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One of the greatest disaster scenarios is the use of WMDs by non-state actors. India is enhancing its commitment to nuclear energy. These reactors are also potential targets for mass casualty terror strikes. The recent Tsunami in Japan led to a nuclear meltdown on an unprecedented scale. CBRN terrorism or catastrophes with a radiological dimension triggered by natural or man-made disasters are an eventuality that we must be well prepared for in this country. The recent Delhi High Court blast also highlighted the need for casualty management in such scenarios. A very timely and well written article by a Greek Brigadier General on CBRN response by hospitals in the event of WMD based terror strike or natural disaster.

This article focuses on hospital CBRN preparedness in megapolis environment and comments on the attitude of state high officials involved in CBRN planning.

**Megapolis**

A megapolis (combined Greek word: mega [or megalo] = huge and polis = city), also known as megalopolis or megaregion, is a clustered network of cities with a population of about 10 million or more and at least 2,000 persons / km<sup>2</sup> (i.e. Delhi has a land of 1,483 km<sup>2</sup> and a population density of 9,296 people / km<sup>2</sup>). Modern interlinked ground transportation corridors, such as rail and highway, often aid in the development of megalopolises. In the top-20 of most populated cities worldwide (Table 1), there are three Indian megalopolises - Mumbai, Delhi and Kolkata.

