MEDICAL/HOSPITAL CBRNE DEFENSE

"Is the medical/hospital community ready to deal with a chemical terrorist attack in megapolis' environment?"

by

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Signed: …… Date: …27 August 2010.

We have to be lucky all the time.

They have to be lucky only once!

IRA spokesman's comment following the unsuccessful attempt to murder former UK Prime minister Margaret Thatcher

When planning, think as a terrorist!

When implementing, think as a victim!

Operational logo of Olympic Games 2004 Hospital CBRN Response Unit, Army General Hospital of Athens, Greece

Hope for the best.

Prepare for the worst!

Common logic!

ABSTRACT

This dissertation addresses the issue of medical/hospital chemical terrorist defense because this threat rates on top regarding possibility of occurrence in urban environment. An additional, is the personal experience attained during the 2004 Olympic Games in Athens, Greece. At that time I served as Commandant of a hospital-based Medical CBRN Response Unit – the only specialized unit deployed in an Olympic Hospital during that time. Therefore, I would like to put all this experience into paper and provide a useful guide to the colleagues assigned to medical/hospital CBRN defense during the London 2012 Olympic Games.

Usually, a CBRN plan is a highly classified multi-pages paper accessible only to head security officials. On the other hand, in open-source bibliography one can find most of the basics that will assist a hospital administration to establish an effective defense plan. All relevant papers indicate that it is not a matter of "when" but a matter of "where". Major sporting events like the 2012 Olympiad in London, represent a likely target.

But if this is the case, why both hospitals and medical/hospital community are still not ready to deal with these new emerging threats?

Three parameters need to be examined: First, the attitude of both physicians and nursing staff in dealing with such incidents. Then it is hospitals administrations' attitude regarding the threat probability. Third, it is the overall attitude of national authorities responsible for national CBRN defense planning. There are two unfortunate similarities in all these three denominators: They all intrinsically believe that "it will not happen to them" and that "the threat is over-exaggerated".

CBRN terrorism might be the next step in the long history of conventional terrorism. In such an uncertain environment, this dissertation will attempt to provide a simple yet efficacious overall plan of medical chemical response starting from the incident site all the way to the hospital premises while exploring the attitude of the medical community's active participation. The dissertation will attempt to investigate the problem of involvement and make useful relevant proposals on the basis of the "CBRN problems identified" during the 2004 Olympic Games.

People in high places tend to forget that CBRN operations last only a few hours, while CBRN medical consequences may last for a lifetime – as seen in

outpatient clinics of a military hospital in Tehran for Iran-Iraq chemical war casualties (personal experience).

ABBREVIATIONS

ABC	Airways-Breathing-Circulation (basic resuscitation)
AQAP	Al Qaeda in Arabic Peninsula
AQIM	Al Qaeda in Islamic Mahreb
ARDS	Acute Respiratory Distress Syndrome
BSA	Body Surface Area
CNS	Central Nervous System
CWA	Chemical Warfare Agent
CWC	Chemical Weapons Convention
CPR	Cardio-Pulmonary Resuscitation
CBRNE	Chemical, Biological, Radiological, Nuclear, Explosives (threat)
CHC	Community Health Center
COLPRO	Collective Protection
EU	European Union
FDA	Food & Drug Administration (USA)
FLHP	Front Line Health Professionals
IED	Improvised Explosive Devices
NBC	Nuclear, Biological, Chemical (threat)
OGSC	Olympic Games Security Committee
PPE	Personal Protective Equipment
TIC	Toxic Industrial Chemical
VBIED	Vehicle Born Improvised Explosive Device
WMD	Weapons of Mass Destruction

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INTRODUCTION

Human brain is the recipient of myriad stress effects. It responds by initiating about 1400 different activities affecting all body organs and systems. From the very first moment primitive man faced a life threatening beast, terror was amongst these stimuli that it was meant to follow him, in different forms, throughout his evolution. Terror for life was elicited in his strives to survive adverse climate phenomena, opposite tribes or pandemics. Then it was territorial expansion, containment of vital resources, exploitation of new worlds, political wars. This kind of terror became a part of his evolution and man acclimatized and at the same time desensitized to the idea of dying for a cause – important or less important makes no difference.

During the last two centuries, this terror element gradually chanced face and new era terrorism produces terror most often without a cause – although all actions do have a causative substrate hidden. But even then there was always a direct relationship between the terrorist and the terrified victim. There was contact – eye contact, physical contact. Victims could see it coming; they could anticipate the end. During the First Word War (WW I) this "contact" changed dramatically. This "contact" disappeared. Death became "atmospheric"; nerve gases were coming from nowhere. Terrified victims stood still observing their comrades dying and wait for their turn to dye as well. This new form of terror was far above the stimuli brain could process – even in the battlefield. Perhaps this was the main reason that opposing forces involved in the Second World War (WW II) including Hitler himself, were so reluctant to use chemical weapons although they had tons of them stored in their arsenals.

World community relaxed and thought that this "bad dream" would be gone for good. It was too terrifying to think the other way. Even the atomic bombing of Hiroshima and Nagasaki was not heavily criticized at that time with the excuse of ending WW II for good. Then at the end of the 20th century, a disturbed Japanese fanatic was inspired with an idea aiming to destroy Japanese nation. His cult members manufactured both biological and chemical weapons and they were willing to release them against their own society. The sarin attack in the Tokyo's subway in 1995 signalled the beginning of a new era in terrorism. Similar to that troops experienced in the European battlefields during WW I and that of Iran-Iraq conflict in the 1980s only now the delivery area is the urban environment and the targets were ordinary

civilians; men, women and children going to their work, their school, their playgrounds.

Six years after that incident, the combination of the bloodiest terrorist attack ever against the Unites States and the "anthrax letters' campaign" made world to realize that these threats were there to stay like the Damocles' Sward over their heads. Mass gathering events represent the perfect environment for a terrorist attack with weapons of mass destruction. In that respect, every four years when global community is preparing for the next Olympic Games, humanity is equally preparing to confront this new threat that might change the course of history.

This is why the medical contribution to this new era CBRN terrorism is immensely important. In an incident involving release of CBRN agents, the medical system will be the one that will take the heat. Victims will rush to hospitals for assistance. Big hospitals, small hospitals, community hospitals, private hospitals, private surgeries – all will be whelmed with casualties. All must be ready to deal with mass contaminated casualties. The medical community must be prepared in advance to deal with such casualties. It might look like dealing with a rare, exotic disease. But imagine tens or hundreds of people suffering from the same exotic disease at the same time! The basis of health policy worldwide is that "prevention is better than treatment". We practice this principle in daily routine. Why cannot we expand it to the remote possibility of a CBRN terrorist incident in urban environment?

This dissertation provides some insides of conventional terrorism such as definitions, major terrorism incidents worldwide, trends in international terrorism and targeting, that will serve as the substrate to understand the transformation of old to new era terrorism (Chapter One). A short outline of chemical warfare agents and urban chemical terrorism is provided in Chapter Two. Chapter Three reviews the attitude of medical community towards new emerging threats; current situation in the United States and the European Union is analysed as well. In Chapter Four, the experience gained from the active involvement in the CBRN planning for the 2004 Olympic Games, is projected through an overall medical chemical response plan for urban hospitals. Finally, in Chapter Five, an effort is made the "CBRN problems identified" during the 2004 Olympic Games in Athens to become "lessons learned" for the benefit of the London 2012 Olympic Games.

CHAPTER ONE – Terrorism in the 21st Century

Definitions of terrorism

Terrorism[1] derives from the French analogue "*terrorisme*" which is based on Latin verbs "*terror*" and "*terrere*" – "great fear" and "frighten" respectively. When Cimbri tribe attacked Rome (105BC) the city came to a status of "*terror cimbricus*" – state of panic and emergency. In France, the period 1793-1794 is described as "La Terreur" (Reign of Terror). The Jacobin Club in the post-Revolutionary France used the term "terrorists" to define themselves; their actions termed "terrorism" attributed to the arrests or executions of their political opponents.

In general, the term "terrorism" has been controversial through time. Mainly because it depends in which side you are. Many say that terrorism is a coin with two sides: one for terrorists and one for freedom fighters. In that respect, an objective definition of terrorism looks utopian since the subjective part will always dominate. What is strictly objective is the final outcome of a terrorist action. It is the civilians who suffer the consequences and experience, fear, terror and death toll. Bruce Hoffman in his book "Inside Terrorism" writes[2]:

> *Terrorism is a pejorative term. It is a word with intrinsically negative connotations that is generally applied to one's enemies and opponents, or to those with whom one disagrees and would otherwise prefer to ignore. (...) Hence the decision to call someone or label some organization 'terrorist' becomes almost unavoidably subjective, depending largely on whether one sympathizes with or opposes the person/group/cause concerned. If one identifies with the victim of the violence, for example, then the act is terrorism. If, however, one identifies with the perpetrator, the violent act is regarded in a more sympathetic, if not positive (or, at the worst, an ambivalent) light; and it is not terrorism.*

In the same motive Ben Saul approaches a generally accepted definition of terrorism as following[3]:

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[1] Definition of terrorism. URL: http://www.experiencefestival.com/a/Terrorism_-_Etymology/id/5163807 [Accessed on 11 August 2010]

[2] Hoffman, Bruce. *Inside terrorism*. 2nd edition. New York, Chichester, West Sussex: Columbia University Press, 2006. 23.

[3] Saul, Benl. *Defining 'Terrorism' to Protect Human Rights*. Sydney Law School Legal Studies Research Paper. No. 08-125. 2008.11.

> *Terrorism' currently lacks the precision, objectivity and certainty demanded by legal discourse. Criminal law strives to avoid emotive terms to prevent prejudice to an accused, and shuns ambiguous or subjective terms as incompatible with the principle of non-retroactivity. If the law is to admit the term, advance definition is essential on grounds of fairness, and it is not sufficient to leave definition to the unilateral interpretations of States. Legal definition could plausibly retrieve terrorism from the ideological quagmire, by severing an agreed legal meaning from the remainder of the elastic, political concept. Ultimately it must do so without criminalizing legitimate violent resistance to oppressive regimes – and becoming complicit in that oppression.*

Perhaps the most important remark that most often is forgotten is the fact that killing is not the primary target of terrorism acts. According to Brian Jenkins "*terrorists desire many people to observe in fear, not a lot of people dead*[4]". In the same motive, Ehud Sprinzak denotes "*terrorism has nothing to do with killing. It is a form of psychological warfare where murdering a small number of people, persuades the rest of us that it is our turn*[5]".

For historical reasons it is of interest to review some of the proposed definitions from organizations worldwide:

Unite Nations definitions

1. League of Nations Convention (1937): "*All criminal acts directed against a State and intended or calculated to create a state of terror in the minds of particular persons or a group of persons or the general public*[6]".

2. United Nations Security Council Resolution 1566[7] defined terrorism as:

> *Criminal acts, including against civilians, committed with the intent to cause death or serious bodily injury, or taking of hostages, with the purpose to provoke a state of terror in the general public or in a group of persons or particular persons, intimidate a population or compel a government or an international organization to do or to abstain from doing any act.*

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[4] Jenkins, Brian. Will Terrorists Go Nuclear? *Orbis.* Autumn 1985. 29(3):511.

[5] Sprinzak, Ehud. The Great Superterrorism Scare. *Foreign Policy.* Fall 1998:122.

[6] Saul, Ben. The Legal Response of the League of Nations to Terrorism. *Journal of International Criminal Justice.* 2006. 4(1):78-102.

