

## Reevaluating the Paradox: Does Low-Dose Radiation from A-Bombs Affect Lifespan and Cancer Mortality?

Razieh Rashidfar (MSc)<sup>1</sup>, Zeynab Seyedi Sarhad (MSc)<sup>1</sup>, Seyed Mohammad Javad Mortazavi (PhD)<sup>1,2\*</sup>, Lembit Sihver (PhD)<sup>3,4,5\*</sup>

The July 10, 2024 program news from the US National Academies highlights the viewpoints of Dr. Preetha Rajaraman, the new vice chair for the Radiation Effects Research Foundation in Hiroshima and Nagasaki, Japan. Dr. Rajaraman emphasizes the critical insights gained from atomic bomb survivors regarding the long-term effects of radiation exposure and the psychological impacts of their experiences. While a few studies have suggested that A-bomb survivors and control groups have demonstrated longer-than-average lifespans and lower solid cancer death ratios compared to the general Japanese population, these findings are puzzling and contradict the vast majority of research on this topic. Most studies have consistently shown an increase in the incidence of various cancers, cardiovascular diseases, cataracts, and a reduction in life expectancy among survivors. A significant increase in leukemia, particularly in the years immediately following the bombings, has also been reported. The experiences of atomic bomb survivors remain a critical area of study, shedding light on both the immediate and long-lasting consequences of nuclear warfare, as well as the resilience of those who endured such tragedies. With a significant number of survivors still living, there is a continued need for long-term research to study the effects of radiation exposure and the psychosocial aspects of surviving such catastrophic events. This research can inform future disaster preparedness and response strategies.

We have read with interest the July 10, 2024 program news of the US National Academies (Science, Engineering and Medicine) [1] In this report viewpoints of Dr. Rajaraman, the new

<sup>1</sup>Ionizing and Non-ionizing Radiation Protection Research Center (INIR-PRC), Shiraz University of Medical Sciences, Shiraz, Iran

<sup>2</sup>Department of Medical Physics and Medical Engineering, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>3</sup>Department of Informatics and Engineering Systems, College of Engineering and Computer Science, University of Texas Rio Grande Valley (UTRGV), TX, USA

<sup>4</sup>Department of Chemistry and Chemical Engineering, Royal Military College of Canada, Kingston, ON, Canada

<sup>5</sup>Department of Physics, East Carolina University, Greenville, NC 27858, USA

\*Corresponding authors: Seyed Mohammad Javad Mortazavi

Department of Medical Physics and Medical Engineering, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

E-mail: mortazavismj@gmail.com

Lembit Sihver  
Department of Informatics and Engineering Systems,

College of Engineering and Computer Science  
University of Texas Rio Grande Valley [UTRGV], TX, USA

E-mail: lembit.sihver@utrgv.edu

Received: 9 August 2024  
Accepted: 20 August 2024

vice chair for the Radiation Effects Research Foundation in Hiroshima and Nagasaki, Japan are presented. According to this report, survivors of the atomic bombings in Hiroshima and Nagasaki have provided invaluable insights into the long-term effects of radiation exposure and the psychological impact of such traumatic events. As of now, nearly 20% of the original survivors are still alive, with a significant portion being children at the time of the bombings. This ongoing presence of survivors offers a unique opportunity for continued research and understanding of their experiences and health outcomes.

Survivors have reported a range of health issues, including increased rates of cancer and other diseases linked to radiation exposure [1]. Studies have shown that those exposed to the bombings are at higher risk for various health complications, which has informed public health policies and radiation safety standards. Moreover, many survivors experience long-term psychological effects, such as post-traumatic stress disorder [PTSD], anxiety, and depression. Understanding these mental health challenges is crucial for providing appropriate support and care. The experiences of atomic bomb survivors remain a critical area of study, shedding light on both the immediate and long-lasting consequences of nuclear warfare, as well as the resilience of those who endured such tragedies.

We have also read with great curiosity the article by Sutou titled ‘Low-dose radiation from A-bombs elongates lifespan and reduces cancer mortality compared to unirradiated individuals,’ published in *Genes and Environment* [2]. It is puzzling that Sutou concluded both A-bomb survivors and control groups demonstrated longer-than-average lifespans. Additionally, he reported lower solid cancer death ratios in both populations compared to the general Japanese population. Recent studies have suggested similar conclusions [3, 4]. In other studies, findings also showed that there was no association between radiation risk and cancer incidence of cancer mortality [5, 6].