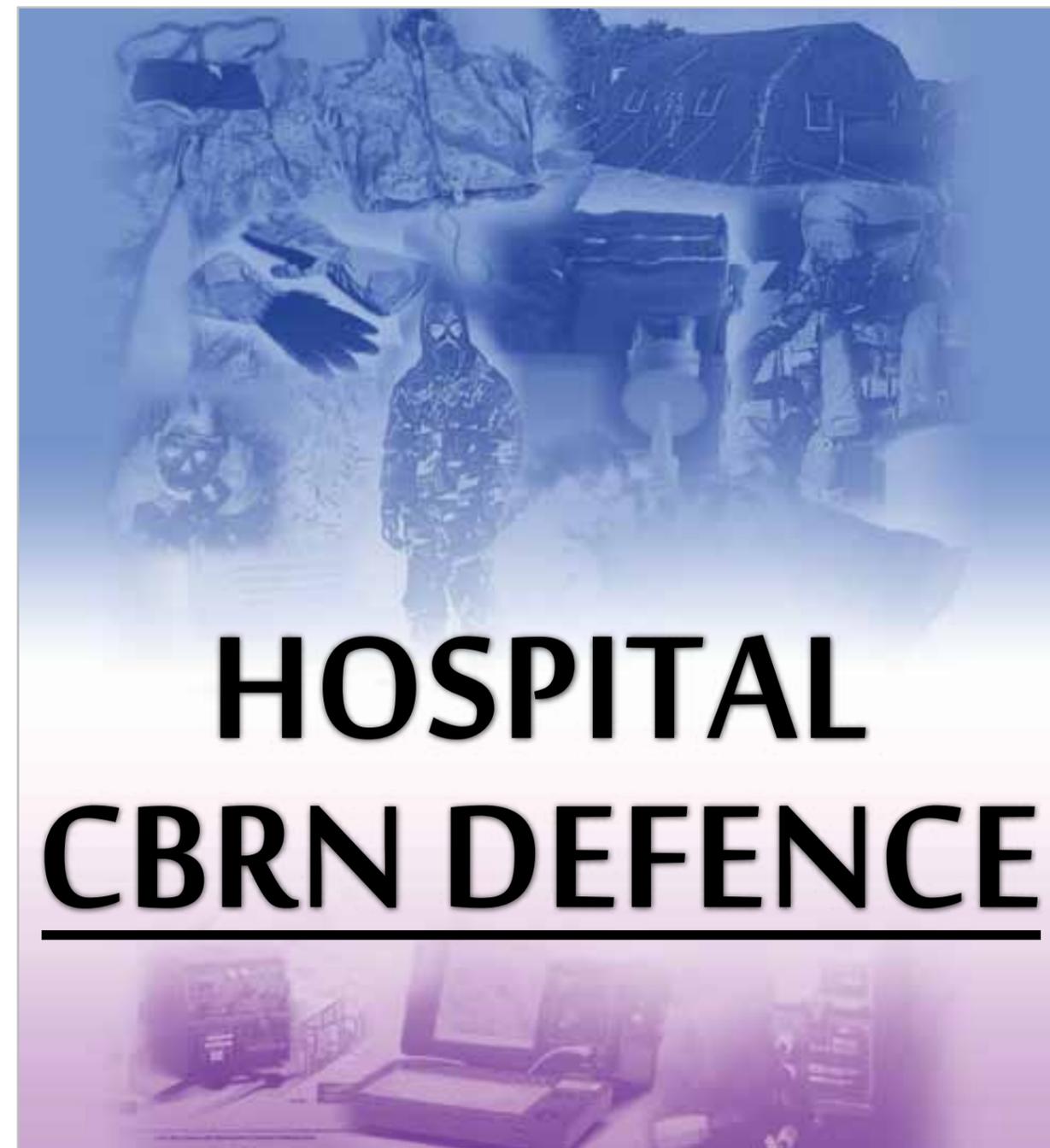
Table 1 - Megapolises of the World

|    |                                  |    |                                      |
|----|----------------------------------|----|--------------------------------------|
| 1  | Tokyo, Japan - 32,450,000        | 11 | Manila, Philippines - 16,300,000     |
| 2  | Seoul, South Korea - 20,550,000  | 12 | Los Angeles, USA - 15,250,000        |
| 3  | Mexico City, Mexico - 20,450,000 | 13 | Kolkata, India - 15,100,000          |
| 4  | New York City, USA - 19,750,000  | 14 | Moscow, Russian Fed. - 15,000,000    |
| 5  | Mumbai, India - 19,200,000       | 15 | Cairo, Egypt - 14,450,000            |
| 6  | Jakarta, Indonesia - 18,900,000  | 16 | Lagos, Nigeria - 13,488,000          |
| 7  | Sao Paulo, Brazil - 18,850,000   | 17 | Buenos Aires, Argentina - 13,170,000 |
| 8  | Delhi, India - 18,680,000        | 18 | London, United Kingdom - 12,875,000  |
| 9  | Osaka/Kobe, Japan - 17,350,000   | 19 | Beijing, China - 12,500,000          |
| 10 | Shanghai, China - 16,650,000     | 20 | Karachi, Pakistan - 11,800,000       |

Source: <http://www.worldatlas.com/citypops.htm>

**Hospitals as targets**

Since the beginning of the 21st century, hospitals both in peace and war were considered as sacred areas respected by adversaries either in urban environment or in the operational field. Starting with Cama Hospital in the Mumbai 2008 multiple terrorist attacks many instances of hospitals' attacks have been recorded in various countries around the globe (i.e. Military Hospital in Kabul, Afghanistan [2011], Misrata Hospital in Libya [2011], etc.). Therefore it is obvious that hospitals represent an attractive soft target for modern terrorists. If by attacking hospitals you kill the hope for the people involved in a terrorist incident then it is like killing them twice.



**CBRNE incident site**

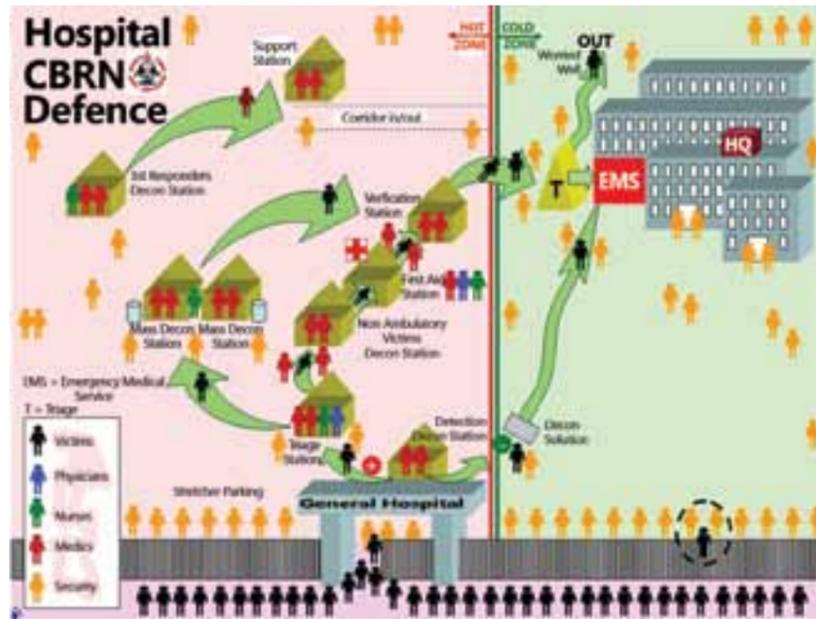
In case of a real CBRN terrorist incident in a megapolis environment there are two things that you must have always in mind. The first one is that planning should follow major anthropocentric patterns. This means that every plan should always answer the following question: "What would be my personal reaction if involved in such an incident?"

