Health and Safety Threats to Ukraine From Nonconventional Weapons
A Clear and Present Danger

Although a focus on trauma response and humanitarian care is essential for the ongoing Russia-Ukraine war, recent posturing by Russian leadership indicates that radiological or nuclear weapons could be used to defend illegally annexed territories in Ukraine. This situation necessitates readiness for nonconventional warfare threats, which include chemical, biological, radiological, nuclear, and explosive (CBRNE) attacks. CBRNE preparedness has been variably among Ukrainian and European Union member states, which may be called on to detect and respond to potential attacks.1-3 Russia or its proxies have used CBRNE weapons in several recent conflicts, and awareness of these risks and mitigation strategies are prudent measures now.3 Based on these historical ingestions, prioritizing education and equipment for health care professionals to recognize and respond to potential CBRNE threats within Ukraine and bordering countries is essential.

Despite regulations against the use of chemical weapons by the Organisation for the Prohibition of Chemical Weapons (OPCW), Russian chemical weapons research has focused on developing highly potent weaponized organophosphates, or nerve agents. The past decade has seen Russia use these agents in assassination attempts of the Skripals and Alexei Navalny through the introduction of nerve agents in food and clothing. These fourth-generation agents (eg, Novichok, a group of nerve agents) are characterized by their lethality, unconventional routes of poisoning, and long-term environmental persistence.4 Russia's connections to Syria also provide insight. The majority of the more than 55 chemical weapon attacks in Syria between 2013 and 2018 involved chlorine gas or the deadly nerve agent sarin in canisters or combined with bombs dropped from aircraft. Although these events have been attributed to the Syrian government, the close relationship between Syria's Assad regime and Russia suggests that these indiscriminate strategies could be used in the current conflict.4

Weaponized opioids have also been used during the Putin regime. In 2002, Chechen terrorists attacked the Dubrovka Theater in Moscow, resulting in a hostage standoff. In response, Russian special forces instilled a chemical aerosol into the theater's vents, incapacitating occupants and resulting in 125 deaths. Analysis of clothing from 2 victims demonstrated the presence of remifentanil and carfentanil, 2 potent opioids, with death likely from poisoning. Although less practical on the battlefield, it is plausible that the Russian military could use similar compounds to cause serious casualties among opposing soldiers, political protestors, or civilians trapped in buildings, hospitals, subways, or bomb shelters.

Russia's biological agent programs have been rumored to include anthrax (Bacillus anthracis), plague (Yersinia pestis), botulism (Clostridium botulinum), and smallpox (Variola major).5 Biological weapons have been deployed less frequently than chemical agents in modern warfare, but recent observations suggest they may be used. When re-elected in 2012, Putin called for development of weapons based on "genetic principles," alluding to a reincarnation of the Soviet biological warfare program.6 It is unclear how the gaps in pandemic preparedness exposed by COVID-19 may influence Russia's views on the use of biological agents.7 Also, Russia recently attempted to establish a United Nations (UN) commission to investigate unfounded claims that the US and Ukraine are carrying out "military biological activities,"8 a move characteristic of prior false flag tactics to disguise the actual source of a potential attack.

The deliberate or inadvertent release of radiological materials is an additional peril. Although escalation of nuclear weapon posturing from Putin is concerning worldwide, many consider potential radiological attacks in Ukraine to be more likely owing to damage to the nuclear power infrastructure, environmental contamination from radiological waste, or deliberate release of a "dirty bomb" (ie, devices that combine an explosive with radioactive material).

