

## Yes I Can Site Report: The Radiation Effects Research Foundation in Hiroshima

Report by Shari Yasin, McMaster University

### 1. How did the RERF start?

The Atomic Bomb Casualty Commission (ABCC), the predecessor organization to the Radiation Effects Research Foundation (RERF), was established in Hiroshima (1947) and Nagasaki (1948) following the recommendation of a U.S.

army-navy task force that a long-range study of the medical and biological effects of the atomic bomb be done. When the ABCC arrived in Hiroshima, they found that the Japanese were already preparing for a similar kind of study on survivors, so a decision

was made to combine the research efforts of the United States and Japan (a cooperative effort between the ABCC and Japanese National Institute of Health). This cooperative effort continued until 1975 when it was replaced by the formation of the RERF.



### 2. Who runs the RERF? What are the goals of the RERF and how are these being met?

The RERF in Hiroshima is located in Hijiyama Park on a hill that overlooks the city. Interestingly, it is this very hill to which some survivors fleeing the city after the bomb



climbed. The RERF is a nonprofit Japanese foundation which is funded equally by the Japanese and U.S. governments. Together, both countries manage the RERF's finances, workers and decision-making. The RERF aims to understand how radiation exposure

affected the health of atomic bomb (A-bomb) survivors over many years and to use this knowledge to guide health care programs for survivors and to protect individuals throughout the world (the world relies heavily on data from the RERF to set radiation safety standards in nuclear power plants and medical radiation facilities for example). Reaching this goal, requires the completion of a number of tasks including, 1) gathering detailed records on as many survivors as possible, 2) tracking the pregnancies of women who were exposed to radiation or whose husbands were exposed to radiation, 3)

estimating the radiation doses to survivors and 4) analyzing health effects in survivors and genetic effects in their children. In the late 1940s and early 1950s, the ABCC began to tackle these sizeable tasks through surveys that collected information on the location and shielding of thousands of survivors at the time of the bombing (for radiation dose calculations) and through registrations of pregnant women as a way of tracking abnormal birth outcomes. Studies of health effects also began around this time and are still ongoing today through the continued efforts of RERF researchers.

### [3. What studies are being done by the RERF? What have they found?](#)

There are five major research departments within the RERF. These are the current activities of each:

**Department of Epidemiology:** conducts studies of the incidence and distribution of diseases among A-bomb survivors (especially cancer)

**Department of Clinical Studies:** conducts health exams on survivors to help detect diseases at an early stage

**Department of Genetics:** conducts studies on the children of survivors to determine if the radiation caused any problems in this generation

**Department of Radiobiology and Molecular Epidemiology:** studies the effects of radiation on the immune system (blood cell defense system) of survivors

**Department of Statistics:** works on measurements and calculations of radiation doses to survivors



The RERF studies differ from other studies of populations exposed to radiation (i.e. Chernobyl accident survivors, World War I radium dial workers), in that only the RERF studies have followed a large population of over 100 0000 survivors for more than 50 years. Therefore, these studies provide the most comprehensive

information to date on the late effects of radiation in humans.

Some of the questions that are being investigated include:

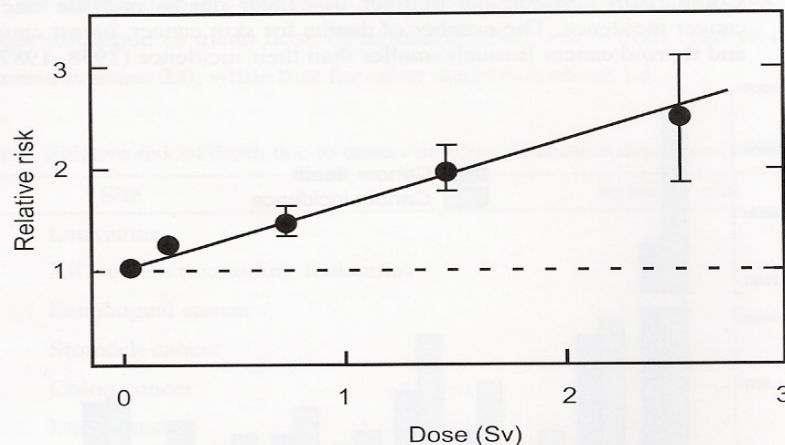
- **What were the doses to survivors?**

Little radiation appeared to have reached beyond 2.5 km from the hypocenter (where the bomb detonated). In general, the closer a person was to the hypocenter, the greater the radiation dose received, although individual doses varied because of different types of shielding from buildings and the surrounding landscape. It is estimated that the radiation dose decreased about one-half for every 200m from the hypocenter and about half of the radiation dose that would have normally been received was absorbed by houses that some survivors were in at the time of the bombing.

