

ESTIMATED CASUALTIES AND DESTRUCTION CAUSED BY THE ATOMIC BOMBS DROPPED ON HIROSHIMA AND NAGASAKI IN 1945

On 6 August 1945 a 13 kiloton atomic bomb exploded over Hiroshima, Japan. This was followed on 9 August by the explosion of a 21 kiloton bomb over Nagasaki. To date, these have been the only times a nuclear weapon has been used in armed conflict. The following figures reflect the scale of the casualties and damage that resulted from the explosions.

Deaths:

Hiroshima: 100,000 – 140,000 killed*
Nagasaki: 60,000 – 70,000 killed*

Total area destroyed by heat, blast and fire:

Hiroshima: 13 sq km (including 4 sq km completely destroyed by a firestorm)
Nagasaki: 6.7 sq km

Impact on medical services in Hiroshima:

270 out of 300 doctors killed or injured
1,654 out of 1,780 nurses killed or injured
112 out of 140 pharmacists killed or injured

* Number of deaths attributable to the atomic bombs by the end of 1945.
Estimates are based on various surveys conducted by the Japanese authorities and by scholars between August 1945 and August 1946.

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ICRC

INFORMATION NOTE NO. 1

National Nuclear Security Administration / Nevada Site Office



SUMMARY

The explosion of a nuclear weapon releases a combination of heat, blast waves and radiation. These forces have the potential to kill and injure massive numbers of people, to obliterate homes, buildings and infrastructure, and to have severe consequences for the environment.

Whether the explosion is a result of a missile strike during an armed conflict, an act of terrorism or an accidental detonation, it will have a major impact on the health of those directly affected and on the capacity to provide assistance to survivors in the immediate aftermath.

THE EFFECTS OF NUCLEAR WEAPONS ON HUMAN HEALTH

THE IMMEDIATE AND LONG-TERM HEALTH CONSEQUENCES OF NUCLEAR WEAPONS

The atomic bombings of Hiroshima and Nagasaki in 1945 and medical studies conducted since that time have shown the type of immediate and long-term health consequences that can be expected in the event of even a limited use of nuclear weapons. The following describes the health effects and casualties that could be expected from only one 10 to 20 kiloton nuclear weapon (the size of the bombs that destroyed Hiroshima and Nagasaki) detonated at an altitude of 1 km above a densely populated area¹.

The intense fireball generated in the instant that the nuclear weapon explodes would trigger the release of heat, blast waves and radiation.

¹ It should be noted that this is a very small weapon by modern standards. Many nuclear weapons today are up to 30 times larger.

THE EFFECTS AND CASUALTIES OF THE HEAT AND BLAST WAVES

Heat casualties: The earth below the epicentre of the blast would be heated to a temperature of approximately 7000°C, which would vaporize all living things in that area. Tens of thousands of those people who will not have been vaporized would be burnt, with most people suffering horrific full thickness skin burns. Severe burns could occur up to 3 km from the blast. In addition, many people looking in the direction of the explosion would suffer temporary flash blindness for up to 40 minutes or even permanent eye damage, including retinal burns and scarring affecting the visual field, from looking at the fireball with the naked eye.

Blast casualties: The fireball and flash heat would immediately be followed by blast pressure waves travelling at supersonic speeds. People would be killed or severely injured by collapsing homes, falling buildings or flying debris,



A hospital in Hiroshima after the August 1945 bombing



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4132/002.02.2013

or from being thrown through the air. Injuries would include ruptured organs, compound fractures, fractured skulls and penetrating wounds. A significant number of people would be left deaf, owing to ruptured eardrums.

The accompanying firestorm: The fireball and heat would raise temperatures to such levels that many objects and structures not immediately vaporized would burn. The combination of the heat and blast would cause fuel storage tanks and flammable liquids to explode. As a result, large numbers of fires would ignite and potentially create an immense firestorm as winds and intense heat combine the individual fires. A firestorm consumes all nearby oxygen and many seeking safety in shelters above or below ground would be likely to die from asphyxiation. Those that survive the lack of oxygen would be at risk of severe burn injuries.

