

## Lessons from Fukushima: scientists need to communicate better

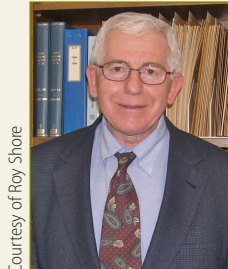
Roy Shore was the co-chair of a scientific panel that compiled the WHO *Health risk assessment from the nuclear accident after the 2011 great East Japan earthquake and tsunami* released in February. He talks to Fiona Fleck about the challenges of producing valid science in a highly charged environment.

**Q: It is tragic that the country that suffered the first and only nuclear bomb attack also faced the most serious civilian nuclear accident since the Chernobyl disaster in 1986. How did the Radiation Effects Research Foundation's study of the health effects of the 1945 bombings prepare Japan and the rest of the world for coping with the Fukushima disaster?**

**A:** Initially, there was a great deal of confusion and uncertainty over this combined disaster of a major earthquake leading to a tsunami followed by a nuclear power plant accident. Any time such tremendous devastation occurs, this initial reaction is inevitable. Given that the infrastructure in the affected area was largely destroyed, with no electricity or mobile phone connections, the response was of course uncoordinated, at first, and the company that owned and operated the reactors was not that well prepared. Despite the initial confusion, the Japanese government and people pulled together a great deal regarding the disaster. It's been a much better response than in Chernobyl [in the former Soviet Union], partly because of lessons learnt in Chernobyl, partly because the society here is well organized once people get over the initial shock. We, at RERF, have developed substantial scientific documentation for estimating the long-term health effects that might occur and their magnitude. This was helpful information in responding to medical concerns.

**Q: What information did you provide?**

**A:** From our accumulated data we have learned many things. We know that radiation increases the risk of developing many types of cancers and that the risk for solid cancers is directly proportional to the radiation dose. This increased risk of developing cancer in someone who has been exposed to radiation at any age appears to be lifelong and exposure at young ages confers a greater cancer risk than at older ages. Some of the cancer types most frequently associated with radiation exposure are leukaemia and cancers of the breast and thyroid gland. We have learned that other diseases, such as heart disease,



Courtesy of Roy Shore

Roy Shore

Syracuse University in 1967 and a DrPH in epidemiology in 1982 from Columbia University in the United States of America.

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stroke and cataract, are also associated with radiation but whether a risk exists at low radiation doses is unclear, and, even at higher doses, the risk appears to be less than for cancer. So cancer is the primary health effect to concentrate on after exposure to low radiation doses. Our data have served as the primary basis for radiation risk estimates by all the national and international risk assessment groups and were used by WHO for its report.

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**Q: What was done to ensure that the scientific process was sound and the results of the WHO report were valid?**

**A:** WHO selected a panel of very solid, top-notch scientists and they introduced balance into it. Some members felt we should not overplay the health risks and thought it quite likely that the exposures were substantially smaller than feared. Others said there may be real risks and that we shouldn't downplay them. We were able to introduce some innovative ideas by estimating

long-term exposures and life-time risks, instead of just short-term doses and risks. We also used a better approach than had been used in the past to estimate childhood thyroid cancer risks. There was quite an effort to get input from different groups once we had a draft report and that helped to improve the robustness of the report.

**Q: How did you manage the pressure from all around?**

**A:** As members of the panel, we decided that we were going to concentrate on the best science possible, without bowing to pressure groups. We had very lively discussions with differences of opinion, and when I chaired the group I made sure everyone had their say. We used the best scientific evidence available, but there is always room for differences in expert opinion and we didn't want to shut down discussion. We tried our best to achieve consensus. Of course, you can't achieve perfect agreement and, so, minority opinions are also included in the report.

**Q: What were the limitations of the study?**

**A:** The single biggest limitation was the uncertainty regarding the doses that people in various communities may have been exposed to. A radiation dose assessment panel was convened by WHO soon after the accident and was only able to use radiation dosimetry information from the first few months. But a lot of dosimetry information came in

after that, which may have changed the picture. Our task was to work with the dose estimates that the radiation dose assessment panel had come up with, although we were aware of later estimates. In addition to reliance on early estimates, there were other uncertainties surrounding all of these estimates: we didn't know what foods people ate; where the food came from; how soon people were evacuated, and so on. So in trying to estimate the health risks, there were a lot of uncertainties.