[7] United Nations Security Council Resolution 1566. URL: *http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N04/542/82/PDF/N0454282.pdf?OpenElement* [Accessed on 5 January 2010]

3. According to United Nations General Assembly resolution 49/60[8] terrorism represents:

> *Criminal acts intended or calculated to provoke a state of terror in the general public, a group of persons or particular persons for political purposes are in any circumstance unjustifiable, whatever the considerations of a political, philosophical, ideological, racial, ethnic, religious or any other nature that may be invoked to justify them.*

European Union's definitions

The European Union addresses terrorism as criminal offence against people and property[9]:

> *... given their nature or context, may seriously damage a country or an international organisation where committed with the aim of: seriously intimidating a population; or unduly compelling a Government or international organisation to perform or abstain from performing any act; or seriously destabilising or destroying the fundamental political, constitutional, economic or social structures of a country or an international organisation.*

United States definition

The United States has defined terrorism under the Federal Criminal Code (Chapter 113B, Section 2331 of Part I of Title 18) as following[10]:

> *(1) the term "international terrorism" means activities that -*
> *(A) involve violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or of any State, or that would be a criminal violation if committed within the jurisdiction of the United States or of any State;*
> *(B) appear to be intended -*
> *(i) to intimidate or coerce a civilian population;*
> *(ii) to influence the policy of a government by intimidation or coercion; or*
> *(iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and*

[8] United Nations General Assembly A/RES/49/60. *Measures to eliminate international terrorism.* 1995. URL: http://www.undemocracy.com/A-RES-49-60.pdf [Accessed on 15 January 2010]

[9] European Union. Council Framework Decision of 13 June 2002 on combating terrorism (2002/475/JHA). *Journal of the European Communities*. 2002. URL: http://www.statewatch.org/news/2002/jul/ frameterr622en00030007.pdf [Accessed on 15 January 2010]

[10] FindLaw for Legal Professionals. *US Code - Section 2331*. URL: http://codes.lp.findlaw.com/uscode/18/I/113B/2331 [Accessed on 15 January 2010]

United Kingdom's definition

Terrorism Act 2000[11] defines terrorism in the United Kingdom:

(b) the use or threat is designed to influence the or to intimidate the public or a section of the public and
(c) the use or threat is made for the purpose of advancing a political, religious or ideological cause.
(2) Action falls within this subsection if it
(a) involves serious violence against a person,
(b) involves serious damage to property,
(c) endangers a person's life, other than that of the person committing the action,
(d) creates a serious risk to the health or safety of the public or a section of the public or
(e) is designed seriously to interfere with or seriously to disrupt an electronic system.

From the above definitions and many other available, it is prominent that almost all include certain criteria such as target, objective of the perpetrator, motive, perpetrator description and legality of the terrorist action taken. In that respect civilians represent the main target of terrorism regardless if in many instances an early warning has been issued (usually by phone – case reports in Greece). Fear production is the second objective – and the most important of all. Intimidation accompanying fear is directed against governments, societies or groups within. Achieving political or religious goals is the third objective. It is difficult to define the perpetrators in a terrorist incident – especially if their action has a global effect (i.e. September 11th, 2001 attack). In that respect "silence" may provide safe heaven against countermeasures from the strong country involved – especially if "state-sponsored terrorism" is involved. Finally, the legality of terrorist action is sometimes controversial especially when it is addressed against military targets (guerrilla/asymmetric warfare).

Major terrorist incidents around the world (following 911 incidents)

Major terrorist incidents worldwide with more than 100 people killed[12] are recorded below:

[11] Legislation.gov.uk. *Terrorism Act 2000*. URL: http://www.opsi.gov.uk/acts/acts2000/pdf/ukpga_20000011_en.pdf [Accessed on 15 January 2010]

[12] Johnston, Robert. (2010). *Incidents of Mass Casualty Terrorism.* 2010. URL: http://www.johnstonsarchive.net/terrorism/wrjp394.html [Accessed on 2 February 2010]

11 September 2001

Incident: Two domestic jetliners crashed onto World Trade Center in New York, USA. A third airplane crashed onto Pentagon in Alexandria, Virginia. Passengers of a fourth aircraft on the way to Washington DC, attacked highjackers onboard and finally the plane crashed in Somerset County, Pennsylvania.

Death toll: 2,993 dead (on ground and airplanes) – 8.700 injured

Targets: Civilians, military/civilian defence personnel

Means: Jetliners turned to "flying bombs" following en route high jacking.

12 October 2002

Incident: Bombs exploded in front of a nightclub in Kuta, Bali.

Death toll: 202 dead (2/3s foreigners) – 350 injured.

Targets: Civilians – foreign tourists.

Means: IED, VBIED.

26 October 2002

Incident: 41 Chechen terrorists stormed a theatre in the Nord-Ost theatre in Moscow, Russia.

Death toll: 129 dead (hostages), 41 terrorists killed – 653 rescued.

Targets: Hostages civilians (around 800 – including 75 foreigners)

Means: Light weapons, explosives – Russian counter-terrorist forces used fentanyl (incapacitating gas used in anaesthesiology) to induce unconsciousness.

27 February 2004

Incident: Bomb exploded on a ferry en route from Manila to Bacolod, Philippines.

Death toll: 118 dead – 9 injured.

Target: Ferry boat – civilians (sleeping time)

Means: IED (4kg of TNT inside a television set)

11 March 2004

Incident: Multiple bombings during rush hours on trains in three stations in Madrid, Spain.

Death toll: 191 dead – 1.876 injured.

Targets: Civilian commuters– foreign tourists (47 killed)

Means: IEDs – three more bombs defused hidden in backpacks.

3 September 2004

Incident: Three days standoff by Chechen terrorists at a school in Beslan, North Ossetia, Russia

Death toll: 336 civilian hostages killed, 30 terrorists – 727 injured

Targets: Civilians (parents, teachers and school children), policemen

Means: Light/heavy weapons, explosives

11 July 2006

Incident: Multiple bombs exploded during evening rush hour on commuter trains in and near Mumbai, India.

Death toll: 200 dead – 714 injured.

Targets: Commuter trains (first class cars) - civilians

Means: IEDs (RDX explosives and pencil-sized timers were used)

14 August 2007

Incident: Multiple bombings in villages Al-Qataniyah and Al-Adnaniyah, Iraq.

Death toll: 520 dead – 1.500 injured

Targets: Civilians of the Yazidi sect, 1000 houses destroyed, 500 damaged

Means: VBIEDs – disguised trash tankers supposed to carry food (2 tons of explosives)

18 October 2007

Incident: Bombings during crowd greeting of the former Prime Minister of Pakistan Benazir Bhutto in Karachi, Pakistan.

Death toll: 139 dead – 540 injured

Targets: former Prime Minister, state officials, followers

Means: Grenade, suicide bomber (15-20kg of explosives)

26-29 November 2008

Incident: Multiple attacks in Mumbai, India by a group of 10 terrorists who took hostages in a two-day siege

Death toll: 174 dead (many foreigners) – 327 injured, one terrorist captured alive.

Targets: several locations (café, train station, hospital, synagogue, 2 hotels) – police forces

Means: Bombs, VBIED, heavy weapons

25 October 2009

Incident: Bombing near government buildings in Baghdad, Iraq.

Death toll: 160 dead, 540 injured

Target: Ministry of Justice, Ministry of Municipalities and Public Works, staff members, civilians (many children)

Means: VBIEDs (1000 kg and 700 kg of explosives in two vehicles)

28 October 2009

Incident: Bombing at a marketplace in Peshawar, Pakistan

Death toll: 118 dead (including seven children from a single family)

Target: Meena Bazaar marketplace (mostly used by women)

Means: Bomb (150 kg of explosives, remotely detonated)

Trends in international terrorism

Late 1990s has been a turning point in terrorism affairs. It was then that "new era terrorism" term was coined to identify new terrorist operational methodologies and violence escalation. Globalization of terrorism is the first characteristic to be noted. Terrorist organizations are still relatively small groups but their structure became more complex and their operational radius longer and wider. Old era terrorist groups transformed to "networks" ruled by personal relationships based to web connections and affiliations. The resulting web transformed from national to trans-national and even international. It is not "core" al Qaeda anymore but rather an "al Qaeda affiliated network" with branches in various parts of the world (i.e. AQIM, AQAP). Observed transformation is partly due to low cost international travelling and modern communication technologies. Uncontrolled mass migration especially towards Western Europe eased translocation of "seeds" of new era terrorism. These "seeds" grow up, spread and flourish through the digital social space of Internet.

Exportation of terrorism from the active battlefields of Iraq, Afghanistan and Somalia became a reality. Well trained combat-experienced individuals can now "retire" in the West and form small terrorist cells or groups or act as "lonely wolves". Besides their experience they imported new methodologies that might surprise counter-terrorism organizations in the near future.

Ideology transformed as well. In modern times, religious-driven ideology and nationalism predominate among terrorists despite their original background. Behind the open face of this religious ideology, a rising demand for radical transformation of hosting societies based on their religious principles and way of life is hidden. Peaceful (for the time being) "Musulmanization" of Europe progressing in accordance to the rising percentage of Muslim immigrants in EU countries, is of particular notice. Only recently, hosting societies are beginning to realize that their new "citizens" are trying to change their political systems and replace them with their own (i.e. Sharia law).

A third characteristic of new era terrorism is that terrorists no more seek public acceptance. In that respect, they do not really "care" for the results of their actions and the mass casualties produced. This characteristic makes them extremely dangerous for the integrity of social network. Usage of weapons of mass destruction (i.e. sarin gas attack against subway commuters in Tokyo), signifies their new perception of value of human life. It became obvious from the listing of major terrorist incidents above, that the "over 100 fatalities" cases are now the rule not the exception. This also signifies a shift in brutality accompanying lethality. The rare phenomenon of suicide-bombing does not surprise any more.

Currently two parameters predominate: violence for violence's shake and symbolism of some kind (often none). Western way of life might in part be responsible for this. Modern generations grew up by watching wars live on their television screens and their violence threshold is high. There are many to support the idea that the next "9-11" must be much more spectacular, much more deadly and widespread ever. In that respect, a chemical or radiological (dirty bomb) attack might make the "desired" difference. According to Peter Neumann "*forecasting is not as easy as drawing a straight line from the past. Unexpected events can play a major*

part in shaping the dynamics and wider framework within which terrorism takes place[13]."

Terrorism targets

From the major terrorist incidents presented it is obvious that the main pattern is "anyone-anytime-anywhere". Two parameters are of critical importance: Number of people gathered and society impact (plus mass media coverage expected). Impact on society is derived from the inability of the state to protect its own population, symbols of authority, society's institutions, infrastructure and state officials while cannot end terrorism itself providing a peaceful living environment.

Coping with this, most preferred urban targets could be: state buildings, ports, airports, trains and train stations, hospitals, bridges, city tunnels, banks, embassies, factories, power plants (hydroelectric, nuclear), water supplies and pipelines, refineries and oil/gas pipelines, computer networks and symbolic national monuments.

Special attention should be given to hospitals. In the past, all buildings or installations bearing a "cross" or "half-moon" were considered as "sacred". Despite the international laws forbidding action against sanitary organizations and installations, it was a common perception that wounded people (both civilians and military) where "out of the game" – a kind of "gentlemen agreement". In recent times, many terrorist actions directed against hospitals (i.e. in Iraq or India). This represents a shift in tactics and hospitals might now become the "ultimate soft target". If you deprive hope from the wounded or the contaminated by making hospitals unavailable, then terror produced will be highly multiplied and "death" would be the next logical step to anticipate.

Other factors in targeting selection include the high degree of surprise resulting in mass panic and societal paralysis, the drama of the attack, the presence of mass media that will spread fear in all directions, and the ability to repeat the attacks causing a pathologic status of "endemic insecurity[14]" affecting both the populace and the governors.

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[13] Neumann, Peter. Terrorism in the 21st century. *Compass 2020*. 2008. URL: http:// library.fes.de/pdf-files/iez/06063.pdf [Accessed on 15 February 2010]

[14] Berry, Nicholas. *Targets of terrorism*. Center for Defence Information – Terrorism Project. URL: http://www.cdi.org/terrorism/moretargets.html [Accessed on 20 March 2009]

CHAPTER TWO – New emerging threats

CBRN threats' overview

Before the World Trade Center attack in 2001, the abbreviation "NBC" was really meant "**N**o**B**ody **C**ares". This was a common joke among defense people who never expected to be confronted with the terror of WW I. Not even the chemical attack in Tokyo (1995) motivated international civilian and military communities to take pre-emptive actions against emerging threats. After "9-11", "NBC" gradually transformed to "CBRN" according to possibility of application and recently modified to CBRNE with "E" deriving from "Explosives" that are expected to accompany the release of weapons of mass destruction.

There are reports for use of chemical substances in the histories of many civilizations such as the Chinese, the Greeks and Byzantium ("liquid fire"). During WW I, it was the Germans who surprised Allied forces by releasing chlorine gas during the Battle of Ypres (1915). In the next two years, 1.2 million casualties were attributable to chemical warfare resulting in more than 90.000 deaths[15]. Although available in both sides, CWAs were not used in WW II.