The second one refers to certain statistics that are crucial to

remember and have to do with the crowd behaviour. In that respect it is estimated that after the CBRN incident approximately 20 per cent of those involved will remain in place (dead, severely wounded and / or contaminated). The remaining 80 per cent will flee to all possible directions seeking medical assistance or if not wounded or contaminated will go home. The third important statistic is that the ratio of truly contaminated vs "worried well" is 1:5. This will soon overwhelm hospitals and collapse even the most

organised and advanced medical systems worldwide. The experience from Tokyo sarin release shows that 84.5 per cent of those involved went to 169 hospitals and clinics all over the capital by their own means. The above numbers stress the need to invest on hospitals' CBRN defence instead of classic "golden hour" first responders. The latter will certainly go there but they will arrive late (due to very heavy traffic and big dimensions of decontamination vehicles) and most probably those who are severely contaminated / wounded would be

Figure 1 - Hospital CBRN defence



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dead. So why invest all that money on first responders that will go there late instead of investing on health infrastructure that will surely accept those escaped and have a good chance to survive? No need to say that medical consequences of CBRN agents' release might last for decades - as is the case with Iran-Iraq chemical war casualties.

**Hospital CBRN defence**

A hospital might be very close or adjacent to the incident site or far to very far away. If very close then reaction time is minimal if none. This means that the EMS section of the hospital must be able to go to "red alert" within minutes. This

takes a lot of training, specialised equipment, modern planning and open minded individuals that understand the nature of the event. Hospitals that are in more distant areas might have enough time to prepare although in many instances nobody will go there no matter how prepared they are. It is obvious that all hospitals and clinics both public and private should be equally prepared to accept mass CBRN casualties in case of a terrorist event. One might say that casualties should be "guided" to certain specialised hospitals and close all those that do not have the facilities to deal with CBRN contaminated victims. Now ask yourself what would be your reaction if arriving in such a hospital with your contaminated / wounded child and someone was informing you that it is closed and you have to go to another far away hospital ...

**Hospital preparedness**

The good thing with hospital CBRN preparedness is that most of the equipment needed is already available within the hospital. Of course there is certain additional equipment that is specifically made for contaminated environments (i.e. field respirator with NBC filter) but apart from these the remaining are every day's materials and resources.

The important parameter

in hospital defence is to keep contamination away from the hospital, working medical personnel and existing patients. In that respect the CBRN Response Unit of the hospital should be deployed outside the hospital; preferably at the parking lot of the hospital. The response unit is composed by several stations that facilitate the arriving casualties.

To start with it is very important to have a fence around the hospital. If there is no fence then the control of the arriving citizens would be difficult if not impossible to control. But even with a fence someone might try to override it if not willing to stay in line. This means that security personnel should be deployed as well guarding the inner territory of the hospital. The usual security personnel of the hospital it is for sure will not be able to contribute since they do not possess the abilities, training and personal protective equipment to fulfill their mission in a contaminated environment. Police support is the only solution available.

**In case of a real event (Figure 1):**

- 1) All casualties / victims presenting to the hospital will enter hospital from one and only gate.
- 2) All casualties / victims will go through "Detection Station" where if negative they will proceed and walk through a decontamination solution on their way to the EMS department of the hospital. If positive they will proceed to "Triage Station".
- 3) Casualties will be either able to walk or on stretchers. In the first case they proceed to "Mass Decontamination Stations" for thorough decontamination.
- 4) If non-ambulatory they will be transported to the "Non-Ambulatory Victims Decontamination Station". When decontamination is over they will be rolled to adjusting "First Aid Station" for provision of life saving first aids (antidotes, respiratory support, bleeding control). Antidotes can be given at the "Triage Station" as well depending on the situation.
- 5) When victims from both the "Mass Decontamination Station" and

"First Aid Station" are ready and "clean" they proceed through the "Verification Station" that confirms the success of decontamination. If negative they end up in the main triage area of the hospital at the "cold zone". If positive they have to repeat decontamination process.

6) At the "Triage Station" hospital personnel will decide who needs immediate hospitalisation and who can go home with written instructions in case a relapse evolves within the next few hours. One of the main tasks of the triage personnel is to get rid of "worried well" that represent a functional threat to the continuity of the hospital work due to their vast numbers.

