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Smaller Nuclear Detonations as the New Emergency Preparedness Challenge in Disaster Medicine and Public Health

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Recent international developments have brought a broader awareness to the vulnerability to global peace because of the increasing likelihood of nuclear events. The increased nuclear threats from Russia in relation to the current Ukraine war have justifiably raised concerns for nuclear war potential with the US and NATO, and the terrifying large-scale outcomes for populations worldwide. Recent surveys have indicated that 75 - 80% of people surveyed worldwide, and consistently across nations, believe that nuclear war is more likely now than in the recent past.[1] Indeed, the fear of nuclear conflict on such a global scale has resulted in a lack of recognition of what is generally recognized as the *far greater likelihood of relatively smaller nuclear detonations, at least in the near term*.[2] Since nuclear detonations have been considered as high impact but low likelihood events in emergency preparedness, there has subsequently been little emphasis on preparing for them, whether as large- or small-scale events. In summary, we therefore find ourselves in the current environment where there is greatly increased awareness of a nuclear threat, though the fear predominates for the less probable large-scale, rather than the far more likely small-scale nuclear events, and there is frankly little preparedness for any nuclear event.

Accelerating nuclear event preparedness awareness

In recognition of the increased nuclear threat, the Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA) has just released the new planning guidance for a nuclear detonation.[3] This is the third edition of this federal guidance (last edition was 2010) and it has been released in this current period of heightened concern for a nuclear detonation. Also, there have been extensive updates in federal and private training curricula for nuclear/radiological events, such as the Radiological Emergency Assistance Center/Training Site (REAC/TS) at Oak Ridge and the Basic Disaster Life Support (BDLS) curricula. National/international medical professional organizations such as the Society for Disaster Medicine and Public Health Preparedness (SDMPH) and the EMS Eagles Global Alliance have recently emphasized nuclear event medical training. To better accommodate the perceived need for preparedness in this new threat environment, the National Disaster Life Support Foundation (NDLSF), in collaboration with the National Alliance for Radiation Readiness (NARR), has made their detailed radiological/ nuclear event response module from the new 4.0 version of BDLS freely available. The following link will take you directly to the registration page for the JIT Radiological and Nuclear Events Training on the NDLSF Learning Management System:

https://register3.ndlsf.org/course/view.php?id=3036

To address the harrowing conditions for front-line humanitarian aid emergency response personnel in the Ukraine/ Russia war, SDMPH conducted a 2-hour seminar with CME/CNE credit in September 2022. In response to a direct request from these front-line responders, I included a just-in-time training session for these workers to be able to survive and continue to serve their patients in the event of the use of small-scale nuclear weapons by the Russians in the same areas where they are already delivering medical assistance. There have been very direct nuclear threats in late 2022 by the Russians, including annexation of conquered Ukrainian territory and people (dangerous justification for the use of nuclear weapons to protect new Russian sovereignty), and vigorous responses from the US and NATO. Together with recent significant reverses in Russian military posture in Ukraine that has reportedly made the use of battlefield (tactical) nuclear weapons more attractive in the perception of the Russian strategists, this has led to an understandable concern that these workers will be a significant portion of the front-line responders to these events, even though they have virtually no training for them.

Just-in-time training for small nuclear weapon detonation medical preparedness

Here are the main features, mainly taken from the newly revised Basic Disaster Life Support (BDLS) curricula, version 4.0.,[4] that are considered essential for small-scale nuclear event nuclear preparedness for these front-line responders:

1) Do most victims die from radiation following radiological exposures and nuclear detonations? No! Many people, including some health professionals, believe that radiological and nuclear events cause either irreversible harm or unsurvivable injury. However, consensus research has shown that many of those exposed even to high doses of radiation can be expected to survive if timely, appropriate treatment is provided.[5]
2) Even in nuclear detonations, the great majority of those harmed will need acute care for trauma and thermal burns, while only a minority will need care for radiation injury itself. In contrast, those exposed to low doses of radiation required little or no acute care, although their mental health needs will be great.
3) The types of radiation exposure that will be encountered from nuclear detonations will involve irradiation either from the gamma pulse near the detonation, or from fallout falling in the hours and days after the detonation. In addition to the gamma radiation exposure which is of greatest significance from fallout on the ground, ingestion and inhalation of radionuclides are also routes of exposure of concern, where alpha- and beta-emitting contamination (in addition to gamma) can result in significant health effects especially long-term. Radiation exposure ends when the person moves away from the source. The exposed person is not giving off significant radiation, once contaminated clothing or skin contamination is removed, which is relatively easily done.[6,7]
4) A persistent perception that there is significant risk to fetuses of mothers exposed to nuclear detonation generated radiation is not supported by the extensive database of these exposures at Chernobyl and Fukushima, where there were no radiation related fetal abnormalities. In the past, X-rays in pregnant women posed a real risk to the fetus, but modern safety protocols have minimized this. Current medical consensus is that there is not an appreciable risk for fetal abnormality from exposure to radiation expected from the wide-spread nuclear fallout.[8–13]
5) The medical responder population will be the most familiar with treatment of the trauma injuries produced, though the staggering numbers will be a very difficult issue. The largest effects would be near Ground Zero and generally diminish with distance from the detonation area. Lacerations from broken glass and other objects will extend out farthest from the detonation area.
6) Thermal burn injuries will occur in approximately the same area as trauma injuries, with many patients having both trauma and thermal burn injuries. Direct thermal radiation and mass fires ignited from the nuclear detonation will also contribute to the very large number of thermal burns.[14]
7) Danger! The overwhelming majority of radiation meters are made for low dose detection and may NOT give accurate readings in nuclear war radiation levels! Nearly all existing meters are made for the expected low doses we have seen in the past and can saturate and give 0 or error messages at the high doses in nuclear weapon detonations. The ion chamber radiation detection device will not be saturated by the high doses expected in nuclear detonation and will continue to give accurate readings. There is a false sense of security with most existing devices when nuclear detonations are encountered.[15–18]
8) Emergency medical teams should NOT move into radiation exposure areas to treat nuclear detonation casualties. The extraordinarily large number of casualties from nuclear detonations will overwhelm available numbers of medical personnel. For this reason, the medical personnel outside radiation areas should treat the patients highly motivated to leave the radiation areas and come to them. Reality: The likely small number of available medical personnel outside the radiation zone will not be able to treat even 10 - 30% of these evacuated patients. As patients are treated/ stabilized, they should be evacuated away from the nuclear war zone for their safety and treatment, and to accommodate more patients coming in.[19,20]
9) The harsh reality of nuclear detonation triage will be created by the very large number of nuclear detonation casualties relative to available medical personnel. Of the casualty categories, the thermal burn casualties will demand far more personnel resources relative to the trauma and radiation injury categories. If radiation protection pharmaceutical agents are available within their effective timing protocol, they should be administered – in most cases, this is unlikely outside the US. Immediate trauma category patients are likely to be the great majority of patients selected by triage for treatment due to the adverse patient/medical personnel ratios and resource scarcity.[14]
10) In US settings under ideal conditions, there are useful protocols for determining likely radiation dose received useful in nuclear detonation triage; however, in most field situations, the chaos and lack of resources may require more rudimentary approaches. For example, there is a simple radiological assessment question that can be used in nuclear detonation triage, stemming from the experience of the patients receiving very high doses of radiation immediately following the Chernobyl nuclear accident: how long was it after your radiation exposure that you started experiencing nausea, vomiting, and/ or diarrhea? If the answer is less than 1 hour, then that individual would be considered Expectant – alive, but not expected to survive. If the answer is more than 4 hours, then those patients might be either Immediate, Delayed, Minimal, or Expectant. Hard-pressed triage decision personnel would then make very difficult resource decisions accordingly.[4]

Emphasis on mutual assured destruction diminishes more likely smaller scale nuclear event preparedness

An unfortunate outcome of the long-term concern for nuclear war is the widespread assumption that nuclear events will result in such large numbers of casualties that it is virtually impossible to prepare for them. Denial is one of our most powerful defense mechanisms designed to protect the ego from uncomfortable but real issues or events that we cannot cope with. Despite overwhelming existence that something is true, denial will reject its existence, and this tendency is exacerbated with nuclear weapon detonation's medical response, and results in ignoring what are achievable goals in this area with the imminent use of the relatively smaller nuclear weapons.[2] Indeed, a survey of emergency medical personnel on perceptions of risk from treating patients from nuclear detonations revealed that despite the very low level of actual risk, these professionals were more likely to refuse to respond to radiation emergencies than far greater demonstrated hazards with other mass casualty events.[21]

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While the threat of mass casualty-producing global nuclear war certainly exists, and no doubt is worse now than in recent decades, the expectation that smaller nuclear weapons will be used in battlefield warfare, and by the 'newer' nuclear weapon-acquiring-states is far more likely. In 2011, Coleman asserted that 'thoughtful planning is not futile and can substantially mitigate health consequences of a nuclear attack,' citing 'never ending new technologies, diagnostics, medical countermeasures, and resource-sharing models.'[5] Even though the capability to plan and respond exists, especially to smaller nuclear weapons, due to this widespread denial, the 'perfect storm' of total health management inadequacy will occur even for small nuclear weapon attacks. Notwithstanding noteworthy nuclear triage and management plans and technical monitoring standards within the International Atomic Energy Agency and WHO, there remains a profound lack of capacity to rapidly deploy a robust well educated and trained professional staffing workforce with internal coordination and collaboration capabilities required for nuclear crises.[14]

'Where is the voice of medicine and public health?'

'Where is the voice of medicine and public health?' was the treatise of a previous article, regarding the nuclear arms race in the Middle East,[22] and this question rings true today, especially in the continued lack of preparedness for smaller nuclear weapon detonations, a more readily achievable goal than is generally acknowledged. A determined effort is needed to address the medicine and public health needs of this imminent crisis, in addition to the diplomatic, military, and political vortex which cascades toward this abyss.

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