Throughout the remainder of the 20th century, chemical weaponry continued to be developed and used in certain conflicts around the world (Persian Gulf War, Iran-Iraq War).

In 1993, the Chemical Weapons Convention (CWC) was finalized. This treaty prohibits the development, production, stockpiling, and use of chemical weapons and provided for the verification and destruction of known stockpiles. The Organization for the Prohibition of Chemical Weapons (OPCW) was set in 1997 in The Hague to supervise CWC. Currently 188 nations, 98% of the global population, have joined the OPCW[16]. Israel and Myanmar have signed but not ratified CWC while five states (Angola, Egypt, North Korea, Somalia, Syria) have neither signed nor acceded CWC.

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[15] First War War. *Weapons of War – Poison Gas.* URL: http://www.firstworldwar.com/weaponry/gas.htm [Accessed on 16 January 2010]

[16] Organization for the Prohibition of Chemical Weapons. *Status of participation in the CWC*. 2010. URL: http://www.opcw.org/about-opcw/member-states/status-of-participation-in-the-cwc/ [Accessed on 13 July 2010]

Chemical terrorism

Chemical Warfare Agents

According to OPCW the term chemical weapon is applied to "any toxic chemical or its precursor that can cause death, injury, temporary incapacitation or sensory irritation through its chemical action. Munitions or other delivery devices designed to deliver chemical weapons, whether filled or unfilled, are also considered weapons themselves[17]."

The most well known chemical weapons are: choking agents – chlorine and phosgene, blister agents – mustard and lewisite, blood agents – hydrogen cyanide, and nerve agents – sarin, soman, VX. Some toxic chemicals, and/or their precursors, are of dual usage – especially in industry worldwide. Only in the case that they are produced and stockpiled in amounts that exceed requirements for those purposes they are considered as chemical weapons.

Under the term "toxic industrial chemicals" there is a wide variety of substances used in large quantities in the chemical industry such as acids, ammonia, bases, chlorine and other inorganic substances. Toxic industrial chemicals are manufactured, stored, transported, and used worldwide. They can be in the gas, liquid, or solid state. These substances can be chemical hazards or physical hazards if accidentally or deliberately released. The US National Environmental Law Center reported that "34,500 accidents involving toxic chemicals were reported to the EPA's Emergency Response and Notification System between 1988 and 1992, meaning that on average, a toxic chemical accident was reported nineteen times a day in the United States, or nearly once every hour[18]."

The most well-known chemical accident is the one that took place in Bohpal, India (1984), where methyl isocyanate was released in densely populated areas causing the death of 3.800 citizens and producing disabilities to more than 11.000 individuals[19].

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[17] Organization for the Prohibition of Chemical Weapons. *Basic Facts on Chemical Disarmament. Brief description of chemical weapons*. URL: http://www.opcw.org/news-publications/publications/basic-facts/#c4128 [Accessed on 15 March 2010]

[18] Environmental Research Foundation. *Chemical accidents.* 1994. URL: http://www.ejnet.org/rachel/rehw408.htm#1 [Accessed 15 January 2007]

[19] Browning, Jackson. Union Carbide: Disaster at Bhopal. Jackson Browning Report - Union Carbide Corp. 1993. URL: http://www.bhopal.com/pdfs/browning.pdf [Accessed on 22 June 2010]

Pulmonary (chocking) agents

Phosgene, chlorine, ammonia, hydrogen sulfide and hydrogen chloride belong into this category. Many of these agents are widely used in modern chemical industries (plastics, pesticides) and are most commonly involved in industrial chemical releases.

Phosgene is a white to pale yellow gas that smells like mown grass or musty hay. Chlorine a greenish gas smells like bleach while hydrogen sulphide smells like rotten egg. Latent period is usually within minutes to 48 hours. These gases are heavier than air and therefore accumulate in low-lying areas. They react with water in mucous membranes and produce corrosive substances, such as hydrochloric acid (chlorine, phosgene) or nitric acid (ammonia). Destruction of the alveolar-capillary membrane of the respiratory tract and leak of fluid in the interstitial tissue, results in ARDS.

Humans expose to these agents is by inhalation and skin and eye contact. In liquid form these agents may contaminate water or food and people can be exposed via consumption. Damage provoked depends on water solubility and direct tissue reactivity, dose and duration of exposure.

The diagnosis of pulmonary agent exposure is clinical. Management is mainly based on rapid decontamination.

There is no specific antidote.

Hemotoxic agents (blood agents)

Cyanide, cyanogen chloride, cyanide salts (sodium or potassium cyanide) belong to this category.

Cyanide was also manufactured between WW I and WW II and has been used in concentration camps and in the Iran-Iraq war in the 1980s; also for assassinations and suicides. It is widely used in the industry (plastics, fertilizers, photography); it is also a combustion product elicited in house fires, considered to play a significant role in smoke inhalation morbidity.

It is a colorless gas or white solid that smells like bitter almonds (only some people are genetically predisposed to smell it). It provokes symptoms immediately (seconds to minutes). Gases are lighter than air and very volatile in liquid or solid salts' form. Chemical asphyxiants replace oxygen in the hemoglobin molecule and

inhibit oxygen transport to the cells causing tissue hypoxia. Certain cyanide salts may also be corrosive to skin and eyes.

Human exposure is by inhalation (gas), skin and eye contact (liquid or solid) or by ingestion. Damage depends on route of exposure, concentration and duration of exposure.

Diagnosis is based on blood cyanide levels. Decision to administer antidotes is clinical and should not await test results.

Management of casualties depends on rapid dry (clothes' removal) or wet decontamination.

There are cyanide antidotes available (dicobalt edetate or sodium nitrate with sodium thiosulphate). Cyanokit® is the only FDA-approved emergency antidote[20] (hydroxocobalamin) indicated for both known and suspected cyanide poisoning.

Vesicants (blister agents)

Members of this category are mustards (nitrogen and sulphur) and organic arsenicals (lewisite, phosgene oxime).

Vesicants were manufactured as chemical weapons between the two world wars and mustards were used in the Iran-Iraq war in the 1980s. These agents are not used in industry, but quantities of them still exist in the arsenals of various countries and are under the process of destruction.

Lewisite may smell like geraniums while mustards may smell like garlic, fresh onion or mustard. The latent period for lewisite is immediate; for mustards it is more delayed (4-12 hours). It is important to know that these two agents can be mixed in order to produce both early and late symptomatology.

Vesicants are oily volatile liquids, pale yellow to amber that in gas form are heavier than air and accumulate in low-lying areas. They cause tissue damage by alkylation, similarly to radiation, affecting all rapidly replicating cells (cell death).

Human exposure is due to inhalation (gas), absorption through intact skin, eye contact with liquid or gas and ingestion (rare).

Damage depends on concentration and duration of exposure, humidity and environmental temperature.

[20] Meridian Medical Technologies. *Cyanokit*. URL: http://www.cyanokit.com [Accessed 23 August 2010]

The diagnosis is clinical. Urine mustard metabolites (thiodiglycol) may be measured in specialised laboratories; also urine arsenic levels after suspected exposure to lewisite. Laboratory tests can be used at a later stage to confirm exposure and should not delay treatment or treatment decisions.

Rapid dry/wet decontamination is critical.

There is NO antidote for mustards. In contrast, there is a specific antidote for lewisite (dimercaprol or British Anti-Lewisite [BAL] or alternatives: 2,3-DMSA and 2,3-DMPS) if there is clinical suspicion of exposure and pulmonary oedema, chemical burn with history of late decontamination (>15 min from exposure) with skin damage >5% BSA. Do not patch eyes; instead administer atropine eye drops for blepharospasm and ophthalmic ointment to prevent eyelids from sticking together. Usual burn care for the skin damage (analgesia, debridement, dressings)

Nerve agents (cholinesterase inhibitors)

Two categories available: "G-agents" (tabun, sarin, soman, cyclosarin) and "V-agents" (VX, Russian VX).

Nerve agents are extremely toxic chemical weapons and were manufactured between world wars. They were used in the Iran-Iraq war in the 1980s and during terrorist attacks in Matsumoto (1994) and Tokyo (1996). They are not used in industry, but quantities of them still exist in the arsenals of various countries and are under the process of destruction. Organophosphate pesticides in general have been banned from use in the EU, but accidental or deliberate (e.g. suicide) exposures are not uncommon.

G-agents are clear, colorless liquids, odorless or may smell kind of fruity. V-agents are brown oily liquid at room temperature and are odorless. Both categories act immediately.

Nerve agents are volatile liquids, colorless to brown at room temperature. As vapors are heavier than air and accumulate in low lying areas (i.e. basements). They act similarly to organophosphate pesticides by inhibiting acetylcholinesterase enzymes, causing extreme cholinergic stimulation of CNS, and peripheral muscarinic and nicotinic receptors dysfunction by the accumulating acetylcholine.

Human exposure in due to: inhalation (gas or aerosol), absorption through intact skin, eye contact with liquid or gas or ingestion (rare).

Damages provoked depend on route, dose and duration of exposure. Progression of symptoms should alert medical staff for continued exposure, inadequate decontamination or inadequate treatment.

Diagnosis of nerve agents' exposure is clinical. Laboratory tests (red cell cholinesterase activity, plasma cholinesterase), can be used at a later stage to confirm exposure and should not delay treatment or treatment decisions.

Rapid decontamination is critical.

There is combined treatment available (atropine [large doses], pralidoxime and benzodiazepines) and should be administered as fast as possible.

Japan – Sarin gas attack in Tokyo's subway

In Tokyo, approximately three million workers and students travel daily via subway. On Monday morning (07:55) of March 20th, 1995 the terrorist group of Aum Syrinkio organized and executed the release of nerve agent sarin into five subway cars on three separate subway lines passing through Kasumigaseki (home of police HQ) and Nagatachō (home to the Japanese government).

St. Luke's International Hospital was in closest proximity to the subway stations attacked[21]. At 08:16 the hospital's administration was alerted. At 08:16 first subway victims arrived at the Emergency Department complaining mostly for eye pain and dim vision. Until 09:20, more than 500 patients arrived (in total 640 within 75 minutes following alert call). More than 100 physicians **of all medical specialties**, 300 nurses and volunteers were available to provide health care.

During the time subway incident took place, in the hospital there was a television crew to film the opening of a new hospital's ward. Their film documentary[22] vividly shows that hospital personnel dealed with chemical casualties

[21] Smithson, Amy and Levy, Leslie-Anne. *Ataxia: The Chemical and Biological Terrorism Threat and the US Response.* The Henry L. Stimson Centre. 2000, Report No. 35. URL: http://www.stimson.org/*cbw/pdf/atxchapter4.pdf* [Accessed on 20 April 2010]

[22] YouTube: Tokyo Sarin attack 1. URL:
http://www.youtube.com/watch?v=00oFivBQdjo&feature=related [Accessed on 9 June 2010]
YouTube: Tokyo Sarin attack 2. URL:
http://www.youtube.com/watch?v=LqMiKvjR9yY&feature=related [Accessed on 9 June 2010]
YouTube: Tokyo Sarin attack 3. URL:
http://www.youtube.com/watch?v=ROHLeELHPXs&feature=related [Accessed on 9 June 2010]
YouTube: Tokyo Sarin attack 4. URL:
http://www.youtube.com/watch?v=VOLtV2nBexc&feature=related [Accessed on 9 June 2010]
YouTube: Tokyo Sarin attack 5. URL:
http://www.youtube.com/watch?v=GITkHxrP_XE&feature=related [Accessed on 9 June 2010]

in the usual way they would react if confronted with a highway car accident. No precautions, no decontamination, no personal protective equipment for the EMS personnel. There was delay in confirmation of the nature of toxic substance; no sufficient antidote stockpile was available. In general, these people had no idea of what they are dealing with in order to provide specialized care and protection. The same applied for first responders and health providers escorting casualties to the hospital (secondary contamination en route due to closed windows).

In total, 13 commuters were killed (two of them at the hospital), 640 presented in the hospital and more than 5.000 people required emergency medical evaluation (worried well) in **169 hospitals**[23] **all over the city**.

