
Health professionals and nuclear warfare

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Editorial

Ukraine War have put nuclear war back on the geopolitical agenda. The prospect of nuclear war was regarded as a greater and more immediate threat to the human race than climate change is considered a threat in this decade.

Strategic nuclear weapons are the intercontinental ballistic missiles (ICBM) designed to annihilate cities and likely to guarantee mutually-assured destruction. These missiles can carry a nuclear warhead capable of generating more than a megaton (a million tonnes) of TNT, 100 times the power of the Hiroshima bomb.

A nuclear explosion may occur with or without a few minutes warning.

Fallout is most dangerous in the first few hours after the detonation when it is giving off the highest levels of radiation. It takes time for fallout to arrive back to ground level, often more than 15 minutes for areas outside of the immediate blast damage zones. This is enough time for you to be

able to prevent significant radiation exposure by following these simple steps:

Get inside

Get inside the nearest building to avoid radiation. Brick or concrete are best.

Remove contaminated clothing and wipe off or wash unprotected skin if you were outside after the fallout arrived. Hand sanitizer does not protect against fall out. Avoid touching your eyes, nose, and mouth, if possible. Do not use disinfectant wipes on your skin.

Go to the basement or middle of the building. Stay away from the outer walls and roof. Try to maintain a distance of at least six feet between yourself and people who are not part of your household. If possible, wear a mask if you're sheltering with people who are not a part of your household. Children under two years old, people who have trouble breathing, and those who are unable to remove masks on their own should not wear them.

Stay inside

Stay inside for 24 hours unless local authorities provide other instructions.

Family should stay where they are inside. Reunite later to avoid exposure to dangerous radiation.

Stay tuned

Tune into any media available for official information such as when it is safe to exit and where you should go.

Battery operated and hand crank radios will function after a nuclear detonation.

Cell phone, text messaging, television, and internet services may be disrupted or unavailable.

What would happen if you were working in the emergency department (ED) when a nuclear attack happens? We've all had questions on boards or inservice exams about the long-term effect of radiation exposure, but would you know what to actually do if a nuclear attack happened? What do you do in the first few minutes? First few hours? We know that if you are in the immediate bomb vicinity, there is not much you can do. But what if you are 5 miles away? Or 10 miles?

If you look for information regarding nuclear attacks, there are no great summary resources on what to do in the immediate aftermath if you are in the ED.

In order to bring this to you in an easily digestible format, we have broken these advisees up into a few topic areas:

Nuclear explosions can cause significant damage and casualties from blast, heat, and radiation but you can keep your family safe by knowing what to do and being prepared if it occurs.

A nuclear weapon is a device that uses a nuclear reaction to create an explosion.

Nuclear devices range from a small portable device carried by an individual to a weapon carried by a missile.

Hazards related to nuclear explosions

Bright flash can cause temporary blindness for less than a minute.

Blast wave can cause death, injury, and damage to structures several miles out from the blast.

Radiation can damage cells of the body. Large exposures can cause radiation sickness.

Fire and heat can cause death, burn injuries, and damage to structures several miles out.

Electromagnetic pulse (EMP) can damage electrical power equipment and electronics several miles out from the detonation and cause temporary disruptions further out.

Fallout is radioactive, visible dirt and debris raining down from several miles up

that can cause sickness to those who are outside.

What to expect

Initially, you are most likely to be dealing with trauma typical of any blast injury. This includes burns, hollow viscus injury, penetrating injury from shrapnel, falls, and flash blindness. You will also have patients with varying levels of radiation exposure, but the exposure levels will be difficult to determine in the first few hours.

Although you can roughly predict that patients with early nausea and vomiting may have more lethal levels, it is important that non-lethal doses and alternative etiologies (e.g. psychological distress) may cause vomiting. Do not use these symptoms solely to triage patients in the first few minutes to hours of a nuclear attack. Implement standard mass casualty triage processes.

How to decontaminate

Decontamination should take place outside the space where you are sheltering. You and all of your patients and staff will have to shelter in place so it is extremely important that you not contaminate your shelter space. Prioritize protection of the

health care worker and proper decontamination of the exposed patient.

Decontamination should occur from head to toe to avoid re-contaminating decontaminated areas. Any run-off water is classified as hazardous waste. Dry decontamination (removing and containing clothes) is preferred to wet decontamination (with a shower or fire hose). Dry decontamination should be accomplished by carefully removing clothes and gently brushing off any debris, being careful not to inhale any particles. Because self-decontamination can decrease a patient's contamination by greater $\geq 90\%$, have the patient perform the initial decontamination for him/herself.

Other logistics to consider:

No electricity: If an EMP disrupts power and electricity, it will be difficult to communicate with the outside world to find out what happened, whether you are in the fallout zone, and how long to stay indoors. Theoretically this could be mitigated by having some communications equipment pre-stored in a Faraday cage, which is a latticed metal box that distributes electromagnetic radiation around the cage, protecting any electronics inside.

Water potability: Water pipes could be damaged in the blast, so water pressure for sinks and showers may be lost. Additionally this water may have been exposed to fallout and unsafe to use. IV fluids and fluids in sealed containers are safe to use. Use bottled water preferentially for drinking. However, if you run out of safe water, it is better to drink contaminated water and risk health issues in the future than face life-threatening dehydration.

While the effects of a nuclear attack can be terrifying, the emergency physician working in the ED needs to understand the immediate hazards. Early sheltering and rapid triaging are critical time-sensitive priorities. Ultimately early planning and awareness can improve patient outcomes in such disasters.

Guidelines and useful articles:

UK - Nuclear Emergency Planning and Response Guidance

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/472419/NEPRG00_-_Concept_of_Operations.pdf

What Do I Do in a Nuclear Emergency? USA Nuclear Regulatory Commission

<https://www.nrc.gov/about-nrc/emerg-preparedness/in-radiological-emerg.html>

Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report

<https://pubmed.ncbi.nlm.nih.gov/25032361/>

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