

**Nuclear Weapons: The Final Pandemic
Preventing Proliferation and Achieving Abolition
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Opening Plenary Speech (Draft) by Masao Tomonaga, M.D. Ph.D.

Title: Human Consequences of the Hiroshima and Nagasaki Atomic Bombs after 62 Years: The Lifelong Health Effects of Radiation and the Psychological Threat

Dear Friends,

When the scientists of the Manhattan Project, such as Professor Oppenheimer, saw the first successful detonation of an Atomic Bomb at the Trinity Site in 1945, they immediately began to fear that a huge number of human lives would be lost if such a weapon were used upon a city. They also foresaw that the Nuclear Age would inevitably open an arms race between the West and the East. Their fears were well founded, as both prophecies were realized. What they could not foresee was the fate of the Atomic Bomb survivors, which would cause them to suffer throughout their lives.

I was one of the Nagasaki Hibakushas as a two-year-old boy. The wooden house of our family was located at 2.7 kilometer from the Ground Zero with a small hill behind. This protected our family lives. I was sleeping in a bed when the house was totally broken by the blast wind, and then burnt out. My mother rescued me in a minute and escaped to a shrine nearby. My father was then a military doctor serving in Taiwan and heard the atomic bomb attack to Nagasaki. One year later he returned home and found we were all alive.

When I graduated from medical school, I decided to work at the Atomic Bomb Disease Institute of Nagasaki University. This morning I will briefly summarize our research continued over a half century.

The earliest medical consequences of the atomic bombings due to massive radiation were direct damage to multiple organs, such as the bone marrow and the intestines. This combined organ damage more than doubled the number of direct deaths in Nagasaki from 35,000 to 75,000 within three months. Hiroshima casualties reached 120,000.

The same numbers of Hibakushas survived this period both in Hiroshima and Nagasaki. Within a few years, however, they began to encounter leukemia as the first cancer. The incidence of leukemia rapidly elevated, especially among children who were more sensitive to the biological effects of radiation than were adults. Sadako Sasaki was one them, and become famous as the atomic bomb girl. A few hundreds of Hibakushas died of leukemia without any meaningful therapy during this early period.

Leukemia incidence gradually declined after reaching a peak around 1955. After relatively calm years in the early 1960s, solid cancers of various organs began to increase, especially among Hibakushas who were younger than 20 at the time of the bombing. This increase, we first expected, should decline after reaching the peak, just as leukemia had. However, this was not true. As of the millennium year 2000 the cancer incidence was still increasing.

The formal statistical analyses performed by the National Radiation Effects Research Foundation (RERF) indicated recently that

the peak will come around 2015, with an increase of cancers among those survivors who were exposed to Atomic Bomb radiation under age 20 and who, in their sixties and seventies, are now passing the most cancer-prone age.

To our surprise, we clinicians have been diagnosing and treating more and more Hibakusha patients with multiple cancers. These cancers occur either consecutively or coincidentally in different organs. The maximum number reached five in a Hibakusha. These cancers are not metastases of primary cancer. Detailed molecular study has revealed they are actually multiple primary cancers. Our recent analysis of the data of the multiple cancers in single cases has revealed a statistical significance among the short-distance exposure group.

Moreover, a special type of leukemia-related disorder called myelodysplastic syndromes — MDS — was recently found to be statistically significantly elevated among the short-distance exposed population. MDS is basically a disease of the elderly and appears first as a benign anemia but progresses in about 30% of patients to acute myeloid leukemia after several years. So it was called preleukemia. As you remember, leukemia was the earliest malignant disease observed among Hibakushas, especially in children. MDS is now being observed when these children became elderly after a half century.

RERF statistics suggest that the elevated risk of cancer shall continue until 2020 to 2025 and then begin to show a substantial decline due to the final aging of the Hibakusha population. Around 2035, 90 years after the Atomic Bomb explosions, the Hibakusha population will disappear from Japan.

Nagasaki University also conducted large-scale psychological and psychiatric studies on over 6,000 Hibakushas, on the occasion of the 50th anniversary of the Atomic Bombing. We employed a WHO scaling system to measure psychological damage to a social population, and also studied the incidence of PTSD. The results clearly indicated that severe psychological damage was persisting among those Hibakushas who lost their relatives by the Bomb, as well as those who suffered from atomic bomb-related diseases. Flash memory and emotional depression are the major symptoms we frequently observed.

Clearly, more than 60 years since the Atomic Bombings, both the physical and the psychological effects have proven to be lifelong. Hibakushas have felt the consequences for their entire lives. Only extensive early cancer detection and treatment could provide a meaningful relief from the burden. Psychological counseling was given them, but usually was not effective.

My dear friends,

Now you may ask why the health effects of radiation exposure to the whole body are lifelong? Do radioactive materials remain in the body for one's entire life? This was proved unlikely. We have recently proposed a hypothesis called the "organ stem cell hit theory". This suggests that the organ stem cells were injured at their DNA by radiation in 1945. The stem cells, namely maternal cells that produce continuously mature cells to form an organ, are the only cell type capable of surviving for more than 60 years in human bodies. We hypothesize that these stem cells become the target cells of final cancerous change.

Our laboratory technique has now reached the level that we can isolate the organ stem cells, such as bone marrow stem cells, and detect genetic derangements by using molecular technique. We have already obtained some evidence that these stem cells are actually carrying chromosomal defects.

Our research is now entering the final stage to make clear the ultimate process by which such a stem cell, with chromosomal damage, transforms to cancer cells.

My friends,

The pandemic of nuclear weapons, only two of which caused the lifelong suffering of the Hibakusha, is still prevalent after 60 years among the governments of the nuclear powers and those states suspected of developing nuclear weapons.

We Hibakushas of Hiroshima and Nagasaki do not yet see the start of the ultimate abolition of nuclear weapons that was promised by the nuclear weapon states at 2000 NPT Review. But I wish to believe

that this pandemic will finally be cured by the power of global citizens in cooperation with scientists, including physicians, who know that abolition is the prescription.

Thank you for your attention.