It is also important to note that victims arrived at the hospital by ambulances (10%), minivans of Fire Defence Agency (5.5%) and **by non-medical vehicles (84.5%)**[24]. Perhaps the most important consequence, other than the shock of the highly industrialized Japanese society, was the fear provoked regarding the safe usage of mass transportation means. This fear is still present (personal remark), especially during the rush hours when commuters are "packed" into subway cars.

[23] Kaplan, David and Marshall, Andrew. *The cult at the end of the world: The incredible story of Aum.* London: Arrow Books Ltd. (Random House UK Ltd.), 1996. 25.

[24] *Ibid.*21.

CHAPTER THREE – Attitude of medical community towards new emerging threats

Is the medical community prepared and willing to deal with new threats?

Almost nine years after the hecatomb of blood in World Trade Center and the Pentagon in the United States, is the medical community prepared and willing to deal with new emerging threats? An optimistic observer might comment that although there are many things to be done, certain progress has been made especially in certain parts of the world. A pessimistic observer will categorically state that not many things have been done so far. A logical observer should note that current situation is in the middle. In that respect we must rely on the objective observer who will support his opinion with facts and figures. If this is the case, then the situation regarding medical/hospital preparedness to deal effectively with chemical and radiological terrorist threats is rather worrisome!

This complies with my personal view and it was the main drive to select this theme for my dissertation. During the 2004 Olympic Games in Athens, I served as CBRN consultant at the Olympic Games Safety Committee (OGSC). I recall the first meeting of the sub-committee on CBRN planning: seventy five entities, bodies and organizations – many were health-oriented – in a round table meeting. The first question was shocking: "what NBC acronym means?" My immediate thought at that very moment was: "We have a big problem to solve!" It was obvious that just a handful of CBRN experts – mainly from the military – had to educate all these people in order to be able to communicate with them. It took many months and endless meetings on various hot topics like the magnitude of the threat, the expected death toll, who is entering where, who is assisting whom, equipment and training issues, drills and exercises, acceptance of international assistance, international CBRN safety advisory board, personnel issues, organized professional unions' objections on role and involvement and many more.

The main objection was two-fold: First it was the inherent "logic" that "it will not happen to us!" This was accompanied by a similar "logic" that release of CBRN agents in a megapolis environment was too inhumane to happen! These basic "logics" were accompanied by the unwillingness of medical/hospital personnel (mainly physicians) to be involved in the management of CBRN casualties. Almost all of them

rejected their involvement in "hot" and "warm" zones' operations since they had not the training required. Most of them thought that this was a job for the military physicians to do – as part of their military medicine training. A second point of traction was the fact that training in medical CBRN defense required a lot of reading, a lot of practical/physical training, new unfamiliar and uncomfortable equipment and frequent exercising both theoretical and field oriented. In fact it was like going back to their time of intern training for acquiring their medical specialty. And they did not need that! Young health professionals spent a lot of time and effort to become specialists. At that time, most of them were practicing their specialty in various hospitals and their private offices. They needed to invest into their training in order to achieve a better financial status for them and their families. If they were involved in medical CBRN operations, their plans should be delayed and that was not cordially accepted.

A second objection had to do with the post-Olympiad era. What if they stuck to this field of medicine and let their initial objective become a secondary job? Then it was the fact that they had to spend all summer-time period into training and stay alert in shifts during the Games. In addition, there was no allowance budgeted for their specialized involvement. In one hand there would be their colleagues who would enjoy their summer vacations or go to the Games and on the other hand would be them training, sweating, reviewing plans, make adjustments, work on their personal protective equipment, practice familiar techniques with unfamiliar rubber gloves or try to persuade their hospitals on the modifications that should be done in order to be able to protect their colleagues from possible contamination in a case of a real CBRN terrorist incident.

Lack of relevant knowledge multiplied their concerns and inner fears. They have never heard of nerve gases' effects, they have never seen mustard casualties; there was no relevant curriculum during their medical years' studies. Not to mention that most of the bibliography available on the Internet was in English (language barrier). Then they have never been in a protective gear ever.

I must admit that the first time in such a gear could be kind of traumatic. Increased respiratory resistance due to the filters attached into gas masks makes breathing difficult and laborious. Certain claustrophobic behaviors arise due to the isolation feeling when the mask is on. Operating with personal protective gear is affected by physical status, ambient temperatures and tasks to perform. Those who

work in EMS departments are familiar with the stress they experience when dealing with conventional traumas. Add the additional stress of a contaminated blast victim to have a virtual picture of the imaginary tasks these people were asked to perform in an environment dangerous for their own lives as well. Physicians suppose to save ALL victims they are dealing with. It is their duty resulting from their Hippocratic Oath. But things in CBRN triage are totally different and difficult to be incorporated into their medical/ethical *modus operandi*. It looked inhuman to let people die in order to treat others with a better chance to survive!

These high-lights are some of the many that medical and nursing personnel had to face and learn to live with. Their concerns were well understood and tried to alleviate via explanation of the basics and by showing them that everything had to do with the right training. But most of them were not willing to participate because the main question into their mind was: "What is it for me?" This specialized training would not be an "add-on" to their curriculum vitae and it would not provide any future benefits; only "troubles" and "future responsibilities". Who is pursuing them in our modern self-centered times and lives any way? It was then, in a very critical turning point, that they (through their unions) threaten to go on strike during the Olympic Games. It was then that the state decided to involve military hospitals as Olympic Hospitals in order to deal mainly with CBRN casualties.

It was decided that Army General Hospital of Athens will be the core hospital with neighboring Air Force General Hospital to provide support personnel and absorb inpatients from Army Hospital in case of a real CBRN incident and Navy Hospital to provide logistical support. It was late January 2004 when I was asked to create a new hospital-based CBRN response unit.

Although military CBRN experts were strongly supporting the idea that there was a gap in the overall CBRN planning when comes to management of contaminated mass casualties, those responsible for the execution of the plan (mainly first responders: police and fire service) focused greatly on the "operational part" of the incident. It was well known from previous mega-terrorist events that the "golden hour" is a period that evaporates fast. In fact what can really be done is to cordon the area and try to evacuate walking casualties from the incident site. On the contrary, "medical operations" may last for many hours and even days or months.

When I participated in a medical-oriented course on the consequences of chemical weapons held by OPCW in Iran (2003), I was amassed when informed that

more than 20.000 patients where in the follow-up program for victims of the Iran-Iraq war era in the 1980s! The course was held at the Baqiyatallah Military Hospital of Tehran. Within the hospital's premises, there is an outpatient clinic dedicated to chemical victims. Participants were given the opportunity to actively examined these patients and talk with them. It was a unique chance for a medical doctor to actually see a "mustard eye" or patients with "mustard scars" in their bodies. These patients were young during the chemical attacks of the past – even small children. Now they have to suffer for the rest of their lives due to the consequences of the inhuman release of chemical weapons in urban populace. It was also a good chance to discuss these items with specialized Iranian physicians with vast experience in management of chemical casualties. This is a "must" to participate course and I strongly recommend it to all medical staff involved in CBRN medical operations[25]. This experience was our strong point to support the opinion that medical CBRN operations should be equally supported – in vain.

Finally, OGSC realized the existence of the gap and ordered measures. I was given 67 people from the Army General Hospital and asked to "transform" them into an "Olympic Hospital CBRN Response Unit" that will be deployed in the parking lot of the hospital ready to deal with CBRN casualties during the mega-event.

People selected were not volunteers, many of them had families and children and all of them had no relevant experience or knowledge about CBRN agents. All the remarks made above about the general attitude of medical/nursing personnel regarding involvement is such operations were apparent during our first meeting at the amphitheatre of the hospital. Anger, fear, skepticism, objections, insecurity where among the many feelings filled the air during this first meeting. It was proven that military medical personnel were also not prepared for this kind of job. But the military had no excuse to turn this task down. It was the pride of the military medical corps that eventually over-run all objections and hesitations. At this point it is worthy to mention that motivation is very important for those involved in such operations. The point of view saying "*why don't you take as an example our colleagues in the United States, Great Britain or Israel who are doing their best to be prepared for events of this kind*" was confronted with the common belief that "*they are prepared because they are in contact with the enemy*". In that respect, "introduction to international

[25] Organization for the Prohibition of Chemical Weapons. *OPCW Calendar of Events.* URL: http://www.opcw.org/events-calendar [Accessed: 05 February 2010]

terrorism" is a very effective tool to reverse this attitude by proving to the audience that "*what is thought to be very far away from us is in fact outside our doorstep*!"

After the first eight hours of introductory presentations on medical CBRN defense issues, all these feelings changed to a universal enthusiasm and all were eager to be actively involved in this new exciting field of expertise. Ignorance produces fear, lack of training produce fear as well. On the other hand, "knowledge is power" and practical training replaces doubts with certainty and confidence. Acclimatization with personal protective equipment greatly helps performance and overcoming discomfort derived from this type of protective gear. For my surprise female personnel proved to be more durable than males and more enthusiastic in fulfilling tasks.

In close cooperation with OPCW (activation of Article "X"[26]) and other foreign organizations, the unit's personnel was trained in several countries abroad, given the opportunity to absorb different training techniques and methodologies. This training created different groups within the unit who strongly support their training against that of others. There was the "Swiss Group", the "British Group", the "Czech Group" and so forth. But all of them eventually compose their expertise to construct a new "Greek Know-How" that would be suitable for the Olympic Games. Through countless exercises, in different ambient temperatures, personnel were acclimatized to the difficulties of summer time operations. The entire unit cooperated closely to finalize the response plan. We followed the principle that a plan should be short, clear and effective. Multi-pages plans are nice when on library selves; it is of no use if something real appears. One must always have in mind that "*no plan stands in front of the enemy!*" Flexibility is a "must to have" ability in order to overcome difficulties and surprises. Leadership during that time was also a big challenge. The model of "personalized command" was chosen and it worked efficiently. In fact it was a combination of "authoritarian-participative-delegative" command styles addressing personalities and problems in a personal manner.

A surprising element that arose during that preparatory period was the fact that many hidden adventurous personalities came to the surface strengthening the view that people involved in extreme situations or activities, have personalities slightly

[26] Organization for the Prohibition of Chemical Weapons. *Chemical Weapons Convention – Article X.* URL: http://www.opcw.org/chemical-weapons-convention/articles/article-x-assistance-and-protection-against-chemical-weapons/ [Accessed on 10 July 2010]

deviating from what is broadly characterized as "normal". Most of the times, these personalities are trapped in daily reality and routine. The so-called "T-personality" ("T" from "Thrill seeking") might be a useful tool in selective the right people to do this job. According to Ron Watters[27]:

> *The world has become far too safe, and heretofore unknown lands are mapped in far too much detail. As a consequence, we need as many outlets as possible for people to participate in challenging outdoor activities. We need wilderness lands; we need rock climbing areas; we need wild rivers; we need outdoor schools, and given proper environmental safeguards, we need free and unfettered access to outdoor areas. The right to risk is unalienable. It makes our society healthier and more vibrant.*

To establish more sophisticated selection criteria, one might take advantage of the work of Ernest Noble's group on prevalence of dopamine D2 and D4 receptors associated with risk-taking behaviour[28] (D2 gene: 20% of people, D2+D3 genes: 30% of people). Future controlled studies on dopamine receptors in CBRN personnel might reveal surprising results.

From all the above, it is obvious that although medical/hospital personnel are neither ready nor willing to participate in medical CBRN operations, knowledge, continuous training, acclimatization and motivation can change this attitude for the benefit of the societies in danger.

Current situation in the United States

The United States declared "war against terrorism" soon after the September 11th, 2001 terrorist attack in New York. One might assume that nine years after this momentous date, this country should be medically shielded against new emerging threats. Current situation is presented below through a series of scientific papers collected from US National Library of Medicine, National Institutes of Health (PubMed.gov):

In 2001, Wetter et al studied hospital preparedness (224 hospital emergency departments in 4 north-western states) for victims of chemical or biological terrorism.

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[27] Watters, Ron. *The Wrong Side of the Thin Edge.* In: To the Extreme: Alternative Sports, Inside and Out. Robert E. Rinehart and Synthia Sydnor (eds). Albany: State University of New York Press, 2003: 258-259.