Damage to a nuclear power plant or disruption of critical infrastructure used to cool spent radioactive fuel rods could result in immediate catastrophic effects from fire, nuclear meltdown, and direct radiological contamination to workers, combatants, and local civilians. The 1986 Chernobyl meltdown illustrated the extent to which compromise of nuclear power facilities can also result in generational morbidity and environmental poisoning, leading to an uninhabitable nuclear exclusion zone and long-term neoplastic disease among its former residents. The artillery attacks at the nuclear power plant in Zaporizhzhia, Ukraine, and seizure of the Chernobyl plant during the current conflict highlight likely scenarios leading to inadvertent release of radiological contaminants. Additionally, preexisting underground radioactive water
storage facilities in east Ukraine and the Donbas region used during the Cold War to develop nuclear arms pose a source of radiation exposure to the environment. Damage to these facilities, which have been recently targeted, may result in leakage of radioactive water into the water table, leading to contamination of agricultural fields and increases in background radiation exposure. Also, isolated radionuclides such as polonium 210 may be used as weapons of targeted assassination patterned after the death of Alexander Litvinenko in 2006.

CBRNE threats have had human and environmental impacts on a public health system in Ukraine that is already at its breaking point, and those effects will continue. It is essential that our global medical and public health community assist CBRNE readiness throughout Europe to avert a worsening crisis. The World Health Organization, the UN, or OPCW could serve as a lead facilitator for governmental and nongovernmental organizations to enable sharing of best practices and prioritize resources. In every case of a CBRNE threat, the ability to rapidly recognize, evacuate, decontaminate, treat, and rapidly transport victims to higher levels of care is essential to mitigate morbidity and mortality.

Rapid, just-in-time (JIT) education is a priority. Most chemical agents have characteristic toxidromes (ie, physical examination findings specific to certain chemical agents that can be recognized by nonmedical personnel). Rapid development and distribution of JIT materials with pictographs demonstrating toxidromes would empower the public and public safety professionals (law enforcement, fire services, and emergency medical services) to take immediate action. Examples of layperson immediate response empowerment campaigns include cardiopulmonary resuscitation, automated external defibrillators, and hemorrhage control. Where internet infrastructure remains accessible, information and communication technologies, including social media, smartphone-based applications, and websites, may be used to distribute JIT CBRNE education rapidly. Intelligence agencies and health care officials must also coordinate to ensure education among first responders, civilians, and combatants that is tailored to potential CBRNE threats. Clusters of cases should alert hospitals to the potential of a CBRNE attack, prompting alternative triage strategies, decontamination area setup, and deployment of antidotes. Establishment of a rapid telehealth consultation system involving CBRNE experts can assist frontline responders in rapidly identifying toxidromes and providing immediate recommendations. During the 1995 Tokyo sarin attack by the Aum Shinrikyo cult, a toxicologist recognized the ensuing cholineric toxidrome by watching the live television footage and alerted Tokyo’s emergency command system.

Distribution of guidance emphasizing simplicity and efficacy of various decontamination techniques such as the Primary Response Incident Scene Management (PRISM) protocol would minimize traditional reliance on running water for decontamination and mitigate injury. In addition to education, prepositioning of personal protective equipment, medical supplies, and xenobiotics to support resuscitations is essential. Key antidotes tailored to specific CBRNE threats should be included in readiness preparations throughout Eastern Europe.

Planning must begin now to mitigate predictable long-term effects that may hamper postwar recovery efforts. For example, environmental persistence of chemical weapons may poison individuals even weeks after an attack, and survivors may experience chronic respiratory and neurologic conditions. Radiological exposures may cause long-term teratogenicity and environmental contamination, requiring careful reentry into potentially exposed regions. Also, the psychological effects of CBRNE threats and actual attacks obscured by disinformation campaigns and false flag operations may result in downstream misconceptions and comorbidities.

The world in conflict has become considerably more dangerous, and health care workers might find themselves on the front lines of new and unprecedented challenges. Although we hope that these observations and recommendations will never need to be used, the recent history of chemical warfare and radiological threats in the current geopolitical environment suggests that readiness and resolve are necessary. CBRNE weapons are a clear and present danger, and their use is reprehensible. Following the lead of the International Physicians for the Prevention of Nuclear War, which was founded by US and Russian physicians at the peak of the Cold War, the global medical community must continue to advocate the abolishment of these weapons of mass destruction.

ARTICLE INFORMATION

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REFERENCES