7) First responders either from the hospital or from other state departments and organisations need to have their own decontamination line. This is mandatory and this line should be deployed before starting to accept contaminated casualties. "Save the saver to operate" is the main reason but also the rule in all CBRN operations.

**The human factor**

Physicians, nurses and paramedics are the main components of a hospital CBRN response unit. Who are these people and why are they doing this? In most cases worldwide they belong to the EMS department of the hospital and they know how to handle medical emergencies of any kind. The problem is if they all can be involved in CBRN operations where usage of personal protective equipment is mandatory. Are they all fit to operate under very stressful conditions - both physically and emotionally? What if those in charge but not fit happen to be on duty the day of the real event?

A dedicated hospital CBRN response unit might be a good alternative. In that respect all personnel involved in this unit are fit to operate under extreme conditions in a contaminated environment. But they need shifts and special arrangements regarding their daily duties in peacetime. Sometimes this is the biggest problem creating lots of friction and discomfort in hospital's administration. A best

Figure 2 - CBRN training (hydration)



Figure 3 - Intubation while in PPE (personal protection equipment)



solution that covers all aspects does not exist. Perhaps a fixed unit with various levels of mobilisation and deployment depending on the threats' index could do the job.

**I strongly support the idea of inclusion of "Medical CBRN Defence" or "Terror Medicine" into the curricula of universities' medical and nursing schools. This will be an opportunity for future front-line health professionals to come into contact with medical CBRN operations and have a basic knowledge in the back of their heads. If something real happens then this basic knowledge might be proven beneficial for the overall management of the citizens involved**

Then it is training (Figure 2). Just a few theoretical seminars are not enough to prepare somebody to be involved in medical CBRN operations. Practical training is of huge importance. Acclimatisation on personal protective equipment is of even bigger importance. Spending 30 minutes with a gas mask on is not enough if you do not do it again and again, day after day. Donning twice a year for a few hours means nothing. It will always be like the first time! Then there are the procedures. It is a mistake to believe that there is nothing we can do while in personal protective equipment. We can do many things - all the way to intubation (Figure 3) - but we need to do them again and again

in order to attain proficiency and self-confidence. We can cut clothing, provide antidotes, suck secretions, support breathing, clean wounds, stop /control bleeding (i.e. by using Quiklot™) or control seizures. These are life saving interventions that along with thorough decontamination will save the lives of those that were