[28] Noble E, Ozkaragoz T, Ritchie T, Zhang X, Belin T, Sparkes R. D2 and D4 Dopamine Receptor Polymorphisms and Personality. *American Journal of Medical Genetics (Neuropsychiatric Genetics).* 1998. 81:257–267.

They concluded that "*Hospital emergency departments generally are not prepared in an organized fashion to treat victims of chemical or biological terrorism. The planned federal efforts to improve domestic preparedness will require substantial additional resources at the local level to be truly effective*[29]."

In 2002, Mann's group studied public health preparedness for mass-casualty events in all 50 states focusing in planning, coordination, training, resource capacity and preparedness for chemical/biological terrorism[30]. Most states had a disaster plan (94%) but only a few (38%) had a bioterrorism component. Personal protective equipment was lacking in 49 states and only 10% of hospitals in all states had decontamination facilities. Therefore, the group concluded that:

> *These findings suggest that disaster plans are prevalent among states. However, key programs and policies were noticeably absent. Communication systems remain fragmented and adequate training programs and protective equipment for health personnel are markedly lacking. State-wide trauma systems may provide a framework upon which to build future medical disaster readiness capacity.*

Higgins, Wainright, Lu and Carrico in 2004 assessed preparedness for mass casualties' events in short and long-terms hospital in a single state by employing the Mass Casualty Disaster Plan Checklist[31]. Their comments were as following: "*Hospital mass casualty preparedness efforts were in an early stage of development at the time of this survey, and some critical capabilities, such as isolation, decontamination, and syndromic surveillance were clearly underdeveloped. Preparedness planning was more advanced among hospitals located in counties participating in Metropolitan Medical Response System Program*."

In 2005, the study of Niska and Burst focused in bioterrorism and mass casualty preparedness in US hospitals as part of the annual National Hospital Ambulatory Medical Care Survey[32]. Main results: (1) most hospitals had plans for

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[29] Wetter D, Daniell W, and Treser C. Hospital preparedness for victims of chemical or biological terrorism. *Am J Public Health*. May 2001. 91(5):710–716.

[30] Mann NC, MacKenzie E, Anderson C. Public health preparedness for mass-casualty events: a 2002 state-by-state assessment. *Prehosp Disaster Med*. Jul-Sep 2004. 19(3):245-55.

[31] Higgins W, Wainright C, Lu N, Carrico R. Assessing hospital preparedness using an instrument based on the Mass Casualty Disaster Plan Checklist: results of a state-wide survey. *Am J Infect Control*. Oct 2004. 32(6):327-32.

[32] Niska RW, Burt CW . Bioterrorism and mass casualty preparedness in hospitals: United States, 2003. *Adv Data*. Sep 2005. 27;(364):1-14.

dealing with new emerging threats (chemical – 85.5%, biological – 84.8%, radiological/nuclear – 77.2% and explosives – 76.9%), (2) Hospitals' percentages of training their staff in any kind of exposure ranged from 92.1% (nurses) to 49.2% (medical residents), (3) Although explosions are the most common form of terrorism, drills for these incidents were staged by only one-fifth of hospitals.

The possibility of a terrorist attack employing the use of chemical or biological weapons of mass destruction (WMD) on State of Mississippi was explored via a questionnaire survey by Bennett in 2006[33]. According to his findings state hospitals scored well in education and training (89.2%), decontamination facilities (75.7%) and pharmaceutical stockpile (56.8%). Hospitals scored badly in increasing surge capacity (59.5%) and laboratory diagnostic services (91.9%). In conclusion:

> *...hospitals in the State of Mississippi, like a number of hospitals throughout the United States, are still not adequately prepared to manage victims of terrorist attacks involving chemical or biological WMD which consequently may result in the loss of hundreds or even thousands of lives. Therefore, hospitals continue to require substantial resources at the local, State, and national levels in order to be "truly" prepared.*

Reilly, Markenson and DiMaggio conducted in 2007 a similar state-wide study on EMS personnel preparedness[34]. Their results indicate that:

> *Lack of training and education as well as the lack of necessary equipment to respond to WMD events is associated with decreased comfort among emergency medical services providers in responding to chemical, biological, and/or radiological incidents. Better training and access to appropriate equipment may increase provider comfort in responding to these types of incidents.*

These studies and many others available in medical bibliography support the overall impression that although many things have been done, much more needs to be done.

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[33] Bennett RL.Chemical or biological terrorist attacks: an analysis of the preparedness of hospitals for managing victims affected by chemical or biological weapons of mass destruction. *Int J Environ Res Public Health.* Mar 2006. 3(1):67-75

[34] Reilly MJ, Markenson D, DiMaggio C. Comfort level of emergency medical service providers in responding to weapons of mass destruction events: impact of training and equipment. *Prehosp Disaster Med.* Jul-Aug 2007. 22(4):297-303.

Current situation in European Union

Six EU member-states (Bulgaria, Czech Republic, Germany, Greece, Poland and the UK) participated at the ETHREAT (European Training for Health Professionals on Rapid Response to Health Threats) consortium representing highly specialized organizations and institutes on public health issues. The National and Kapodistrian University of Athens was responsible for the management and coordination of the project (2005-2008) as well as for the cooperation of the whole partnership with the European Commission (Directorate for Public Health), which co-financed the project. I participated in this project as CBRN consultant.

The final product of ETHREAT Project was to create a manual aiming to assist training institutions, universities and public health authorities in the education of health professionals, so as to enhance the European human capital on the timely identification, the management and response to events that could be the result of deliberate attacks with the use of biological, chemical and radiological agents.

Moreover, the project team explored the opinions of their target audience and of European experts on the existence and appropriateness of currently available programmes, as well as the desired content of an educational package by surveying front line health professionals (FLHP) and PH and CBRN experts in the European Union (EU) member states (MS). An outline of the major findings from the questionnaires disseminated is presented in Appendix A.

During the 2006 annual conference of the 14th European Public Health Association and following oral presentation of the ETHREAT Project, we concluded[35]:

> *Our results reveal a gap in the base of medical CBRN defence in all EU countries at the level of front line health professionals that will deal first with WMDs casualties in urban environment. Therefore, emphasis will be placed on strategies for the diffusion of the final educational material in all the 25 member-States and particular to the students of medical and nursing schools with final aim the incorporation of the relevant material to the last year of medical and nursing studies.*

[35] Andriopoulou E, Galatas I, Baka A, Kirch W, Fuchs A, Kyncl J, Dowie J, Szosland D, Koycheva V, Tavoulari E, Kotsioni I, Linos A. European training for health professionals on rapid response to health threats following biochemical terrorism incidents. *European Journal of Public Health*. 2006.16(Sup 1):123.

CHAPTER FOUR - Medical defense against chemical terrorism in urban environment

Hypothetic scenario

> **13:00** – *in a busy multi-store shopping mall, shoppers start falling down with convulsions and frothy saliva coming out from their mouths. People panic and call the police. Police crew that arrived on site experienced similar symptoms. Head of mall security calls police HQ and give a brief description of the incident. First responders arrive at the incident site after 30 minutes. An explosion takes place at the parking entrance of the mall where responders were gathered ready to enter the complex.*
> **14:00** – *a second explosion is heard from the near-by square in front of the Parliament where change of guard is taking place and hundreds of tourists are watching. A second wave of first responders is directed to the new incident area. Many tourists experience difficulties in breathing and dim vision.*

Important clarification: Following directives and proposals are valid for a CBRN incident that evolves in a randomly selected urban area. In case of known targets (i.e. during the opening ceremony of Olympic Games), the deployment of forces and mode of action (triage, decontamination, evacuation etc) is totally different and it is not within the scope of this paper. Also, the contaminated plume generated in this realistic scenario is expected to be limited affecting only a few blocks' area compared with other forms of CWAs release (i.e. chemical munitions, multiple chemical attacks in subway system etc).

At the incident site

Three important statistics

To start with it is important to memorise **three important numbers**[36]: Approximately **10-20%** of the people at ground zero will stay there because they are dead or severely contaminated and/or wounded. The second number to remember is that approximately **80%** of the people involved in the incident will flee to every possible direction – including those with minor lessons and mild contamination. They will panic and will be directed to all medical facilities available in this area or near their residence – perhaps later on depending on the agent released. The third import number is the varying ratio **"1:5"** regarding "contaminated vs. worried well" individuals that will

[36] Nyberg, Ann Göransson. MASs-casualties and Health-care following the release of toxic chemicals or radioactive materials (MASH Project): WP6-Report. 30 March 2009. URL: http://www.mashproject.com/index.php?option=com_content&view=article&id=10&Itemid=13 [Accessed: 23 August 2010]

soon overwhelm hospitals' surge capacities[37]. These numbers are critical in CBRN response planning because they represent normal reactions of people involved in a catastrophe. An equally important issue is that CBRN planners must have personal training and experience in all levels of PPE. It is common practice "people who know things not to sign and those who sign not to know things from inside!" Just theory is as dangerous as the threat society itself is facing.

Golden hour

People evacuating the incident site in combination with the explosions' effects will create traffic chaos in an area of many blocks surrounding the attack area. Soon traffic will come to a stop and there will be no free lanes for first responders to move in order to approach the hot zone. Massive fire engines, police cars, ambulances, mobile decontamination units might be available but they will be "sitting ducks" unable to arrive on time. And time defined as the "golden hour" is critical since it is "*the hour immediately following traumatic injury in which medical treatment to prevent irreversible internal damage and optimize the chance of survival is most effective*[38,39]*.*"

Although this definition derives from conventional accidents, military battlefields or urban terrorist attacks, it is of value for CBRN incidents as well. The difference is that in case of CWA release it might be "golden minutes" instead of "golden hour". So it is taken almost for granted that first responders and specialized medical units will arrive late to assist those that will remain on site and most probably they will be dead on arrival. Perhaps the only good solution available for urban environment is that of the Israeli "Magen David Adom" (national emergency medical, disaster, ambulance and blood bank service). Part of their first responders crews are on motorcycles that can penetrate heavy traffic fast and arrive on time at the incident site.

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[37] Stone, Fred. *The "worried well" response to CBRN events: analysis and solutions*. The Counterproliferation Papers. Future Warfare Series No. 40. USAF Countreproliferation Center. Air University: Maxwell Air Force Base, Alabama. June 2007; pp. 1-64.

[38] Merriam-Webster Online Dictionary. Golden hour – definition. URL: http://www.merriam-webster.com/medical/golden%20hour [Accessed on 28 July 2010]

[39] Lerner EB, Moscati RM. The golden hour: scientific fact or medical "urban legend"? *Acad Emerg Med.* 2001, 8:758–760.

First responders at the incident site

Hypothetically, first responders do arrive at the incident site on time. What will be their medical contribution to the victims on the spot? For the reasons already described: minimal to none. The main problem is that nobody knows the nature of the agent released. Common practice is to enter hot zone with totally encapsulated gear (Level "A"). Common objection is that when **in Level "A"** the window from donning to doffing is approximately 20 minutes (maximum 40 minutes). The main objective of this team is to go in, evaluate the situation and report, activate their detectors and report, take samples (if possible) and then get out. It is almost impossible to practice medicine on site, to carry loads of possible antidotes, stop bleeding, support ventilation and carry stretchers for the wounded or contaminated victims. The only reason for justifying the presence of medically qualified personnel (fire or police medics) inside the hot zone is to provide assistance to first responders themselves in case someone is wounded by falling debris, fire from remaining terrorists, secondary explosion aiming first responders or accidental tearing of PPE thus exposing responders to contaminated environment.

It is of note that if police crew practice the **"1-2-3" rule** (one person down is normal – might be a hear attack or just faint, two people down proceed with cautious, three and more down step aside, secure perimeter, report and wait for assistance) upon arrival they might be alive and able to assume duties mainly by directing panicked people out and securing the perimeter until more forces arrive on site. It would be also ideal if they had personal **escape hoods** that would have protected them from the agent released and would provide them enough time to do their job safely[40].

