

Chemical Incidents Impact in the Psychological Risks of Firefighters. An Analysis of the Findings for the Stress Factors in the Personnel of Hellenic Fire Corps

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Abstract—Nowadays, chemical incidents are very common and they tend to increase worldwide. Any person or emergency responders that may be harmed by chemicals may also experience severe psychological stress. In the present study, 540 professional firefighter's participants rated and ranked the stressfulness of 17 duty-related incident stressors. Among the findings, 46,70% of firefighters evaluated chemical and biological incidents third in ranking as the most stressful situation among others daily-stressors incidents. Moreover, approximately 88 % of the total of the responders reported that the unpredictable situation, which is a characteristic feature of this type of incidents, evoke to them extreme psychological pressure.

Index Terms— CBRN incidents, First-responders' psychological reactions.

1 INTRODUCTION

Chemical Biological Radiological and Nuclear (CBRN) incidents may release hazardous materials.

They have as initiating event a natural disaster or anthropogenic intervention. In nowadays chemical incidents are very common and there is an increase worldwide, particularly in developing and transition economies. Chemical substances contribute to economic development because their production has commercial value. Therefore, many times there is a pressure by industries, governments' agreement with other countries for chemical extractions, increasing thus the likelihood for a chemical incident [1]. "Chemical incident" is defined as a situation in which people are vulnerable and exposed to potential chemical hazards. Any person or emergency responder may be harmed by chemicals materials through the mechanism of fire, explosion, toxicity and the experience of traumatic events." [1]

Probably a source of firefighters' stress for CBRN incidents is related to the unclear nature of most chemical and biological substances [2] and the imperfect knowledge of the chemical hazardous materials' effects [3] especially in the case they are awaiting the results of blood test, after the event, chemicals

fear, uncertainty, helplessness and loss of control. However, because of the non visible and tiseable properties of many chemical (e. g. visible gas cloud, biting smell, skin irritations, breathing problems , firefighters ranked chemical incident less stressful than radiological or biological incidents [3].

The non-specified health-related effects of chemical incidents, the uncertain decisions they have to make when firefighters take part in this type of operation, the unpredictable behavior of the crowd are included to the conditions that provoke negative psychological responses to them. [3, 2]. The risk factor is bonded with the occupation of first-responders and especially with the challenges they face in front of a CBRN incident.

The occupation of Firefighter is one of the most dangerous and hazardous jobs worldwide and they have accepted that the success of an operation it may require a degree of personal risk. Moreover, they have to to insecure the safety of others and very often witness victims' pain, injury and strong feelings. [4]. Firefighters may face the challenge to confront with the unpredictable behavior of worried people who may not are in the mental condition to realize that they need to stay away from the danger zone because there is a risk of contamination for a longer time stay [3]

When chemical materials released, firefighters put themselves in a greater danger of being contaminated. The proximity with the exposed place with chemical hazard materials or the remain to this place for a long time may influence negatively the stress they experience in this type of incidents [2]. Other risks related to chemical incident is the demands of a new technology such as how to use the complicated technological equipment that is required.

Moreover, because these missions are technically challenging and not included to daily stressors, firefighters might not be

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viewed as the invisible enemy filling them with feelings of

sufficiently prepared, acting via a familiar emergency plan, feeling thus many times insecure and less confident about the decisions they need to take [5, 6]. Work under Personal protective equipment (PPE) also put a lot of psychological strain on the first responders because it limits communication and orientation. Moreover, firefighters when they are involved in such missions afraid that protective clothing might be damaged. Even how to follow procedures it can be exhausting and extremely stressful [3]. In addition, they need to act under extreme time pressure conditions –because an error or a minor delay can cost the loss of life of someone who is endangered. When fires involve the release of toxic substances, the stress of firefighters becomes exacerbated and the feelings of fear and helplessness are stronger [6]. When first-responders deal with a CBRN they face problems such as inadequacy of protective complexity, lack of familiarity of equipment and procedures or how to wear it [3].

