The Genetic (trans-generational) health effect of radiation and human rights of the second-generation of Atomic Bomb survivors in Hiroshima and Nagasaki

Katsumi Furitsu M.D.Ph.D.
National Institute of Biochemical Innovation and Nutrition, Osaka
Hyogo College of Medicine, Hyogo, Japan

This text is the script for the 10th North Asian Regional conference and the 3rd North-South Consultative Meeting of the International Physician for the Prevention of Nuclear War (IPPNW) on 13-14 September 2018 in Ulaanbaatar, Mongolia.

1) Introduction

Title slide:

I would like to express my deep gratitude to the organizers of this conference, especially to the doctors of MPPNW and Prof. Tomonaga, for allowing me to talk in this symposium.

As a physician, I have the experience to take medical care of the atomic bomb survivors who live in Osaka.
I am also a researcher in genetics for the past 18 years, and my main research focus is the genetic (trans-generational) effects of radiation.

Today, I will briefly talk about what we know about the trans-generational health effect of radiation and also introduce some of the activities of the second generation of A-bomb survivors in Japan to protect their human rights.

2) Studies on genetic effects of radiation

Slide1

We, scientists, are trying to prove or understand the genetic health effect of radiation on human beings from the studies of these three fields.
1st: Estimation from the results of animal experiments.
2nd: Epidemiological study on the children of survivors exposed to radiation.
3rd: Studies of molecular genetics, such as DNA mutations of germ-line cells.

- We already have clear scientific evidence and consensus on the induction of the genetic effect of radiation from the data of animal experiments. So, we can estimate the genetic impacts on human beings from these data of animals, especially the data of mammals such as mice.
- As for the epidemiological study and studies of molecular genetics, we have not yet reached a clear consensus on the scientific assessment of the results in the case of human beings, including the second generation of A-bomb survivors.
- The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) considers a genetic risk of radiation on humans. They calculate the genetic risk of radiation on humans based on the natural background incidence rate of human genetic diseases and the radiation-induced genetic risk data estimated from the experimental mice.

3) Results of experiments on mice

Slide 2

I will show some of the important experiments on mice from Prof. Nomura's study. He is my teacher.

① This slide shows the induction of embryonic death from radiation exposure to father mice:
Father was exposed to radiation in the experiment. Prof. Nomura used quite a high dose of radiation in this case, and mated with the unexposed mother, and examined the fetus.
In this case, he found nine embryonic death from 11 fetuses.

The incidence rate of embryonic death, induced by radiation, increased in proportion to the radiation dose to parents.
The matured germ cells, spermatid, are most sensitive than im-matured cells, spermatogonia.

Slide 3

② This slide shows the results of tumor induction in the next generation after parental radiation exposure:
Again, the incidence rate increased in proportion to the exposure dose of parents.
In germ cells before meiosis, the increased rate is less than in matured cells.

The solid lines indicate the results of single and high dose exposure,
and the broken lines indicate low and fractionated exposure,
You can see the difference between two kinds of lines in the case of spermatogonia and oocyte.

I do not show any data here, but,
The incidence rates of tumor induction are quite different among the various species of mice.
The difference of sensitivity among different species of mice corresponds to the sensitivity of individual persons in human beings.

Slide 4

③ This slide shows an example of the pedigree of mice with radiation-induced "tumor susceptibility." The male mouse was exposed to radiation in this family, mated with the unexposed mother. As a result, the children and the further generations have a high incidence of various tumors.
So, in this family, “Tumor susceptibility” transfers to the next and further generations.

4) **Understanding from the animal experiment**

Slide 5

I summarize what we understand from these animal experiments in this slide.

① The animal experiment results, especially on mammals, suggest that radiation could induce similar genetic health effects in human beings.

② The genetic health effect induced by radiation exposure is not “specific diseases” to radiation.
It includes congenital disorders, cancers, non-cancer diseases, and so on, which could also occur spontaneously and other environmental factors might cause.

③ The risk of the genetic health problems of radiation increases in proportion to the exposure dose of the parents. It is the "stochastic effect."

＊ “Stochastic effect” means that there is a risk of health problems, which could occur in certain probability among the children, in proportion to the radiation dose of parents.
So, all the children of A-bomb survivors might have a certain risk of genetic health problems, but not all of them experience such diseases for their lifetime.
This situation makes the children of survivors anxious about their health for their life because they sometimes could not have proper social and medical support to secure their right to health.