At the hospital

Casualties seek medical assistance

People escaped from the incident site will return to their homes or rush to the nearest hospital available. If the hospital is very close to the incident site it would be caught by surprise – especially if they have not notified in advance (common practice). With zero reaction time, even if the hospital has the proper structures, personnel, PPE, plan and procedures, frustrated crowd with rush into EMS premises

[40] King, Alan. Going for the Gold. *CBRNe World.* Spring 2009. URL: http://www.cbrneworld.com/pdf/09_spring_Going_for_Gold.pdf [Accessed on 18 July 2010]

demanding medical assistance. Depending on the agent released this might lead to the contamination of EMS personnel or even other areas of the hospital. The basic principle "save the savers to operate" will be compromised in just a few seconds. A second problem in near by hospitals is the fact that they have not enough security personnel to control the crowd and in many instances not a perimetric fence to forbid unauthorized entrance into the hospital area. But even if there is a fence it might be jumped over by people who believe that their lives are at stake. Security personnel are valid for daily routine and car/visitors control but totally insufficient when dealing with many people some of which are contaminated. They do not have PPE, they lack specialized training, they do not know how to protect themselves while on PPE. Most probably they will run away to save themselves.

Hospitals that are located far away from the incident site might also be caught by surprise if they speculate that casualties will go the nearest to the incident's site, hospital. In Tokyo (12.3 million inhabitants) ALL hospitals and clinics accepted more than 5.000 casualties from the sarin incident at the metro system. In that respect all hospitals within megapolis' limits must be prepared to deal with CBRN mass casualties. An alternative might be to shut down those hospitals that lack resources to deal with such emergencies. It might sound unethical but life will continue in the aftermath of the incident and health is a mandatory asset for the society. Another expected phenomenon would be all casualties to rush in the near by hospital while at the same time, another well prepared hospital but in a lesser proximity, might manage no casualties at all! Therefore casualties' guidance and redirection is as important as medical assistance itself.

Casualties arrive at the hospital

Following the Tokyo incident, more than 85.5% of those involved arrived at the hospital with their own cars, taxis, mini-vans or even buses. So there is no need to send vast numbers of ambulances at the incident site. They will serve better if they provide assistance to the one or more hospitals that will be overwhelmed with casualties. It is of note that ambulances windows must keep their windows open to dissolve further the contaminants absorbed on victims' clothing.

Hospital security

Hospital must be secured by sufficient police forces in PPE who have relevant training. It is important police forces to be there well in advance before first casualties arrive.

Hospital's CBRN Response Unit

This is the biggest problem in all CBRN plans and directives. Should it be permanent or deployable? What is the best composition of such a medical team? What should be the motivation to participate? What would be the criteria for selection? Who will cover equipment and training expenses?

From what it has already been mentioned above, the nature of the incident dictates hospital to have a dedicated CBRN response team that will operated in fixed installations outside the main building of the hospital. This might be possible for hospitals in close proximity to chemical plants or major targets. Although it is ideal, hospitals' authorities consider it as loss of people, resources and time.

A second option might be to train and equip all the personnel involved in EMS departments. This is a more realistic approach but certain individuals might fail to operate under PPE mainly for various reasons (i.e. age, fitness, medical conditions, etc). This is the best proposal taken into consideration that decontamination facilities for both walking and ambulatory casualties will be fixed and ready. Then all that it takes is the time to don and this can be minimized by continuous training and acclimatization to PPE.

EMS CBRN Response Unit

By choosing the latter option what must been done next is to make a response plan that will be proportionate to the available personnel and the duties they have to perform. This will determine the type of equipment that must be purchased. It would be wise to have a commn *modus operandi* that will be practiced by all medical facilities nation-wide. In that respect there will be compatibility of equipment and homogeneity of training and standard operational procedures.

Duties

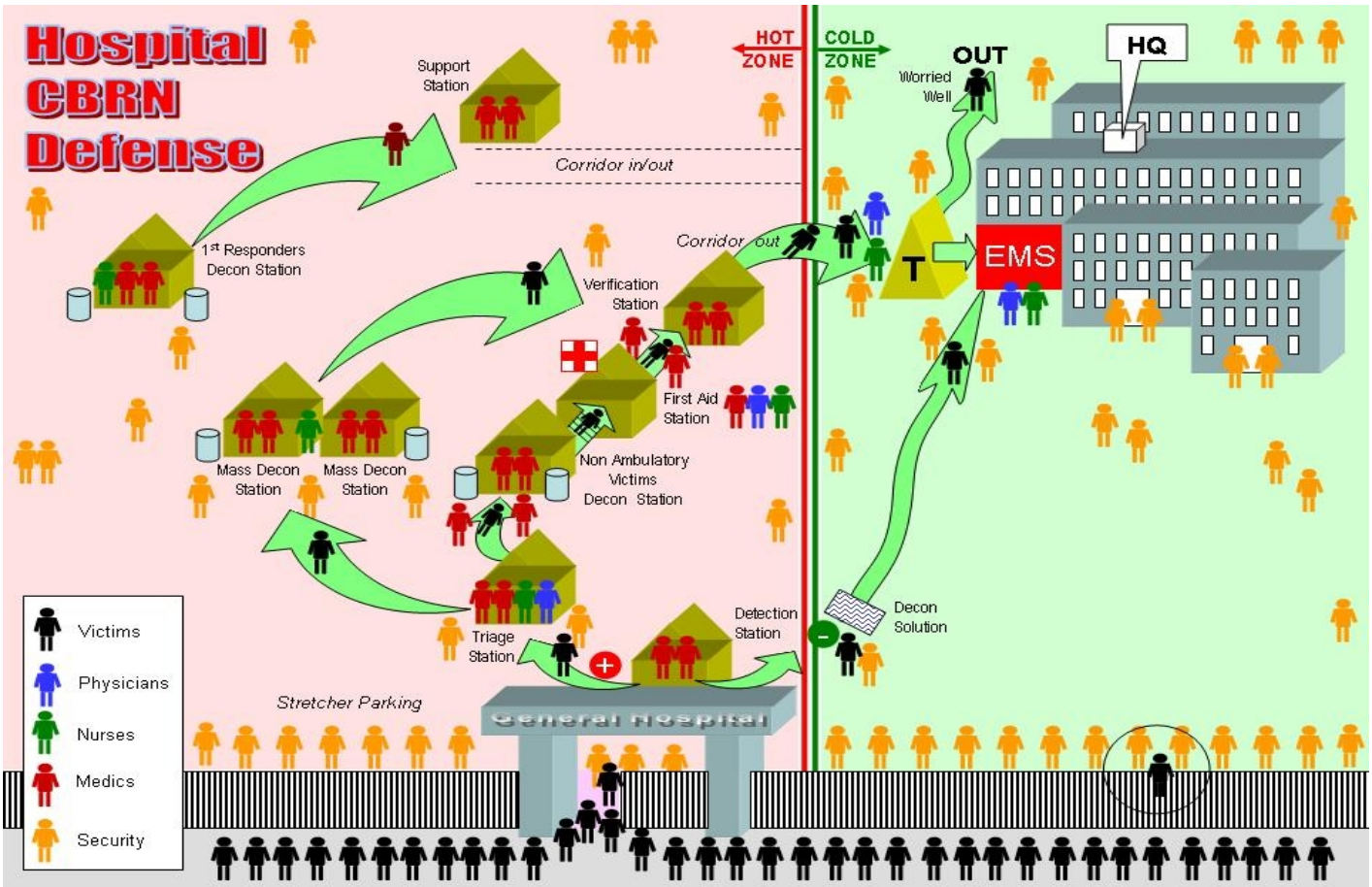
The EMS CBRN Response Unit must have a single operational goal. That is to contain contamination outside the hospital's premises. They will become the barrier

between the contaminated outside environment and the inside of the hospital where their colleagues will continue to operate safely without PPE and in support of the Unit. It must be clear to all that a "clean" chemical or radiological casualty can be handled thereafter safely and "as usual".

Main duties to be performed at the hospital parking lot or other suitable area (Figure 1):

NOTE: This area is considered as gradually contaminated area (warm zone)

Figure 1 – Hospital CBRN defence plan – Chemical: Working Stations



Source: Galatas I (2004)

(1) Initial detection of incoming casualties (Detection Station)

All incoming casualties are scanned for possible chemical and radiation (just in case…) contamination. Chemical/radiological contamination detection time depends on the number of incoming victims. If they are only a few modern detection equipment can be used. It is of note that detection takes some time to accomplish and it should be done in specific mode from head to toe. If the victims are many and in

order to avoid overcrowd in the main gate of the hospital, simpler but equally effective CWAs' detection can be done by using special chemical colorimetric papers that indicate exposure or not. These self-adhesive papers can be stacked onto mouth pieces for single usage. If the incomer has been declared "clean" he follows security personnel to a "decontamination tank" containing a solution that will clean any small amounts of agents from his shoes. Then they proceed to the EMS department. If the incomer has been declared "contaminated", he is given further directions to proceed to the Triage Station. Both procedures are applied to non-ambulatory victims as well

(2) Triage of incoming casualties (Triage Station)

All "contaminated" incomers are passing through Triage Station. If they are walking victims or those with minimal injuries are given instructions, to proceed to the Mass Decontamination Station. If they on stretchers, CBRN triage methodology is applied. Most preferred system is the START (Simple Triage and Rapid Transport) triage system[41] that classifies victims into certain categories of medical priority ("immediate", "delayed" and "deceased"). On each victim a paper (Japan) or plastic (Israel) triage card of different colour is attached. If plastic, information about the victim can be recorded by punching holes in them using a finger[42].

In 2007, Japanese researchers proposed a system that combines triage with cards under the name STARDOMCCP (Simple Triage and Rapid Decontamination of Mass Casualties with Colored Clothes Pegs System)[43]. This system employs ordinary inexpensive clothes pegs in 7 colours: Red (emergency care), Yellow (semi-emergency care), Green (non-emergency care) and Black (expected) while White is for dry decontamination (clothing removal) and Blue for wet decontamination. In each victim two pegs define its medical/decontamination status. Employing a more military style recording (Israel), triage personnel might use permanent (water-proof)

[41] Critical Illness and Trauma Foundation, Inc. *START triage system*. URL: http://www.citmt.org/start/flowchart.htm [Accessed on 22 December 2009]

[42] Zoraster RM, Chidester C, Koenig W. Field triage and patient maldistribution in a mass-casualty incident. *Prehosp Disast Med.* 2007, 22(3):224–229. [Accessed on 22 December 2009]

[43] Okumura T, Kondo H, Nagayama H, Makino T, Yoshioka T, Yamamoto Y. Simple triage and rapid decontamination of mass casualties with the colored clothes pegs (STARDOM-CCP) system against chemical releases. *Prehosp Disast Med.* 2007, 22(3):233–236. [Accessed on 22 December 2009]

pens to write directives/notes directly on the skin of the victim (especially important for doses of antidotes provided; also info stay with the victim all the way to EMS).

Many clinical triage algorithms' models have been proposed so far the optimal management of mass terrorist events' casualties. When EMS personnel have to deal with vast numbers of victims "the simpler is the better"[44]. Victims should be periodically re-evaluated for possible changes into their clinical/priority status.

(3) Decontamination of non-ambulatory (NA) victims (NA Decontamination Station)

This is the most difficult mission for the personnel involved since they will have to simultaneously manage contamination and (in many instances) conventional wounds. Record the victim and provide a wrist bracelet with a unique number (or barcode). Use same number to identify victim's valuables placed in double-sealed bags. If there are bandages applied in advance, remove them and replace them following copious irrigation of the wound. With water/saline or bleach? This is a controversial question; the main objective is to remove contaminants from inner tissues as soon as possible and as thoroughly as possible; both are effective[45]. Cut all clothes and dispose them. Proceed fast but carefully. If victim deteriorates during decontamination ask assistance from the near-by First Aid Station. Usually decontamination is performed on a special roller system that allows easy rolling of victim from one station to the other.

(4) First Aid provision to NA victims (First Aid Station)

One of the myths surrounding medical CBRN operations is that medical staff cannot perform while being into their PPE. Mainly because of the heavy rubber gloves that accompany this type of protective gear. The truth is that many things can be done with appropriate training and methodology. First personnel can replace rubber gloves with two sets of surgical gloves (white) and a third one (purple) on top

[44] Bond WF, Subbarao I, Kimmel SR, Kuklinksi J, Johnson C, Eberhardt M, Vozenilek J. Testing the use of symptom-based terrorism triage algorithms with hospital-based providers. *Prehospital Disast Med.* 2008, 23(3):234–243. [Accessed on 22 December 2009]

[45] Levitin H, Siegelson HJ,Dickinson S, Halpern P, Haraguchi Y,Nocera A, Turineck D. Decontamination of mass casualties — Re-evaluating existing dogma. *Prehosp Disast Med.* 2003, 18(3):200–207. [Accessed on 22 December 2009]

of them. This method is safe for the saver and provides extra sensitivity and feeling. Replace purple gloves every five minutes or when a new patient arrives.