Among the duties of firefighters is the decontamination which includes the removal of the hazard materials from the victims in order to prevent the contamination of the clean areas [1]. Moreover there is evidence that after a chemical incident, firefighters may suffer from secondary contamination [7]. The terrorist attack in 1995 in Tokyo with the use of a chemical agent known as sarin caused low fatalities but 9.9% of responding firefighters faced secondary contamination [8]. Of course priority of Emergency responders is the safety of their relatives, partners and friends. Many times when they have to deal with a CBRN incident they are in a conflict between their role as rescuers and their concern about the well being of their friends and relatives [3]. Moreover, there is an excessive exposure to traumatic and life-threatening situations such as chemical and physical hazards [7, 9]. There is evidence that the exposed people and first responders have concerns or complain about their perceived health status and psychological well being [1, 10].

It is well documented that the firefighters suffer from chronic health diseases. These adverse physical health risks include changes in the genetic, material, respiratory diseases, cancer prostate, as well as melanoma and Hodgkin thyroid, esophageal etc [2, 11]. Chemical incidents not only affect psychologically and mentally the injured victims but also have impact to psychological well-being of uniformed personnel such as the firefighters [3]. Firefighters are exposed to disasters that results in immediate death, severe injuries, and loss of people's property (ie houses) [2, 12].

There negative and severe psychological effect on involved firefighters. Short-term psychological consequences include shock, anxiety, sleep disruptions, feelings of guilt. A study of [2] studied the impact of chemical polyvinyl chloride fire in psychological well-being of responding firefighters in comparison with non-responding firefighters after 5-6 weeks and 22 months of the incident. The results revealed that the involved firefighters demonstrated higher degree of demoralization, specific emotional distress and perceived physical health related risks after the episode. The results showed that the symptoms did not alleviate. Actually the psychological distress was significantly increased over time [12].

In summary, the literature focuses mainly to the exposure of emergency responders to stressful incidents but there are limited studies that have ranked the psychological distress. The primary goal of this investigation was to empirically rank and categorize ratings obtained from a sample of professional Greek fire service personnel for many stressors including chemical incidents.

2 METHODOLOGY

The target population for this study included all firefighting personnel working in the total of 300 fire service stations in Greece. The health and safety direction of national headquarters distributed the questionnaires to fire stations and the chief of each division administrated them to participants, assuring the anonymity of each responders. Questionnaires were completed individually and the duration of the collection of the questionnaires lasted approximately three months. A representative sample of 1060 firefighters from each of the divisions and grades was drawn up.

2.1 Tools of Measurement

Self-reported sources of psychological distress were measured with a 71 item questionnaire. 8 items were chosen as stressors related to chemical incidents (e.g item 7. risk factor, item 15, the unknown and unpredictable risk of operation, item 22, lack of personnel and equipment) . A likert scale 0 to 5 was used. For all items, responders rate how much they agree with the statement (from 0 strongly disagree to 5 strongly agree) with a higher score to indicate greater self-reported psychological distress.

Organizational and incident related operational stresses were measured with a questionnaire selected from a previous study with British Fire Service [13]. The listing included of 17 duty-related incident stressors items/ scenarios includes Items (eg. CBRN, incidents involving death of colleague or a child).

2.2 Sample, Background and Demographic questionnaire

A general information questionnaire, recorded the demographic (age, education, marital status) and professional features (professional rank, years of experience) of the sample of the study. It was formulated by the investigators according to similar questionnaires found in Greek and international literature. The sample was predominantly male (95,19%), with average age 28-38 (56,89%). 63,77% of them were married and 39,60% are officers. Participants reported to have been employed about 10 years on average.

2.3 Statistical analysis

The data analysis was realised with statistical methods of descriptive statistics. The level of statistical importance was fixed equal or smaller of 0,05.

2.4 Ethics

Approval to conduct the study was obtained from the the Direction of Health and Safety of the National Headquarters. The agreement to complete the questionnaire was considered as

consent to the participation in the study. Information was given via text or orally to the inquiring team in relation with the aim of study, the maintenance of anonymity and confidentiality of data, the voluntary attendance and the possibility of interruption any moment.