- **What radiation-related late effects were seen in survivors?**

*Cancer.* A number of cancers have been linked to A-bomb radiation including leukemia and cancer of the lung, liver, breast, stomach, bladder, large intestine, colon ovary, thyroid and nervous system. In general, the greater the radiation dose received

Figure 8. Relationship between radiation dose and the relative risk of incidence of all cancers, excluding leukemia



by a survivor, the greater their risk for these cancers. The graph to the left (obtained from the RERF), shows that the risk of cancer increases by a factor of 2 for every 1.5 Sv of A-bomb radiation received.

*Non-cancer Diseases.* A few years after the end of the war, radiation cataract (a clouding of the eye lens which impairs sight) increased among survivors. A number of other diseases have been clearly linked to radiation, including increases in non-cancerous (benign) tumors of the thyroid gland, parathyroid gland, uterus and intestine. However, the link between radiation exposure and some diseases (which may



also result from unhealthy lifestyles) like heart disease, liver disease, changes in immunity and thyroid abnormalities needs to be confirmed. Additional effects which show a clear association with radiation exposure are hyperparathyroidism and delayed growth and development (for those exposed as children).

*Genetic Abnormalities.* Genetic studies have revealed chromosomal mutations and somatic cell mutations (especially in blood cells) among some survivors as a result of radiation exposure.

- **What radiation-related effects were seen in the children of survivors?**

The RERF's first major study of the children of survivors (known as the F1 generation or "first filial generation") began in 1947 and was a study of abnormal pregnancy outcomes. Study results have shown that some children who were exposed to radiation while still in the womb suffered from A-bomb microcephaly resulting in mental retardation and low IQ. However, no such increase was found for other pregnancy outcomes like miscarriage, malformations or still birth compared to children whose parents were not exposed to A-bomb radiation. In addition, no increases in blood disorders or mortality have been observed in the F1 generation to date. Genetic studies have also revealed no effect of parental radiation exposure on DNA mutations or chromosomal aberrations in these children. However, more studies are needed to confirm these results since such effects may possibly appear later on. In any case, these results are important as they dispel the myth that the children of survivors would have had horrible birth defects...this is a myth that prevented many survivors from marrying into other families and was a major source of their stigmatization in Japanese society. Currently, studies are underway to see if parental radiation predisposed children to diseases that typically appear later in life like cancer, heart disease, hypertension and diabetes.



#### [4. How did/do survivors view the RERF?](#)

When the ABCC first began its research, many of the survivors did not trust the organization and viewed it negatively for a number of reasons. First, many survivors felt further victimized and disapproved of the United States studying the very population that

they had dropped the bomb on. Consequently, there were two very different views of these studies, with survivors feeling like they were the guinea pigs in an experiment and with U.S. workers feeling that they were helping survivors to understand what may have happened to them through determining the effects of the radiation. Second, the results of many early studies by the ABCC were published in western countries only. This led to further criticism of the U.S. for its apparent secrecy in its work. Third, for legal reasons the ABCC and RERF were unable to provide treatment to survivors who were found to have serious radiation-related health problems and therefore, many survivors were upset that these organizations only conducted studies without offering any follow-up health care. Despite some initial resistance, many survivors voluntarily participated in the ABCC studies and many more survivors continue to participate in the RERF studies. Since the late 1940s, the attitude of many survivors who originally refused to participate has changed as they now recognize the importance of the RERF's work and the RERF's commitment to helping them understand how their health may have been affected. Today, participation rates in some studies have been maintained at levels as high as eighty percent!

Approximately forty percent of all survivors are still alive, so studies on these individuals will continue for the next few decades and once complete, will hopefully provide definite answers on the health impacts of the bombing. Until then, the success of the RERF's long-term health and genetic studies crucially depends on the continued participation of A-bomb survivors and their children.

### [References](#)

Introduction to the Radiation Effects Research Foundation. Fourth revision November 2005. Hiroshima; RERF. pp 1-27.

Shigematsu, I (1998) Greetings: 50 Years of Atomic Bomb Casualty Commission-Radiation Effects Research Foundation Studies. *Proceedings of National Academy of Sciences of the United States of America*. 95:5424-5425.

The Children of Atomic Bomb Survivors: A Genetic Study (1991). *The National Academy of Sciences of the United States of America*. pp 331-333.

Images:

<http://www.gensuikin.org>

<http://www.hiroshima-is.ac.jp/Hiroshima/radiation.htm>

<http://www-sdc.med.nagasaki-u.ac.jp/n50/disaster/Center.gif>

<http://www.hiroshima-spirit.jp>

Thank you to Rob Cowan for kindly providing one of the pictures!

For more on the RERF, visit <http://www.rerf.jp/>