There are three procedures that are life-saving and **can be done** on site: provide antidotes (i.e. atropine [auto-injectors or regular vials for hospital usage), control bleeding (with the aid of haemostatic means (i.e. haemostatic sand in a sponge [Quiklot™ and similar] for single use) and support airways (remove excessive salivation blocking the airways (i.e. nerve agents) all the way to regular intubation. Following the latter, patient can be connected with breathing support apparatus or bag-valve-mask ventilator[46] (providing they have a CBRN filter attached – i.e. compPAC™ ventilator or AMBU™ Mark III Resuscitator). In fact, among the long list of first aid equipment supplied from the hospital (regular items), only ventilation support (above) need to be purchased separately.

For training purposes, the First Aid Station environment can be duplicated in a dedicated hospital simulation room ("tent-in-a-room"), where EMS personnel can be regularly trained[47]. In that respect, the Laerdal's latest SimMan™ 3G with NBC module and accompanying software could make the difference and are highly recommended.

(5) Mass decontamination of walking casualties (Mass Decontamination Station)

While waiting to be decontaminated, walking casualties must be asked to remove ALL their clothes (dry decontamination). This simple method can be live saving since it reduces contamination to minimum. Certain problems emerge during this procedure. Even if their life is at stake, certain people will refuse to remove them completely for their own reasons (physical condition, modesty, religion). There is no reason to insist on this. Rephrase your orders to "as many clothes as possible and desire."

Then it is the language barrier that might complicate things. Do not assume that all victims understand English. A good solution (but expensive) is to have

[46] Schumacher J,Weidelt L, Gray SA, Brinker A. Evaluation of bag-valve-mask ventilation by paramedics in simulated chemical, biological, radiological, or nuclear environments. *Prehosp Disaster Med.* 2009, 24(5):398–401. [Accessed on 1 July 2010]

[47] Haim Berkenstadt, Amitai Ziv, Daphna Barsuk, Inbal Levine, Amir Cohen, Amir Vardi. The Use of Advanced Simulation in the Training of Anesthesiologists to Treat Chemical Warfare Casualties. *Anesth Analg*. 2003, 96:1739 –42. [Accessed on 5 January 2010]

electronic message boards that can show messages in many languages. Instead you can use inexpensive placards with multi-lingual messages.

Try to have the unclothing area as "visually" protected as possible (mass media are everywhere – even airborne!). This will be an add-on for victims to reluctantly discard their clothes.

Give clear instructions on the washing procedure and time. Stress the fact that hard brushing is no better than normal brushing that leave skin intact. Let families be together. Separate males from females. Record patients and give them a wrist bracelet with a unique number (or barcode) printed. Collect all their valuables and put them in double-sealed bags where same referral number is attached. In the aftermath, there will be many that will claim their valuable Rolex watch now missing… Let them have their eye-pieces, hearing aids or walking canes if they cannot function without them.

Have some nurses or medics to keep an eye on the victims during the decontamination process. Some might deteriorate during washing and need first aids or transfer to the First Aid Station. During hot weather conditions, decontamination can be performed with cold water (that reduces vasodilatation of skin thus reducing absorption[48]). If the incident takes place during winter time, warm water should be used to avoid hypothermic reactions. Provide a post-decontamination clothing kit (like those surgery personnel is using).

(6) Verification of decontamination for (Verification Station)

Following decontamination of walking on NA casualties, it is wise to confirm it by having victims check-out through Verification Station. Properly equipped personnel will detect if there is residual contamination present. If there is, individual must repeat the decontamination process again given priority. If there is no contamination present, individual is accompanied via the "out corridor" (warm/cold zones border) to the hospital main triage area for thorough evaluation and hospitalization if required.

(7) Decontamination line for first responders (First Responders Decontamination Station)

[48] Clarke SFJ, Chilcott RP, Wilson JC, Kamanyire R, Baker DJ, Hallett A. Decontamination of multiple casualties who are chemically contaminated: A challenge for acute hospitals. *Prehospital Disast Med.* 2008, 23(2):175–181. [Accessed on 1 July 2010]

There is a standard operational procedure that cannot be surpassed by any means: **First responders DO NOT operate unless they have their separate decontamination line in place**. Personnel (hospital responders, supporting first responders) in PPE (various levels – "A", "B", "C"), cannot wait in line with victims waiting to be decontaminated – for obvious reasons. If operations going to last for many hours, it is advisable to deploy a collective protection (COLPRO) tent where personnel can rest, replace filters, hydrate etc.

Main duties to be performed at the warm/cold zones' border:

(8) Thorough triage of "clean" casualties (Hospital Triage Station)

The moment contaminated victim becomes "clean" then it can be handled as usual by EMS personnel without PPE being necessary. At the Hospital Triage Station patients will be hospitalized if this becomes apparent according to their clinical status. In the same area, a team of psychiatrists and psychologists will evaluate possible "worried well" individuals and direct them to return home this avoiding the overwhelming of the hospital[49]. It is clever to provide written instructions on "what to do" in case delayed symptomatology develops.

It is of note that "psychological desensitization" of all personnel involved in field medical CBRN operations is mandatory for their well being on the long run[50]. This is something that is usually forgotten even during the daily routine of an EMS department.

[49] Leiba A, Goldberg A, Hourvitz A,Weiss G, Peres M, Karskass A, Schwartz D, Levi Y, Bar-Dayan Y. Who should worry for the "worried well"? Analysis of mild casualties center drills in non-conventional scenarios. *Prehosp Disast Med*. 2006, 21(6):441–444. [Accessed on 5 July 2010]

[50] Ruzek JI,Walser RD,Naugle AE, Litz B, Mennin DS, Polusny MA, Ronell DM, Ruggiero KJ, Yehuda R, Scotti JR. Cognitive-behavioral psychology: Implications for disaster and terrorism response. *Prehospital Disast Med.* 2008, 23(5):397–410. [Accessed on 5 July 2010]

CHAPTER 5 - Medical/hospital chemical-radiological defense during the 2012 Olympic Games in London, UK

Athens' 2004 Olympic Games medical/hospital CBRN defense experience

As military CBRN consultant attached to the 2004 Olympic Games Security Committee and Commandant of the Olympic Hospital CBRN Response Unit deployed at the Army General Hospital of Athens there are certain "problems identified" that will be collectively presented herein:

Pre-games status:

General attitude: "It will not happen to us…" This small sentence was the biggest obstacle all CBRN-related specialists were facing in almost all levels of authority. Focused on traditional/conventional terrorism all relevant authorities had no faith that weapons of mass destruction could be released during the biggest athletic event of mankind. Even after the 9-11 incident and "anthrax-letters" they were reluctant to admit that this is the new reality and that the least we could do was to take this under serious consideration. Of course, CBRN defense for such a major event required a lot of money that would exaggerate further the already out of control budget.

Medical/Hospital personnel/structures: When come to medical/hospital/ public health entities, the situation was much more primitive. Medical people had minimum to zero knowledge regarding CBRN threats and their consequences on humans and societies. The same applied for CBRN crisis management that is totally different than any other medical crisis during peace time. It took a lot of time to re-educate all these entities and try to make them realize the magnitude of the problem. But even the extended presentation of the Tokyo, Bohpal and Guiânia incidents did not bend their skepticism.

A second severe point of traction was their attitude in participating in "hot" and "warm" operational zones. Sterile objection could be replaced with productive willingness to learn and participate. With some limited exceptions from the EMS people, they strictly refused any kind of involvement.

What was the case on personnel preparedness the same was applied for CBRN structures' preparedness. During the Games, Olympic Hospital CBRN Response Unit

was the only hospital-oriented unit deployed in all five Olympic cities. It was the only unit that was ready to accept CBRN casualties – mainly chemical and few inner radio-contaminated victims. An effort to create a new bio-safety lab (BSL Level "3") was failed – the lab was ready made but manning was absent. Same applied for the negative pressure ward (12 beds able to expand to 24) that has been equipped with negative pressure capabilities (including a central Microgenix™ air purification system[51]), but it was faulty constructed by a civilian constructor who did no follow detailed guidelines given.

Despite the past global experience of SARS and avian flu only a few hospitals in Greece had a handful of negative pressure wards. Mass decontamination at hospitals? A joke! Most probably they would wait for firemen to arrive and create "water curtains". Or even worse: redirect all casualties to the "specialized" Army Hospital! CBRN response plan? Yes, they all had copies of the master CBRN plan where there was a big entity devoted to medical mass casualties. But big plans are not easy to study and implement.

Total lack of CBRN PPE: With the exception of EMS personnel, hospitals lacked PPE. Medical planners must realize that theory and practice when come to CBRN operations go hand-by-hand. A few lectures on weapons of mass destruction are NOT enough to make audience realize how hard it is when you don the PPE and you asked to save lives.

Let us suppose that all hospitals' EMS departments were equipped with PPE stored in a special room. Can anybody imagine the moment that the threat becomes real and they open the room to distribute PPE? What if in that particular shift, chief surgeon on duty is a doctor with a history of double by-pass just 6 months ago? Does anyone really believe that all these people will last more than 15 minutes? Medical people must feel when in PPE as comfortable as with their white blouses! (exaggeration? perhaps; but most close to reality). At the Army Hospital, unit's personnel were practicing daily, march, run, load and upload stretchers, even slept on PPE – even with ambient temperatures of 35^0 to 40^0 C! It was hard, but the purpose was sacred – we had a mission to accomplish!

[51] Clark AJ, Bird H, Goodyear D, Reid K, Webber D, Whatley P. *Trials assessment report: Prototype air filtration system.* DERA, CBD Porton Down (an Agency of the UK Ministry of Defense) – Commercially sensitive. 2000:1-32

Lack of cooperation/integration between civilian-military medical systems: Although both systems practice same medicine, a hidden competition arose during the Olympic Games. This competition transformed to opposition when mass CBRN casualties were put on the table. The opinion that this is a "military medicine issue" was universal and their attitude firm. On the other hand, military hospitals are just hospitals that take care of the enlisted personnel, veterans, their families and a few categories of civilian patients. Military medical personnel did not had a special kind of training on how to cope with CBRN casualties – especially in urban environment that is so different from field operations. But still it was a matter of "military medicine". Even amongst military hospitals there was argument on who will be in charge and take the heat in case of a real CBRN terrorist incident. The establishment of the Medical CBRN Response Unit supported by Air Force General Hospital and Naval Hospital of Athens was a solution that worked out well.

Olympic Games' status

During the Olympiad in Athens (the first summer Olympiad after 9-11), the Olympic Hospital CBRN Response Unit was ready on-time and in place in full alert.

A second military medical-oriented CBRN unit created in the last half of 2003 was also ready. The target of this Joint Medical CBRN Unit (250 physicians-nurses-NCOs), was to support first responders (police, firemen) in operations within the "hot" and "warm" zones. At the same time they could provide support to Army Hospital's existing unit, to Olympic Hospitals near incident's area or to Olympic Hospitals located in the four participating Olympic cities.

NATO provided the NBC Battalion that in full composition was stationed in the city of Chalkis (approximately 88 km away from Athens). The historian of the future might reveal who choose this location and what international planners had in mind in case of a real CBRN terrorist incident. CBRN planners must once and for all realize that being "ready and far away" is not as important as being "ready and on the spot". In CBRN operations time is not money; "time is life!"

Post Olympiad status

Military sector: The Olympic Hospital CBRN Response Unit was gradually diminished and finally dissolved by the end of 2004. Military medical hierarchy believed that after the Games the threat was not real anymore projecting the heavy

daily work schedule that left no time for continuation of training, drills, equipment maintenance etc.

The Joint Medical CBRN Unit was transformed to a Joint CBRN Platoon located in Athens. This was the only gain for the military. At least now Hellenic Armed Forces we have something ready to deploy and assist if needed.