Figure 4 - Medical CBRN drill

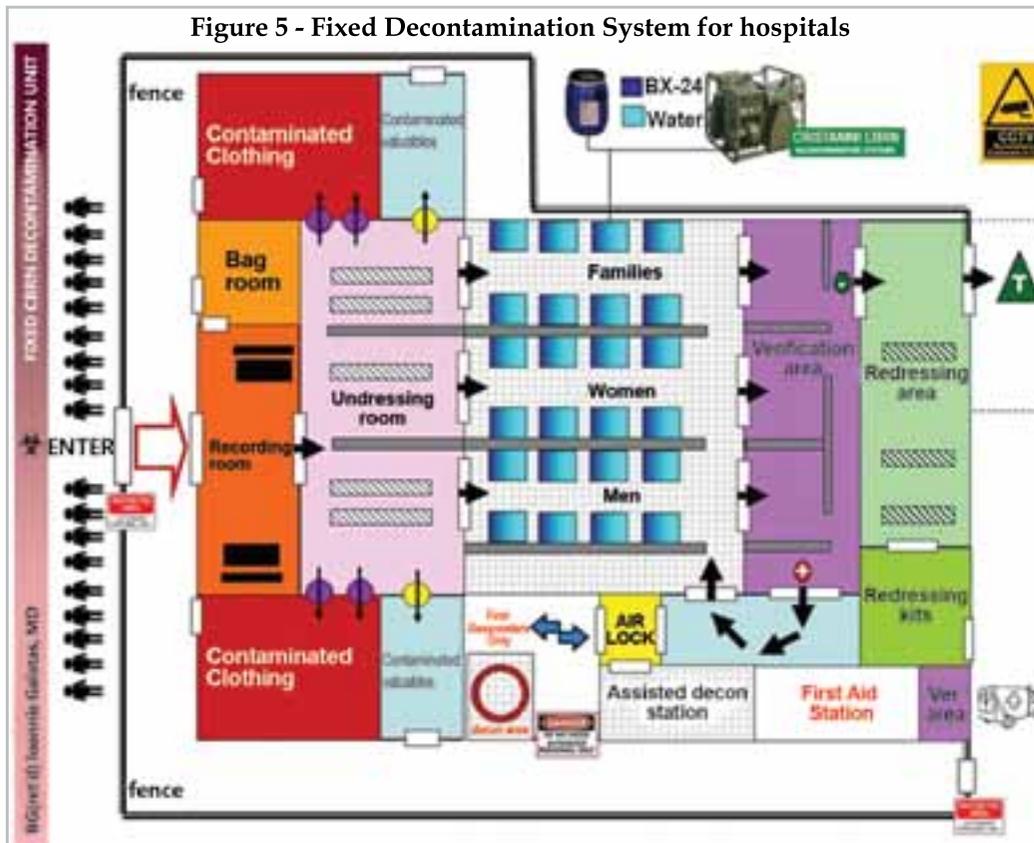


unfortunate enough to be both wounded and contaminated at the same time.

Drills and exercises (Figure 4) is the next logical step. They will help personnel involved to understand plans and practice their procedures. Night drills are of particular importance because then you discover that there was no prediction for flood lights! But even in this scenario, a medical responder must be able to improvise and operate even in the dark. Intubate once in the dark and you will never forget it - for life!

Exercise (Figure 4) with other first responders both national and international. Participate in international exercises and try to copy and paste things and procedures that will help you

Figure 5 - Fixed Decontamination System for hospitals



particular is the main reason for this reluctant attitude of medical community observed almost universally. In that respect, I strongly support the idea of inclusion of “Medical CBRN Defence” or “Terror Medicine” into the curricula of universities’ medical and nursing schools. This will be an opportunity for future front-line health professionals to come into contact with medical CBRN operations and have a basic knowledge in the back of their heads. If something real happens then this basic knowledge might be proven beneficial for the overall management

improve your own. Create a network of experts that will help you solve problems and exchange ideas relevant to the core CBRN medical operations.

**Decontamination** is the most important task given to the hospital CBRN response unit. Should it be fixed or deployed if needed? If it is fixed preparedness time is kept to minimum but the overall cost is higher. If it is portable, the cost is lower but preparedness time might be a problem especially if the hospital is close or adjacent to the incident site. My personal opinion is that all hospitals should have fixed dedicated decontamination stations (Figure 5).

The final question is “why should they do it?” A good answer could be “for their country, their families and their society”. Although logical, logic is something that is very rare - especially in Western societies. There in order to do something extra from your given assignments you must have a very good motivation. And motivation is usually translated to money. To a certain point there is some right in this way of thinking. Why? Medical CBRN defence is practically a **new medical specialty**. With a lot of studying, a lot of

laborious training, a lot of responsibility and a very dangerous one since medical personnel will have to save lives in a potentially lethal environment. So why a surgeon who spent many years in the medical school, then some additional years in order to become a specialist / consultant and now is working in a hospital and has his own private practice to be involved in a second specialty with no extra benefits for his future progress, no regular patients, no extra salary and no recognition of his role in the overall defence of his country? I experienced all kind of attitudes from “what is in it for me” (Greece) all the way to “for the country and the Queen” (UK) or “because they are told to” (India). Truth is always somewhere in the middle. I strongly support the **strategy of motivation** but also the feeling of community and universal support. If there is no gain at all, then even the most passionate responders will retreat sooner or later. So why not keeping everybody happy by applying a carrot and stick policy?

**Towards the future**

Ignorance is a bad advisor and lack of knowledge regarding new emerging threats and CBRNE in

of the citizens involved. In other words, if you have many cases of flu-like illnesses in August and the only thing you know is flu then your differential diagnosis will balance between “flu” and “flu” and you will miss “respiratory anthrax” because you have never heard about it and how you can identify it and set an alarm.

*“They have to be lucky all the time. We have to be lucky only once!”*

*Statement made by an IRA spokesperson following the unsuccessful attempt to murder former UK Prime Minister Margaret Thatcher.*

Many people in high places usually mumble why spend all that money for something that will not happen. Well, if in January 2011 someone presented a scenario involving a mega-earthquake, a mega-tsunami and a mega-nuke catastrophe, then the audience would surely laugh and comment on presenter’s sci-fi capabilities. And then it happened in Japan! So keep in mind that **“the unexpected always happens!”** and support the medical / hospital CBRN preparedness by all means. It is never too late to do the right thing and it has been proven that by doing the right things it costs less! **DSA**