*Q: Given your experience and that of your institution studying the effects of the atomic bombs dropped on Hiroshima and Nagasaki in 1945, can such uncertainty in the estimates affect their reliability?*

A: Yes, for sure. In the atomic bomb study we have considerable data on the magnitude of dose uncertainty and can, therefore, use statistical methods to adjust for it, which improves the resultant risk estimates. But, for Fukushima, we don't have sufficient information on the size of dose uncertainties to formally make allowance for them.

*Q: Were there other limitations?*

A: Another had to do with thyroid cancer. We know that intensive, highly sensitive screening for this is now being done in the Fukushima area and that this is likely to detect more thyroid cancers than would otherwise have been the case without such screening. We don't know the medical significance of this highly sensitive screening. What fraction of these tiny cancers thus detected would eventually grow to cause significant health problems? That's an unanswered question. But it's quite possible that our projections, which were based on past thyroid radiation studies with less effective screening, may underestimate the frequency of thyroid cancers detected in Fukushima.

*Q: When it comes to studying the health risks and effects of radiation why do critics often accuse governments of a lack of transparency?*

A: After the Chernobyl catastrophe, the people affected were not informed that there had been a major radiation accident until several days later, so their children were still drinking milk from the local backyard cows and in this way their thyroid glands were exposed to

very large doses of radioactive iodine from the contaminated grass eaten by the cows. This is one example of a lack of transparency, but the bigger problem is that there is usually limited information and, therefore, confusion, when a nuclear accident first occurs.

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*Q: Has it also to do with communication?*

A: Yes, we scientists often don't do a very good job of communicating with the public. This was true with regard to the Fukushima accident. The media were confused. For example, one scientific communication to the news media about radiation dose used millisieverts and another about radioactivity concentration used becquerels, without explaining how one relates to the other or what was an important dose in terms of the health risks. We scientists do not always consider how best to convey potential health risks, so that journalists and their audiences have a context for understanding them. For instance, we need to explain better how much exposure to radiation increases an individual's chances of becoming ill. Comparison with the individual's chances of developing such diseases in the absence of radiation exposure i.e. by looking at the baseline disease rates may help understand the real magnitude of the numbers we are providing. Putting the radiation risks in the larger context of other risks, such as exposure to certain lifestyle factors, can help reduce unfounded fears.

*Q: Are there other reasons why governments are accused of a lack of transparency in this context?*

A: There is a considerable advocacy community, including advocacy-oriented scientists, with a slanted view regarding radiation risks. They receive a lot of press because the media and the advocates like sensational stories

and this tends to overplay the situation. Given the unclear scientific messages plus the discrepancies in the messages, it's very hard for a reporter to sort out what is valid science and what are its implications. So it's a very difficult, muddy situation.

*Q: How do you, as scientists at your research centre, cope with the sense of pressure from all sides: with governments hoping your results will put nuclear power in a positive light and their critics accusing you of downplaying the health risks and effects of radiation?*

A: At RERF we take a strong stand that we are neutral and impartial, that we are neither going to sensationalize nor cover up scientific findings if we believe they are valid. Over the years, the Japanese government has accepted that. In one particular case, the government was reluctant to support a new line of radiation research, but once our independent external advisory groups all supported the research – and it also had public support – the government agreed and that research is ongoing. So we have found that by emphasizing good science, we can manage the pressure points relatively well.

*Q: Given the 60-year history of investigating the health risks and effects of radiation; in the field of radiation biology, which questions still baffle scientists?*

A: There is a lot of controversy in the literature about how much risk there is from low radiation doses, especially when exposures are received over the course of months and years rather than in a few seconds or minutes, such as with the atomic bomb study. This issue concerns people who get multiple computed tomography scans and people exposed to radiation in the course of their work. Some of the more highly exposed workers are industrial radiographers and certain medical personnel. Another controversy pertains to the genetic or inheritable risk to the offspring of those with radiation exposure to the reproductive organs. We are gathering data on that at RERF but, at this point, the offspring of the atomic bomb survivors are only in their 50s and early 60s, and much of the disease experience lies ahead. So we don't yet have a good answer regarding how much genetic risk there may be for adult-onset diseases, and no one else does either. ■