

Dr. Bonnie Arquilla

Director of Emergency Preparedness, SUNY Downstate Medical Center

Assessment of Preparedness in the Event

Of A Radioactive Disaster

I would like to thank the committee for inviting me to speak. My background is in Emergency Medicine with an emphasis in Disaster Preparedness at SUNY Downstate Medical Center. We have created a number of guidelines and full-scale exercise drills to examine disaster preparedness. As an Emergency Medicine physician, I do clinical work at University Hospital, Brooklyn and Kings County Hospital Center. I have been the Director of Emergency Preparedness for both institutions since 2001. When I took over this post, it was chiefly a “regulatory position” to help the hospitals with JOINT commission inspections. With the September 11th and the anthrax terrorists attacks, that all *changed*.

Globally, we saw a critical need for *preparedness*. Medical professionals went about changing the culture of their hospitals; indeed *all* institutions and organizations address the need for a higher level of *preparedness*. It takes a generation to change cultural attitudes and so far, with regard to disaster preparedness, we’ve made good progress, but as with any ambitious goal or cultural shift, there’s still more work to be done.

The two hospital facilities I mentioned earlier on Clarkson Avenue, see a majority of the patients in central Brooklyn. We have a special research interest in vulnerable populations such as pediatrics and geriatrics. Obviously, my primary viewpoint is around the *preparations* that hospitals can make to provide better care for the neighborhoods they serve, *in addition* to hospital care of the sick or injured. We are *also* **acutely** aware that we are the safety net for *disaster relief* in central Brooklyn and New York City... So

what would happen if there *were* a dirty bomb, a nuclear explosion, or covert release of radioactive material?

Data based on exercises that we at SUNY have conducted in collaboration with other organizations, tells us that we are *not* adequately prepared to respond to the expected overwhelming influx of patients seeking medical evaluation and assurances. However, it must be noted that most of these patients would *not* be at immediate medical risk!

For the purposes of this testimony I've been asked to address the following issues and concerns:

- A basic review radiation
- A few scenarios where populations might be exposed to radiation
- Acute medical issues around radiation exposure
- The response framework established at SUNY, while identifying important gaps
- The necessity to secure potential radiation resources.

A Basic Review of Radiation:

The following are types of non-ionizing, harmless, radiation:

Microwaves
Radio waves
Infra-red rays
Laser

For the purposes of this inquiry, let's take a closer look at **Ionizing Radiation**

What Is Ionizing Radiation? It is the spontaneous emission of “fragments” or “bundles” of energy from unstable nuclei creating more stable nuclei.

Ionizing radiation can rip off electrons from other atoms. It then attacks the atoms in living cells creating free radicals that damage our DNA. This is how it damages our cells. “The Cell/DNA itself is directly *ionized* by the radiation.” This *attack* causes genetic mutation and the cells die from necrosis.

Following are Forms of Ionizing Radiation

Alpha particles

Beta particles

Gamma photons or gamma rays

Alpha Particles are made up of two protons and two neutrons.

It’s a helium nucleus, only with lots of kinetic energy. They are positively charged, physically **large** on the atomic scale—the heaviest and most highly charged.

Alpha Particles can normally be **stopped** by the dead layer of skin on the body or a sheet of paper.

Beta Particles are high-speed electrons stripped free from their atomic parent and sent off with kinetic energy. They are smaller and travel much faster than Alpha Particles. They may be positively or negatively charged.

Beta Particles can be stopped by 1 cm of plastic, wood or paper. Like Alpha Particles, Beta Particles can cause damage to skin and other cells.

However, beta particles are not typically involved in acute radiological events.

Gamma Rays are packets of energy in the form of Photons, much like the visible light in this room, forming Electromagnetic Radiation (EMR) of high energy. Their interaction with materials is energy dependent. They can travel up to 1 mile in open air.

Gamma Rays are very penetrating and can pass right through the body. They are stopped best with lead or concrete. *In high concentrations, they can penetrate to the bones and marrow and depress production of red blood cells. **This is usually the type of radiation of most concern in disasters.***

Scenarios Where Populations Might Be Exposed To Radiation:

While most of us are familiar with dirty bombs, another type of attack is the **I-cubed** (for ingestion, inhalation and emersion) these attacks are not accompanied with a flash and bang. Fortunately, it is hard to kill a lot of people with an ingestion attack.

Contaminating a reservoir or even a water main is ineffective because the radioactivity is quickly diluted. *However*, the population knowing that the attempt has been made may be enough to create a disaster. This is an important area that should have government attention. Training and education in “risk communication” **must be better**, to help our population better cope with their fears.

An inhalation attack, sometimes called a smoky bob, uses radioisotopes that can be burned, vaporized or aerosolized in a confined space to contaminate the air. The subway, for example, is an ideal location. The population inhales the contaminated air, the effect either killing quickly by radiation poisoning, or slowly by causing cancer. Obviously, in this type of event detection is an area of importance, but it is not enough to simply detect and measure, we need a healthcare workforce that is trained to manage this type of exposure. Refer to Dr. Steve Becker’s work. He shows a lack of understanding by many emergency department physicians of radiological events and effects.

An immersion attack, or radioactive spray, is hazardous because people wipe their face and then transfer isotope to the mouth.