The BSL-3 lab turned to be an ordinary microbiology lab while the negative pressure ward is now used for hospitalization of daily infectious disease cases – mostly as an isolation area with limited access. What a disappointment for those dreamed a new era in military medicine… The original dream of a just a few people for a hospital-based CBRN unit supported by a BSL-3 lab and a negative pressure ward dissolved by the lack of ability of "those who sign" to have a look in the future to come. The inner belief of "nothing will happen to us" prevailed – one more time!

Civilian sector: After the Games, civilian sector returned to normal. CBRN adventures and possibilities were forgotten overnight. Those involved in certain medical CBRN trainings were absorbed in various services and desired continuity and passing the experience to new generations was thrown to a drawer and left in the dark. More or less the same applied for first responders although police still conducts some training seminars from time to time. Officials in high places tend to forget or forget at will, that people with certain specialization and training are getting older, transferred to desk offices, transferred to other cities or have new duties while many of them retire or die. If a new generation of people involved in management of new emerging threats fails to exist, then state CBRN preparedness will return to zero soon. Until next time something "big" will happen somewhere in the world. Then mobiles will start ringing again (it is of note that the "diagnosis" of the agent released in Tokyo was made by a retired "chemical colonel" who was watching the news), plans will be back on the table for revision, new units will be formatted, veterans will be asked to participate because they have the knowledge and experience – but it might be too late.

Key-points regarding medical/hospital chemical-radiological defense during the 2012 London Olympic Games

In August 2010, the United Kingdom will have the pleasure and pride to host the Summer Olympiad. It is a common secret that security is the number one priority for the hosting country. It is also known that the United Kingdom is among the top five countries that terrorists would love and pursue to attack for many reasons. Global

television coverage of this major event provides the best opportunity to pass their message to the rest of the world and succeed a strike to remember to the infidels. A strike that has to be "bigger" from 9-11 in order al Qaeda, affiliated and franchise to "keep face" (keep respect) amongst Muslim world. Perhaps a simultaneous strike with 10 airplanes crashed in urban targets within the country's major cities would do the job. A chemical or radiological attack downtown London is even better. A combination will raise the long board to immense heights!

In that respect, a few key-points will be referred below regarding medical/hospital CBRN defense during the Games:

- Time left is barely enough to feel the gaps in medical CBRN defense.
- All hospitals in London and other Olympic cities must be prepared to deal with mass CBRN casualties. Chemical and radiological casualties should be a priority.
- All EMS departments' personnel must be trained in CBRN operations and acclimatize in PPE usage and performance.
- Find the right ways to motivate hospital personnel. Work with these people and listen to their needs and hesitations. It would be nice to do it "for the Country and the Queen!" But at the beginning of the 21st century, are you sure that this alone will work?
- All hospitals must have the same CBRN response plan. The plan must be short and clear, threat-specific, with defined duties and responsibilities.
- CBRN equipment must be carefully purchased with emphasis to urban operations. All military CBRN equipment is not suitable for long lasting operations. Companies will try to sell everything they have! This is why the plan is so important! Duties derive from the plan. Equipment derives from duties. Ask the question: "do we really need this"? Improvise and/or adapt. It will cost less and it will do the job perfectly.
- Mass decontamination facilities must given priority. Hospitals do not have to buy expensive decontamination systems; an open-minded plumber with dedication and inspiration will do the job. Choose the biggest wall of the hospital and fill it with showers (even better have water from the top and two more water-jets for trunk and lower extremities). Construct a waste water

collection tank underneath and connect it with the main drainage system. Construct many isolation panels like those you have at the hospital wards. Privacy is ready. It might look primitive but will do the job!

- Program many drills: threat-specific and combination drills; hospital drills, drills between hospitals, national drills, hospital-first responders' drills; table-top, night and day drills. It is different on paper and in real life operations.
- Cooperate with OPCW for chemical defense issues could be extremely fruitful. Apply for activation of "Article X" provided for all member-states. It does not matter how big country Great Britain is. CBRN events are bigger than countries! Why taking the risk to do it all by yourself?
- Medical CBRN Defense and/or Terror Medicine should be included in the curricula of last years of medical/dental/pharmaceutical/ veterinary/nursing and public health schools. This is the only solution to private future front line health professionals with some basic knowledge of new emerging threats and their effects on humans, livestock and environment. If the young doctor is unaware of anthrax then for people coming to his shift or his private practice, his differential diagnosis would be between "flu" and "flu". Do you think that your surgeons have the knowledge and practical experience to deal with suicide-bombing blast injuries? The training package (presentations, manuals, pocket cards, practical training) can be done once and then disseminated to all schools of interest. A good starting point might the already existing guide from Health Protection Agency entitled "CBRN incidents: Clinical management and health protection[52]" or the ETHREAT manual[53] for front-line health professionals entitled "How to respond to radiological, biological and chemical threats". For the practical training (if applicable) the Defence Nuclear, Biological and Chemical Centre [DNBCC] at Winterbourne Gunner (Salisbury) would be ideal. You can even create an entirely new "UK Medical CBRN Training School" that will serve universities' needs. There are many experienced people (in national and international level) who can facilitate the

[52] Heptonstall, Julia and Gent, Nick. *CBRN incidents: Clinical management and health protection*. Health Protection Agency. 2005:1-65

[53] EUROPA, DG Health and Consumer Protection, Public Health. *ETHREAT Project*. URL: http://ec.europa.eu/health/ph_projects/2004/action2/action2_2004_02_en.htm#4

program with minimum cost. Take advantage of your military medical personnel on duty in Afghanistan. They are more than willing to transfuse their unique expertise to domestic colleagues. Take advantage of the medical innovations used in the war field to strengthen your medical shield in the inland. Involve retired medical personnel with active experience from IRA era. They can teach things that younger generations of doctors cannot imagine or read in the books. Unfortunately, evolution usually walks through wars and losses of human life.

CONCLUSIONS

When in 1995 members of the Aum Shinrikyo cult attacked Tokyo's subway by releasing nerve gas sarin, the world was shocked. It was the first usage of chemical warfare agents in megapolis environment and a new shift in terrorism. Since then, and especially following "anthrax letters" campaign accompanying the 9-11 incidents in the United States, the possibility of employment of weapons of mass destruction by terrorists of the future became more evident. It is not "NoBody Cares" (NBC) anymore. Instead new emerging threats are amongst top three mega-threats Western societies will be asked to confront. CBRN agents provide destruction, produce terror, gain sky rocket media ratings and sometimes might even achieve political gains.

In all CBRN plans, medical/hospital CBRN defence represents the "weak link". State bodies tend to invest in operational aspects of CBRN operations forgetting that medical consequences might last months or even years. On the other hand, medical community in general is not very willing to be involved in such operations. Basically it is ignorance and lack of specialized knowledge that creates an exotic environment when comes to chemical weapons or dirty bombs. The key to this problem is training in both theory and praxis. Theory and praxis turns a medical student to thoracic surgeon. Theory and praxis turns an EMS physician to medical CBRN specialist. Without training one cannot sew even a button! It is totally understood that such training requires time and effort, physical conditioning and dedication. This is the part that motivation plays an important role. The questions: "what is it for me?" and "why should I be involved?" must be addressed carefully and with good will in order to achieve the final goal – volunteering. You can not force medical people to do things. Medicine is a vocation and not just a profession!

A second problem roots within the administration attitude. If people in high places do not believe that new emerging threats pose a danger to the society, then it is extremely difficult to make a good plan. Specialized equipment cost sufficient amount of money, training cost money as well – and time. At the same time, hospitals' are always on the look for financing in order to cover daily expenses and future projects. Spending money for a program that will last only for a few weeks looks like an unnecessary investment that will bring no gain to the hospital especially when "nothing is going to happen to us!" All those involved in administrative duties must

realize that the threat is here to stay! It is an investment of life and if only one time repays its money it will be worth investing into it.

Problems identified during the 2004 Olympic Games in Athens regarding medical/hospital CBRN defence remained unsolved during the next Olympiad in China and are expected to be there during the London 2012 Olympic Games. They have to do more with the nature of the threat than the organizational concepts of the hosting countries. Perfection in counter-terrorism does not exist. Terrorists will always have the benefit of surprise and they will be always a few steps ahead their prosecutors. The solution is to minimize the distance from them in order to save as many lives as possible. It is impossible to train all doctors and nurses on how to deal with new threats. Let us train as many as possible. It is impossible to have all hospital ready and prepared to accept mass contaminated casualties. Let us focus to as many hospitals as possible. We cannot provide multi-figure bonuses to those involved in extra duties and responsibilities. We can give them a symbolic contribution to their devotion to the main cause: to organize the safest Olympic Games ever!

United Kingdom cannot organize medical CBRN defence completely by its own. Even great nations need international assistance especially from countries that have already been through the agony of organizing the biggest sports event in the world. It has nothing to do with national pride, technological development, science proficiency and all the qualities characterizing great nations. It has to do with the safety of British people and their guests from all over the world that will visit United Kingdom to celebrate in unity this major event. In that respect, people must work together against a common enemy – terrorism!

APPENDIX A

ETHREAT PROJECT AT A GLANCE

QUESTIONNAIRE ONE – For Front Line Health Professionals

Questions on: demographics, CBRN plan availability, CBRN training, PPE confidence, PPE in work place, discriminate of natural vs man-made incidents, preparation/knowledge regarding CBRN threats.

- **Questionnaires delivered: 531**
- **Origin of questionnaires: 22 EU countries**

Participants' age distribution:
- **30-39** (29.9%)
- **40-49** (26.4%)
- **50-59** (20.8%)

Participants' profession:
- **Physicians** (45.5%)
- **Nurses** (14.3%)
- **Public health officers** (26.8%)

Participants' working status:
- **Civilian** (96.5%)
- **Military** (3.5%)

National CBRN plan available:
- **No** (49.4%)
- **Yes** (50.6%)

Knowledge of whom to contact in case of deliberate incident:
- **No** (32.9%)
- **Yes** (67.1%)

Last CBRN training was:
- **<6 mo** (19.5%)
- **12 mo** (12.6%)
- **24 mo** (18.2%)
- **36 mo** (4.8%)
- **>48 mo** (17.7%)
- **Never** (27.3%)

Confidence in PPE usage :
- **Very low/Low** (17.3%)
- **High/Very high** (28.5%)

Access of PPE in workplace:

- **Very low/Low** (9.5%)
- **High/Very high** (35.9%)

Discriminate natural vs man-made incidents:

Chemical

- Very poorly/Poorly (55.8%)
- Well/Very well (31.6%)

Biological

- Very poorly/Poorly (60.2%)
- Well/Very well (30.3%)

Radiological

- Very poorly/Poorly (57.1%)
- Well/Very well (27.3%)

How well prepared for:

Chemical

- Very poorly/Poorly (53.3%)
- Well/Very well (37.2%)

Biological

- Very poorly/Poorly (47.2%)
- Well/Very well (46.8%)

Radiological

- Very poorly/Poorly (57.6%)
- Well/Very well (28.6%)

Level of knowledge regarding:

Anthrax

- Very poorly/poorly (32.5%)
- Well/Very Well (64%)
- No (3.5%)

VHF

- Very poorly/Poorly (35.9%)
- Well/Very well (57.6%)
- No (6.5%)

Nerve agents

- Very poorly/Poorly (52%)
- Well/Very well (42.9%)
- No (5.2%)

Mustard

- Very poorly/Poorly (52.4%)
- Well/Very well (34.7%)
- No (13%)

QUESTIONNAIRE TWO – For CBRN Experts

Question: What proportion of FLHPs in your country is adequately prepared to recognize and manage biological, chemical and radiological incidents?

- **Questionnaires delivered: 93**
- **Origin of questionnaires: 16 EU countries**

Biological incidents	
0% - 24%	42.9%
25% - 49%	17.5%
50% - 74%	15.9%
75% - 100%	4.8%
Do not know	19%
Chemical incidents	
0% - 24%	38.1%
25% - 49%	23.8%
50% - 74%	12.7%
75% - 100%	6.3%
Do not know	19%
Radiological incidents	
0% - 24%	52.4%
25% - 49%	17.5%
50% - 74%	3.2%
75% - 100%	4.8%
Do not know	22.2%

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