3 RESULTS AND DISCUSSIONS

According to the findings of the research, approximately one out of three fire fighters supported that the responsibility for citizen’s life quality is a factor that adds psychological pressure to their work. Among the main duties of firefighters when they are involved in CBRN incidents, is the evacuation of the contaminated place from the surrounding crowd for their own safety and the protection of clean areas in order to insecure the health of general population [1,4]. Moreover, pressure behalf of citizens is included among firefighters occupational stress sources. Often when they have to deal with a CBRN mission they have to face the incalculable behavior of the population who do not realize the dangers [2]. More than half of the total responders consider the unpredictable factor (56,90 %) and the risk of the situation (53,20%) as sources of stress (Table 1).

TABLE 1

SOURCES OF OCCUPATIONAL STRESS RELATED TO CBRN INCIDENTS

Factors	Very Stressful	Very much Stressful
Risk factor	25,9%	31,00%
The unknown and unpredictable risk of operations	24,80%	38,40%
The complicated nature and risk of incidents	27,80%	31,00%
Lack of personnel and equipment	27,80%	35,40%
Shortage of specialized colleagues	27,20%	23,50%
Pressure behalf of people	22,80%	25,90%
The responsibility for quality of citizens’ life	22,00%	15,20%
Complicated use of equipment	18,30%	15,60%

Regarding the equipment, 31,90% consider stressful the com-

plexity of equipment and 55,20% the shortage of equipment and expertise. First-responders feel rather unprepared about how to use the protective clothing and to meet the technical demands of the missions [3].

In addition, the listing of 17 duty- related incident stressors items/ scenarios includes Items (eg. CBRN, incidents involving death of colleague or a child), revealed that 21, 50% of the responders consider biological and chemical incidents to be very stressful situations. In ranking, the first three most stressful incidents are those which involves death of injury of colleague (84,80%), the death of a child (88,40%), and CBRN incidents (75,40%). Firefighters evaluate biological or radiological incidents (65,40%) as those that imply a lot of psychological pressure on them while technological/chemical incidents seem to appear lower at stressors’ rankings (48,70%).

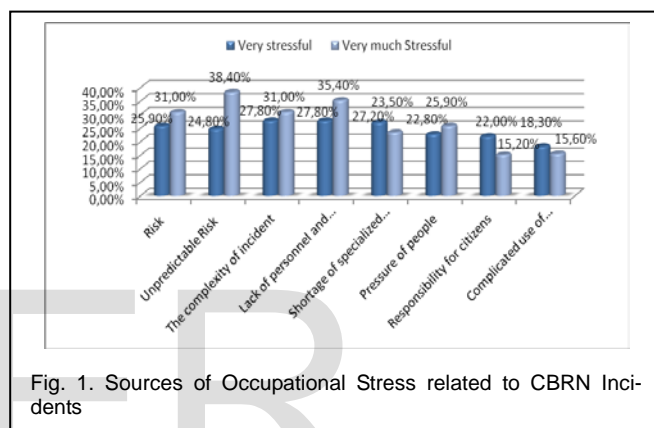


Fig. 1. Sources of Occupational Stress related to CBRN Incidents

TABLE 2

RANKING OF STRESSFULNESS OF DUTY-RELATED INCIDENT STRESSORS

	Very Stressful		Very Much Stressful	
	Num.	%	Num.	%
Unpredictable Situation	181	34,00%	65	12,20%
Potential injury	192	36,40%	118	22,30%
Earthquakes	167	31,40%	132	24,80%
Fire	153	28,90%	65	12,30%
Death of child	125	23,60%	295	55,80%
Injury during duty	191	36,00%	148	27,90%
Incidents with bacillus of anthrax	152	28,70%	247	46,70%
Scene of immediate death	147	27,70%	202	38,10%
Suicide attempt	162	30,50%	124	23,40%
Rescue Operations	147	27,90%	245	46,50%

Technological /chemical incidents	144	27,20%	114	21,50%
Death/ injury of colleague	136	25,70%	313	59,10%

4 CONCLUSION

The stress is a factor that affects not only the health but also the well-being psychological balance of the first-responders such as firefighters. CBRN incidents due to their risky nature are related with negative psychological responses to involved emergency personnel. It is clear that we are in need of a framework agreement to address work-related stress for fire services, generally. Therefore, we propose a framework agreement for action to tackle work-related stress.