5) Genetic studies on the children of A-bomb survivors by ABCC/RERF

Slide 6

As for the genetic research on the children of A-bomb survivors in Hiroshima and Nagasaki, the US sent an investigation team led by the US military to Hiroshima and Nagasaki soon after the bombing. They established the "Atomic Bomb Casualty Committee" (ABCC) in 1946 and started to study the people in the cities to get information, how “effective” or “useful” the atomic bombs were as weapons. ABCC began the investigation on the second generation in 1948. The Radiation Effect Research Foundation (RERF) took over ABCC's study in 1975.

Therefore, the studies of ACBB and RERF have been historically conducted by the US, which dropped Atomic-bombs and wanted to get the information of the effectiveness of atomic bombs as weapons to develop more nuclear weapons. A-bomb survivors, Hibakusha, often criticize their studies saying that they treated Himashusha as experimental animals.

You can see the list of their studies on children of A-bomb survivors on the table:
I do not have time to make comments on each of them in detail, but, up to now, they have reported that there

is no evidence, which indicates the health risks induced by radiation exposure of parents. The Japanese government has been refusing to provide proper support to the second and third-generation survivors based on the statement of RERF. However, their genetic study has several scientific problems and limitations: the size of the population, which is only about 70,000, is too small to detect any genetic effect by epidemiological study, and bio-genetic-markers, which they used, were not proper to detect the genetic impact of radiation.

6) Ongoing researches on the genetic effects of radiation on human

Slide 7:

We, the research team headed by Prof. Nomura, have been trying to detect the trans-generational effect with the samples of residents in the contaminated area and clean-up workers of the Chernobyl accident, using the DNA markers of mini-satellite. We can detect mutations of these markers to analyze the difference of numbers of the repeated sequence of DNA.

Slide 8:

This slide shows a part of the results of my Ph.D. work. Unfortunately, we could not get the statistically positive effects of the increased mutation rate with the samples of the liquidators, clean-up workers', families from Belarus. There were some limitations in this study, though. For example, we could not get the precise exposure dose of fathers.

Slide 9:

Here is the list of studies on children of radiation-exposed parents using the markers of repeated sequences. Most of the studies did not show a significant increase in the mutation rate of the second generation, except the mini-satellite studies by Duvrova. However, all of his samples are from inhabitants in contaminated areas, so the exposure might not be limited to germ cells. The result might include the radiation effect on the cells in all stages after conception in such a condition.

7) Recent social activities of the children of A-bomb survivors in Japan

Slide 10:

I would briefly introduce the social activities of children of A-bomb survivors in Japan.
It is estimated that there are about 300 – 400 thousand children of A-bomb survivors in Japan, though we do not yet know the exact information on the number.

The children of A-bomb survivors are not subjected to the A-bomb survivor's compensation law, though they are possibly affected by their parents' exposure to radiation. So far, the only measure provided by the Japanese government to second-generation survivors is the annual health examination.

So, the association of second-generation (Japanese Liaison Council of Second-Generation Atomic Bomb Survivors) has been requesting the Japanese government to apply the A-bomb survivor's compensation law to the second generation. However, the Japanese government has refused their request for more than 30 years.

In such a situation, last year (2017), some of the children of A-bomb survivors started the class actions in Hiroshima and Nagasaki against the Japanese government.

They also have started to raise the issue of their human rights at the international level. For example, the association of second-generation survivors submitted a report to the UN human rights council on the occasion of the UPR of Japan last year. They also went to Geneva to lobby several countries, and Costa Rica and Mexico took the issue and recommended the Japanese government to protect the right to health of the second-generation A-bomb survivors. But, the Japanese government did not accept the recommendations.

Anyway, this was the first step of the international activities of second-generation A-bomb survivors.

They also organized a side-event on the NPT preparatory committee in May this year (2018) in Geneva. It was the first time for them, as an association, to give voices in an international meeting to raise the problem of their human rights and appeal for a nuclear-free world. They also met with many country delegations, including Ambassador White of Costa Rica.

I have been supporting their activities as a science and medical advisor.

8) What is necessary to protect the nuclear victims' human rights, including their second and further generations?

Slide 11

In conclusion, I would like to mention, “What is necessary to protect the human rights of the nuclear victims, including A-bomb survivors, and their second and further generations?”

It is not only a matter of the future; it is an urgent issue as the second generation is now making voices themselves.

① It is urgently necessary to provide social and medical support to the nuclear victims and their next generations based on the "precautionary principle."
The states, military, or industry, which caused such health risk of radiation to people, should take responsibility for providing support to the victims.

② We have to abolish nuclear weapons and "peaceful use of nuclear energy” to avoid further burdening future generations from radiation contamination and exposure.