

A BRIEF SUMMARY OF THE MEDICAL IMPACTS OF HIROSHIMA²¹

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An estimated 140,000 people died in Hiroshima and 70,000 in Nagasaki by the end of 1945 as a result of the atomic bombs. Within the eight days Sadako Okuda spent searching for her niece and nephew immediately after the atomic explosion in Hiroshima, approximately 80,000 people died in that city.

The nuclear explosion created a fireball of superheated gas that emitted intense thermal radiation. At the hypocenter — the location

²¹ This summary was prepared in order to relate the research on medical impacts to the specific first-hand observations of Sadako Okuda and other *hibakusha*, and heavily draws upon: Committee for the Compilation of Materials on Damage Caused by the Atomic Bombs in Hiroshima and Nagasaki (1981) *Hiroshima and Nagasaki: The Physical, Medical, and Social Effects of the Atomic Bombings*, published in English by Hiroshima City and Nagasaki City (original Japanese report published in 1979 by Iwanami Shoten Publishers), pp. 30, 107, 113, 115, 118, 121, 126, 131-136, 140, 205. The eight-day mortality figure of 80,000 was estimated by Dr. Robert Vergun based upon the finding in this report that the number of deaths within each successive six-day period after the explosion decreased by approximately 50% (p. 107).

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below the explosion of the atomic bomb over Hiroshima — ground temperatures reached 3,000 to 4,000 degrees Celsius (approximately 5,400 to 7,200 degrees Fahrenheit). This was roughly equivalent to 50% to 70% of the temperature at the sun's surface. The Hiroshima bomb released the equivalent of about 15 kilotons of TNT²⁴ and therefore most people close to the hypocenter were literally blown apart by the power of the blast. However, the vast majority of deaths in Hiroshima were related to thermal injuries as a result of the extreme heat of the bomb, complicated by suffocation as the firestorm consumed all available oxygen in the air.

The primary thermal injuries were flash burns, which appeared on areas of the body that were unprotected from the rays of the thermal radiation, for example areas not covered by clothing. The other type of thermal injuries or burns were secondary ones, so called because these were injuries that came about indirectly, for example, as a result of the fires spreading through the buildings of the city. Many victims were besieged by flames and had difficulty escaping from the buildings burning and collapsing all around them. Some were blinded by radiation or deafened by the pressures of the blast.

People and objects that were situated very close to ground zero were instantaneously vaporized. Near the hypocenter of the explosion, the heat radiation threw permanent shadows of the people and objects onto surfaces like sidewalks that had been behind them.²⁵ Many of the victims near the hypocenter in the central district who received severe thermal burns suffered loosened skin that fell off in flaps. In addition, a brief and sudden but extreme fall in air pressure near the hypocenter caused people's eyeballs to pop out of their bodies. Sadako Okuda describes these victims in her memoir.

Because of extensive burns and high fevers, victims begged and pleaded for water. This situation was made worse because of the difficulty of getting water after the bombing, coupled with the sweltering humid heat of even an ordinary Hiroshima August day. According to Sadako's account, as well as the accounts of other survivors, there were rumors circulating in Hiroshima following the blast that providing water to these victims would kill them. Most Japanese soldiers, medi-

24 Malik, John S. (1985) "The Yields of the Hiroshima and Nagasaki Nuclear Explosions," *Los Alamos Report*, LA-8819.

25 Liebow, Avenill A. (1970) *Encounter with Disaster: A Medical Diary of Hiroshima, 1945*, W.W. Norton and Company, p. 124.

cal providers, and ordinary Hiroshima citizens did not understand the nature of the radiation and the injuries of the victims during the immediate hours and days following the blast. One possibility is that some people dissuaded others from providing water to the victims because of the belief that the ingestion of water would increase blood flow, which in turn would increase bleeding in these victims. While this may be the case, the most comprehensive and detailed compilation of the medical impacts of the atomic attack does not mention the consumption of water as a significant cause of acute death among Hiroshima victims.²⁶ Another possibility was the valid concern that the water itself was poisoned (by radiation, broken sewer systems, debris in the river), but the extent of many people's injuries was so great that poisoned water may not have hastened death by more than a few hours.

Many of the victims with thermal injuries also suffered crush injuries, lacerations (from shattered glass fragments, for example), bruises, and other wounds that failed to heal because of the harmful effects of the bomb's radioactivity on the body's immune and defense mechanisms. In particular, the radioactivity caused damage to bone marrow, suppressing not only the body's ability to produce white blood cells (leaving these immune-suppressed individuals extremely vulnerable to infection), but also suppressing platelet production (resulting in severe hemorrhage).

Deaths caused by infections that originated near broken, hemorrhaging skin were widespread in the days and weeks following the blast. Slow deaths caused by uncontrolled hemorrhaging in the mouth and pharynx areas were not uncommon, as Sadako Okuda witnessed.

