly inhibits the enzyme Acetylcholinesterase: 11%
-I don't know: 54%
-999: 5%

28. Which medicine is not appropriate for treating patients exposed to chemical warfare agents?

-Atropine: 16%
-Toxogonin: 5%
-Digoxin: 32%
-Diazepam: 18%
-999: 30%

29. What are the clinical symptoms of organic phosphorous poisoning?

-Narrow pupils: 0%
-Increased secretions, tears, and diarrhea: 14%
-Bradycardia: 0%
-All of the answers are correct: 19%
-I don't know: 58%
-999: 9%

30. The signs of atropine poisoning are:

-Blurred vision, dry mouth and mucous membranes, enlarged pupils and tachycardia: 55%
-Increased urination until loss of control, moist skin, and low body temperature: 11%
-Increased urination, narrow pupils, slow heartbeat, and increased secretions: 2%
-None of the answers are correct: 0%
-I don't know: 32%
-999: 11%

32. For each of the following, please mark for each statement whether it's correct or incorrect

A. Team protective gear includes: Protective suit, double gloves, a NBC mask and overshoes
-Correct: 47%
-Incorrect: 0%
-I don´t know: 46%
-999: 7%

B. A critical casualty will be transferred to a treatment site without decontamination
-Correct: 5%
-Incorrect: 40%
-I don´t know: 47%
-999: 7%

C. The treatment of a combined casualty will focus on his conventional injury
-Correct: 4%
-Incorrect: 21%
-I don´t know: 67%
-999: 7%

D. Triage is performed prior to decontamination to classify casualties to immediate, ambulatory and combined casualties
-Correct: 30%
-Incorrect: 23%
-I don´t know: 40%
-999: 7%

E. Dry decontamination using Fuller powder is intended only for combined casualties who cannot undergo wet decontamination
-Correct: 2%
-Incorrect: 7%
-I don´t know: 84%
-999: 7%

F. In a prolonged incident, removing the protective clothing in order to eat and drink is allowed in the decontaminated site
-Correct: 12%
-Incorrect: 28%

-I don´t know: 53%
-999: 7%

G. After undressing the casualties, team members do not need to wear any protective gear other than gloves
-Correct: 0%
-Incorrect: 44%
-I don´t know: 49%
-999: 7%

H. The personal protective kit can be hosed with water for cooling purposes
-Correct: 9%
-Incorrect: 14%
-I don´t know: 70%
-999: 7%

Freetext:
We will be pleased to receive any comment/enlightenment pertaining to the knowledge and perceptions of the hospital staff involved in treating casualties during a chemical warfare event:

”I feel I need more information & practise from my work suppliers!”
“It´s very hard to answer this question because we are not familiar to CW at all!!”