In a Dirty Bomb attack health workers are more concerned about the actual explosion, rather than the radioactive effects of the blast. Blast injuries themselves will kill more people and cause greater morbidity than the release of the nuclear agent. Delays brought about by the need for screening of a hysterical population, seeking to know if they are OKAY, and reek havoc on the system! Look at last spring with the flu, many people who

presented for evaluation to either private physician's offices or hospitals, just wanted to be sure that they had swine flu or did not. Under regular circumstances, they would not have sought medical attention and especially not emergency care. The hospitals in New York City were overwhelmed with ambulatory patients seeking reassurances.

Acute Medical Issues Around Radiation Exposure

The most likely radioactive materials to be used in a terrorist attack are cobalt; strontium, cesium, and americium. All are poorly protected and readily available in medical, military, research and industrial resources.

Cobalt is used in food irradiators and americium is used in smoke detectors and oil exploration.

Emergency Considerations

THE MOST IMPORTANT INDICATOR TO EXPOSURE OF A PATIENT IS THE TIME OF ONSET OF VOMITING FOLLOWING IRRADIATION. Vomiting within in 2 to 4 hours is an indication of a high dose of radiation.

The greatest potential morbidity can be determined by

- Symptoms?
- What are they?
- Time of onset?
- Point Source or Contamination?
- What is the isotope (alpha, beta or gamma)?
- Length of exposure?
- External and/or internal contamination?

The initial symptoms to **Acute Radiation Sickness** include; skin redness, nausea, vomiting and depressed white blood cell counts. *These are the effects we worry about predominantly for first responders and in major accidents with very high levels of radiation.*

The Prodromal Phase, is the phase *after* exposure to radiation with several vague, nonspecific symptoms.

In the **Latent Phase** patients appear asymptomatic typically for 2 to 4 weeks. Then patients begin to develop infections, usually require prophylactic antibiotics, antiviral agents, or antifungal agents.

The **Illness Phase** is expressed by damage to the specific organ system and depends on the level of “whole body” exposure received by the patient.

Other effects of Dirty Bombs include **Traumatic injuries**. This is thought to be a bigger killer in the short term. The associated trauma that accompanies a Dirty Bomb attack, presents the greatest risk.

Prolonged mental health problems:

- Fear/Panic:
- Demand for medical resources
- Post Traumatic Stress Disorder
- Stigmatization

Often these mental “after effects” of an event go untreated. This is a critical area for the government to provide aide, focusing on first aid, screening and long term treatment.

The Response Framework Established at SUNY

Preventing unnecessary exposure is the best defense! This is achieved through Personal Protective Equipment (PPE) such as:

- Gloves
- Over garments
- Respirators

Additional important safety measures include:

- Time; limiting the time of exposure
- Distance; maintaining a distance from radioactive sources
- Shielding; the use of PPE

Patients should be screened, stripped of all clothes (they hold radiation), showered and re-screened.

Let me bring to your attention, that I am not aware of any hospital that has a fully trained decontamination team in place and available 24 hours per day, 7 days per week. This type of specialized work is beyond the scope of the average healthcare worker. Currently, most decontamination teams are made up of volunteers. Yet, most healthcare workers are afraid to volunteer, *because they lack training!* Ideally, what is needed to rectify this situation is:

- Education; of radiological events and practices for healthcare workers
- Decontamination training for healthcare staff and professionals– as a *regular* part of their job
- Government support of the above, including funding

Facility Preparation & Planning

Important questions every facility should ask when responding are:

Who should get radiation screening?

- Patients that require monitoring and or admission to hospital
- Non-injured, injured, dead
- Personnel working in and around the event

Where should radiation screening be done?

- ED, OR, decontamination area, dress out areas
- Any other area where contamination might occur

What other radiation screening should be done?

- Personal belongings of victims
- Medical instruments, equipment
- Waste

How should radiation screening be handled? Or, What is the hospitals disaster procedure?

- Who will do screening?
- How will screening be done?
- How much equipment/PPE is needed to fulfill this mission?

Additional planning considerations:

- Pressure on normal ER staff
- Press coverage
- Psychological reaction of patients, public, and hospital staff
- Prioritize areas, facilities, and equipment to be recovered
 - What is needed ASAP?
 - What can wait?
- Establish a checklist for recovery

The Necessity to Secure Potential Radiation Resources

Once radioactive materials are no longer needed and the costs of appropriate disposal are high, security measures become lax, and the likelihood of abandonment or theft increases. We need to allocate funds for the safe disposal and storage of our radioactive materials.

In conclusion, the National Opinion Research Center at the University of Chicago reports that, “In the event of a dirty bomb explosion 65 percent of urban residents expect that they would evacuate after learning from the media that a dirty bomb has exploded, but with out receiving any directive or information regarding the event from local government officials.” Alarmingly, current guidelines say that people who received more than 25 times the threshold dose for evacuation would have to be taken into medical supervision. This would be an overwhelming number of people to evaluate and then follow for at least 25 years.

As I mentioned earlier, most medical facilities are simply not equipped to handle the large influx of “potential” patients who require reassurances. Our best defense against the effects of an I-cubed attack is to inform and educate the populous regarding their risk as soon after the attack as possible. Additionally, medical personnel and facilities should be *prepared* to deal with the specifics of such an attack. Currently, they are not. This can

only be achieved through **disaster preparedness training**, the need for which cannot be over emphasized. It is my hope that the Homeland Security committee considers disaster preparedness training as part of their defense strategy in managing our countries safety against terrorists' attacks.

Thank you,