It is necessary that this document aims to encouraging the partners of fire services to raise awareness and understanding about the magnitude of the problem and to promote initiatives amongst stakeholders. In order to emphasize the importance of this framework, the fire services in collaboration with health and safety agencies needs to organize a series of seminars where representatives of government entities and fire service unions will discuss various issues related to the causes and effects of stress at the workplace and how the framework can help to minimize these problems.

Accidents at work and occupational diseases in general have a high cost, both in human and financial terms. This is why European Union needed to establish a similar legal framework. Since then, the European Union has continuously powerful strategies for reducing accidents and protection the safety and health of workers and many goals have been achieved. However there is need to establish a more modern and effective legal framework, which will provide workers with better health and safety protection with specific public service activities (the armed forces, the police or certain civil protection services, such as firefighters). At this point we underline that the activity of these services poses the greatest dangers and risks and the present legal framework doesn't even make a special mention; actually it excludes the above groups.

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REFERENCES

[1] *Manual for the public health management of chemical incidents*. World Health Organization. 2009.

[2] J.S. Markowitz, E.M. Gutterman, and B. Link, "Psychological response of firefighters to a chemical fire", *Journal of Human Stress*, vol. 13, pp. 84-93, 2 1987.

[3] C. Schedlich and J. Helmerichs, Federal Office of Civil Protection and Disaster Assistance [BBK] Department of Crisis Management, Section Psychosocial Crisis Management Date: December 2009 / updated March), Bonn 2011.

[4] T.L. Guidotti, "Human factors in firefighting: ergonomic-, cardiopulmonary-, and psychogenic stress-related issues", *Int Arch Occup Environ Health*, vol 64,

pp. 1-12, 1992.

[5] C.E. Hantsch, K.A. Martens, C.E. Stake, T.A. Mikhailov, et. Al. "Out-of-hospital provider participation and support needs for chemical, biological, radiological, or nuclear events?", *Annals of Emergency Medicine* 44, S95, 4 /2004t.

[6] C.P. McMahon, "Phenomenological study of stress and coping in the fire service". M.S. Dissertation. P Presented to the Faculty of the Department of Psychology Our Lady of the Lake University, In Partial Fulfillment of the Requirements", 2010.

[7] R. Beaton and S. Murphy, "Secondary traumatic stress in crisis workers: Research implications". In C. Figley [Ed.], *Compassion fatigue*. New York, Brunner Maze, p. 51-81, 1995 .

[8] D. Baker, "The problem of secondary contamination following chemical agent release", *Critical Care*, vol. 9, pp. 323-324, 2005.

[9] T.L. Guidoni and V.M. Clough, "Occupational health concerns of fire fighting". Occupational Health Program, University of Alberta Faculty of Medicine, Edmonton, Alberta.

[10] B. Manuck, A.L. Kasprovicz and M.F. Muldoon, "Behaviorally-evoked cardiovascular reactivity and hypertension: conceptual issues and potential associations", *Annals of Behavioral Medicine*, vol. 12, pp. 17-29, 1990.

[11] B. Weinhold, "Emergency Responder Health: What Have We Learned from Past Disasters?", *Environmental Health Perspectives*, 118, A346-A350, 8/2010.

[12] J.S. Markowitz, "Long-term psychological distress among chemically exposed firefighters", *Behavioral Medicine*, vol 15, pp. 75-83, 2 /1989.

[13] J. McLeod, D. Cooper, A Study of Stress and Support in the Staffordshire Fire and Rescue Service. Keele University Centre for Counselling Studies: Staffordshire, 1992.