THE CASUALTIES AND LONGER TERM EFFECTS OF RADIATION AND RADIOACTIVE FALLOUT RELEASED BY A NUCLEAR EXPLOSION

The immediate effects of radiation include the following:

- central nervous system dysfunction (at very high doses);
- nausea, vomiting, and diarrhoea from damage to the gastrointestinal tract, leading to potentially fatal dehydration and nutrition problems; and
- destruction of the body's capacity to produce new blood cells, resulting in uncontrolled bleeding (because of the absence or severe reduction of platelets) and life-threatening infections (because of the absence or reduction of white blood cells).

Many of those who survive the heat and blast effects of a nuclear explosion would fall victim to radiation sickness in the weeks and months that follow. This unique consequence of nuclear weapons would affect persons located outside the immediate proximity of the explosion, as those close to the explosion are likely to have died from fatal burn and blast injuries. Radioactive fallout may also be carried considerable distances downwind, exposing a much larger population than that affected by blast and fire.

Many affected individuals would not be aware that they have received a potentially lethal radiation dose until days or weeks after the explosion, when the damage to their blood system would become evident from bleeding from the gums, or from uncontrolled infections or wounds that fail to heal.²

² The extent of radiation injuries from fallout will depend on a variety of factors, such as where the nuclear explosion takes place (explosion in the air above a city will create much less radioactive debris and resulting fallout than an explosion at ground level), the local wind patterns and weather conditions and whether individuals in the area of fallout are able to remain sheltered, especially during the initial days following the explosion, when radioactivity would be most intense.

Even if people survived the immediate dangers or exposure to radiation, they would face an increased risk of developing certain cancers, such as leukaemia and thyroid cancer. Over time, many more lives would be lost.

In Hiroshima and Nagasaki the fatalities attributed to the bombings had, by 1950, risen to 200,000 and 140,000 respectively.³ Leukaemia incidence increased during the late 1940s and reached a peak in the mid-1950s before decreasing to a lower but still elevated level. The risk of cancer of the breast, oesophagus, colon and lung also rose, particularly in people exposed to high levels of radiation.⁴ Even today, radiation-related illness and death are seen among the now elderly survivors.

³ The Committee for the Compilation of Materials on Damage Caused by the Atomic Bombs in Hiroshima and Nagasaki, *Hiroshima and Nagasaki: the Physical, Medical, and Social Effects of the Atomic Bombings*, p. 369.

⁴ British Medical Association, *The Medical Effects of a Nuclear War*, pp. 103–104.

THE EFFECT ON MEDICAL TREATMENT AND ASSISTANCE

The medical needs of the wounded and sick in the aftermath of a nuclear bomb explosion would be enormous. An overwhelming number of people would need immediate treatment for severe and life-threatening wounds, but no such treatment or assistance would likely be available in the short term.⁵

The explosion of a nuclear weapon exacts a heavy toll on the medical services. In the area affected by the explosion most medical personnel would be dead or wounded and most medical facilities would be destroyed or unable to function. Any medical supplies that survived the explosion (e.g. fluids, bandages, antibiotics and pain medicines) would quickly be used up. There would be no electricity for X-ray machines or ventilators.

⁵ See, "Humanitarian Assistance in the Response to Nuclear Weapon Use", ICRC Information Note, February 2013.

These consequences were highlighted by Marcel Junod, a delegate of the International Committee of the Red Cross, who was one of the first foreign doctors to arrive in Hiroshima and assess the effects of the atomic bombing. It was immediately clear that the human suffering and loss of life there were catastrophic, as was the impact of the explosion on the medical infrastructure and medical services.

As noted by Junod, and indicated in the table above, Hiroshima's medical infrastructure was devastated by the bombing, with most of its skilled medical personnel killed or injured. Structurally, a Japanese Red Cross hospital, located 1.5 km from the epicentre, remained largely intact. However, it could no longer function as a medical facility as its equipment was unusable, a third of its staff had been killed and there was no possibility of blood transfusions, most potential donors being either dead or injured. In an improvised hospital visited by Junod patients were suffering from the effects of radiation poisoning. To use his words:

The Japanese Red Cross hospital in Hiroshima withstood the atomic bombing but was badly damaged and barely able to function as a hospital



Shunkichi Kikuchi



ICRC Archives/Masami Onuka

“They need small blood transfusions at regular intervals; but there are no donors, no doctors to determine the compatibility of the blood groups; consequently, there is no treatment”.

Survivors of the atomic bombing in Hiroshima, such as this woman, were often badly burned, and many also suffered long-term health consequences