Most health care professionals had been transported to the front and many who remained were killed or wounded in the blast. Thus, shortages of health care professionals, shortages of medicine, the destruction of transportation infrastructure and medical facilities, and pre-existing malnutrition from food shortages that existed in Hiroshima before the atomic bomb was dropped, all combined to greatly aggravate the situation. For the vast majority of victims, even palliative care with narcotics for pain relief was unavailable. The horror of

26 Committee for the Compilation of Materials on Damage Caused by the Atomic Bombs in Hiroshima and Nagasaki (1981) *Hiroshima and Nagasaki: The Physical, Medical, and Social Effects of the Atomic Bombings*, published in English by Hiroshima City and Nagasaki City (original Japanese report published in 1979 by Iwanami Shoten Publishers)

the devastation surrounding them surely must have compounded their final agonies.

Roughly 70% of Hiroshima's population that did not immediately die from the blast began to suffer nausea, vomiting, and/or lack of desire to eat within the first 24 hours. Radiation resulted in the death of cells (necrosis) throughout the body. Intestinal cell necrosis resulted in significant diarrhea in about 20% to 40% of the city's population. Gastrointestinal injuries generally impair the body's ability to absorb nutrients and therefore worsen the effects of malnutrition.

Among those who survived the first few weeks, 40% to 55% of Hiroshima victims began to experience hair falling out at the roots (epilation).

Ten to fifteen years after the explosion, almost one-fourth of survivors in Hiroshima developed cataracts. The most notable long-term impact, however, was the development of cancers.²⁷ Five to ten years after the explosion, doctors in Japan started seeing high rates of mortality from leukemia. Hiroshima and Nagasaki victims alive after five years who had experienced significant radiation exposure from the blast (equivalent to those less than 1.5 miles from the hypocenter) were about 50% more likely to die from leukemia compared to the general population in Japan.

Ten to fifteen years after the bombing there were high rates of mortality from other cancers (e.g., lung, stomach, liver, colon, bladder, thyroid, skin, multiple myeloma, breast, ovarian). Women who were 10 years old at the time of the blast and experienced significant radiation exposure were 25% more likely to die from cancers (other than leukemia) compared to non-exposed, age-matched women in the general population.

²⁷ Committee for the Compilation of Materials on Damage Caused by the Atomic Bombs in Hiroshima and Nagasaki (1981), pp. 131, 218-219, 238-241. See also Pierce, D.A., Y. Shimizu, D.L. Preston, M. Vaeth, and K. Mabuchi (1996), "Studies of the Mortality of A-bomb Survivors: Part I (Cancer: 1950-1990)," *Radiation Research*, vol. 146, pp. 1-27; Thompson, D.E., K. Mabuchi, E. Ron, M. Soda, M. Tokunaga, S. Ochiaikubo, S. Sugimoto, I. Ikeda, M. Terasaki, S. Izumi, and D.L. Preston (1994), "Cancer Incidence in Atomic Bomb Survivors: Part II (Solid Tumors: 1958-1987)," *Radiation Research*, vol. 137, pp. S17-S67; Preston, D.L., S. Kusumi, M. Tomonaga, S. Izumi, E. Ron, A. Kuramoto, N. Kamada, H. Dohy, T. Matsuo, H. Nonaka, D.E. Thompson, M. Soda, and K. Mabuchi (1994), "Cancer Incidence in Atomic Bomb Survivors: Part III (Leukemia, Lymphoma and Multiple Myeloma: 1950-1987)," *Radiation Research*, vol. 137, pp. S68-S97. See also the web site of the Hiroshima Peace Museum, www.pcf.city.hiroshima.jp.

Among persons exposed *in utero*, about 25% who survived infancy suffered severe lifetime mental disabilities associated with abnormally small head circumferences (microcephaly).

All those who survived had a high risk of developing post-traumatic stress and other psychiatric illnesses. The costs of providing medical care and social services to victims of Hiroshima were borne by a Japanese economy weakened by the war.

Three days following the Hiroshima blast, a larger, 22 kiloton atomic bomb was dropped on Nagasaki, resulting in 70,000 deaths and similar short- and long-term health and societal consequences.

This summary cannot adequately survey all of the medical impacts of the atomic bombs dropped on Hiroshima and Nagasaki.²⁸ However, in discussing the historical, sociological, and political background surrounding the decision to drop the bomb, we should not lose sight of the magnitude of devastation seen in the raw numbers of people who were killed and injured in Hiroshima and Nagasaki. Furthermore, since we live in a world where the megatonnage of nuclear weapons vastly exceeds that of the Hiroshima and Nagasaki bombs combined, it is imperative that we work for peace and the abolition of these weapons of horrific suffering and mass destruction.

²⁸ For example, it refers only very briefly to the mental health impacts on Hiroshima survivors. For more on those impacts, see Lifton, Robert (1991), *Death in Life: Survivors of Hiroshima*, University of North Carolina Press (reissued).