

Lessons learned from radiation disasters

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The triple catastrophe that began in Japan on March 11, 2011 was unprecedented. In the wake of the devastating earthquake and tsunami, the Fukushima Daiichi nuclear power plant crisis deteriorated to a Level 7 nuclear accident, the most severe level reserved by the International Atomic Energy Association for accidents involving significant releases of radioactive material having the potential for extensive environmental contamination and health consequences. The evacuation zone encompassed 50,000 people living within 20 km of the facility. However, as occurred after the Chernobyl accident, additional communities with high levels of contamination were subsequently identified and evacuated.

Although three such catastrophic events have never before occurred simultaneously, it is safe to predict from previous studies of earthquakes, tsunamis, and nuclear power plant disasters that these events will have significant psychological consequences (1-5). Studies of radiation events (6) and risk perceptions (7,8) show that this specific exposure, whether real or perceived (9,10), is highly dreaded and pernicious because it is conflated with nuclear weapons and the bombings of Hiroshima and Nagasaki during World War II. Thus, the mental health effects will likely be long-lasting.

When the problems at the Fukushima Daiichi reactors first began, the situation was likened to the 1979 Three Mile Island accident, a Level 5 event in central Pennsylvania. At the time, communities surrounding Harrisburg were given confusing and contradictory information about what exactly was occurring at the reactor and whether their health was at risk. The Governor advised pregnant women and small children living nearby to evacuate and, although optional, most people living within 5-10 miles fled. The President's Commission on Three Mile Island documented an immediate impact on distress and anxiety symptoms and growing distrust of authorities amidst the perplexing, ambiguous, and inconsistent reports (11). Subsequent research has demonstrated the intractable nature of such distrust (8). Longitudinal studies of residents who participated in the Task Force report (12), surveys by the Pennsylvania Department of Health (13), and a small prospective population study (14) showed that a range of symptoms was elevated up to six years after the accident, including somatic complaints, generalized anxiety, post-traumatic stress, and depression. Our longitudinal research found that the rate of clinical depression and anxiety among mothers of young children living near the plant was double that of a comparison group in the year after the accident (15). A decade later, depression, anxiety and hostility symptoms remained elevated, and 75% of women were worried or uncertain about the effects of the

accident on their own or their children's health, concerns that were strongly associated with symptomatology (16).

Seven years after Three Mile Island, the Chernobyl nuclear reactor in Ukraine exploded. The 30 km zone around the plant was permanently evacuated, and pregnant women were told to have abortions. Evacuees were stigmatized and feared by the communities where they were resettled (17). Although there were no official statements that something serious had occurred, rumors spread about birth defects, hundreds of thousands of deaths, and cancers arising in countries miles away (17,18). Research conducted 6-20 years after the accident in contaminated villages and communities where evacuees were resettled found elevated rates of anxiety, including post-traumatic stress disorder, depression, and somatization relative to controls (19,20), particularly in mothers of young children (21,22) and clean-up workers (23). In part, fears about contamination were fueled by local doctors who indiscriminately attributed many medical problems to radiation exposure or diagnosed patients with radiophobia (17). At the 20th anniversary, the Chernobyl Forum (24) and others (25) concluded that mental health was the biggest public health effect from Chernobyl. Although misconstrued by many to mean that the physical health effects of Chernobyl were inconsequential, the Forum report used this finding to promote the importance of integrated mental and physical health care.

If past research is a predictor of the future, it is clear that the Japanese populations exposed to the triple disaster, especially the nuclear power plant disaster, will develop significant psychological and somatic symptoms that will be long-lasting in some risk groups. The few English-language reports about the psychological aftermath of the atomic bombings of Hiroshima and Nagasaki support this prediction (26-28). Thus, the radiation exposure could spawn persistent fears about developing cancer and long-term depression, regardless of the actual dose of radiation exposure received. Nonetheless, most survivors of extreme events are resilient (2,3). Therefore, future research in Japan should focus on vulnerable populations, such as mothers with young children evacuated or remaining near Fukushima or in Tokyo, pregnant women and small children living in towns found to have high levels of contamination, nuclear plant workers and their families, the elderly living in shelters, evacuees who lost their jobs and livelihoods, and A-bomb survivors and their offspring. Based on previous research, the most salient aspects of mental health will be health-related anxiety, somatic complaints, anger, sense of abandonment, stigma, and distrust in authorities. It is criti-

cal that a registry be created to enumerate individuals directly or indirectly affected by these events and document the exposures they endured.

What can be done in the short-term to prevent or reduce the expected fears, worries, anger, and distrust? First, plant and government officials should be truthful about what is known and unknown about the situation in and around the plant (29). Second, dosimetry monitoring centers should be available throughout Japan for the foreseeable future. Third, most people with common psychiatric symptoms do not seek professional care, including in Japan (30). Those who seek such care often present to general practitioners or pediatricians with physical symptoms (31). Medical practitioners need to understand the true health effects of radiation exposure, to recognize and manage psychosomatic, anxiety and depression symptoms, and to treat mental and physical health with equal respect. Most importantly, building resilience will be the key challenge for disaster recovery (32).

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