We know that, in most studies conducted to date, an increase in the incidence of various cancers, cardiovascular diseases, cataracts, and a reduction in life expectancy have been observed among survivors [7-10]. Several studies have reported a significant increase in leukemia, particularly in a few years after bombing [11-13]. In 2016, it was claimed that the risk for a number of cancers such as bladder, female breast, lung, brain, thyroid gland, colon, esophagus, ovary, stomach, liver and skin [excluding melanoma] increased significantly among survivors [12].

Due to the few similarities between the results of previous studies and Sutou’s studies, we believe that his studies may not be enough to accept his approach for A-Bomb survivors. It seems that long-term studies are needed to either confirm or refute this author’s perspective. With a significant number of survivors still living, there is a continued need for research to study the long-term effects of radiation and the psychosocial aspects of surviving such catastrophic events. This research can inform future disaster preparedness and response strategies.

To summarize, the ongoing debate over the effects of low-dose radiation from atomic

bombs on lifespan and cancer mortality highlights the complexity of interpreting epidemiological data. The conflicting reports from studies such as Sutou's necessitate continued research, especially as nearly 20% of the original survivor population remains alive today. These studies are not only pivotal for setting accurate public health policies and radiation standards but also provide invaluable lessons for disaster response and preparedness strategies moving forward. Future research should aim to reconcile these discrepancies through rigorous, longitudinal studies and enhanced international collaboration to ensure a comprehensive understanding of the long-term effects of radiation exposure.

### Authors' Contribution

SMJ. Mortazavi, SAR. Mortazavi and L. Sihver conceived of the presented idea. R. Rashidfar and Z. Seyedi Sarhad made the first draft of the manuscript. All authors have contributed to the gathering of data and the writing/reviewing of the current manuscript and read, modified, and approved the final version of the manuscript.

### Conflict of Interest

SMJ. Mortazavi and L. Sihver, as the Editorial Board Members, were not involved in the peer-review and decision-making processes for this manuscript.

### References

1. Huddleston N. What We've Learned from Survivors of the Atomic Bombs. National Academies; 2024.
2. Sutou S. Low-dose radiation from A-bombs elongated lifespan and reduced cancer mortal-

ity relative to un-irradiated individuals. *Genes Environ.* 2018;**40**:26. doi: 10.1186/s41021-018-0114-3. PubMed PMID: 30598710. PubMed PMCID: PMC6299535.

3. Sutou S. Low-dose radiation effects. *Current Opinion in Toxicology.* 2022;**30**:100329. doi: 10.1016/j.cotox.2022.02.002.
4. Janiak MK, Waligórski MP. Can low-level ionizing radiation do us any harm? *Dose-Response.* 2023;**21**(1):15593258221148013.
5. Neel JV, Kato H, Schull WJ. Mortality in the children of atomic bomb survivors and controls. *Genetics.* 1974;**76**(2):311-36. doi: 10.1093/genetics/76.2.311. PubMed PMID: 4822470. PubMed PMCID: PMC1213068.
6. Yoshimoto Y. Cancer risk among children of atomic bomb survivors. A review of RERF epidemiologic studies. Radiation Effects Research Foundation. *JAMA.* 1990;**264**(5):596-600. PubMed PMID: 2366299.
7. Sugiyama H, Misumi M, Brenner A, Grant EJ, Sakata R, Sadakane A, et al. Radiation risk of incident colorectal cancer by anatomical site among atomic bomb survivors: 1958-2009. *Int J Cancer.* 2020;**146**(3):635-45. doi: 10.1002/ijc.32275. PubMed PMID: 30873589. PubMed PMCID: PMC6916284.
8. Utada M, Brenner AV, Preston DL, Cologne JB, Sakata R, Sugiyama H, et al. Radiation Risk of Ovarian Cancer in Atomic Bomb Survivors: 1958-2009. *Radiat Res.* 2021;**195**(1):60-5. doi: 10.1667/RADE-20-00170.1. PubMed PMID: 33181839. PubMed PMCID: PMC10320731.
9. Samet JM, Niwa O. At the 75th anniversary of the bombings of Hiroshima and Nagasaki, the Radiation Effects Research Foundation continues studies of the atomic bomb survivors and their children. *Carcinogenesis.* 2020;**41**(11):1471-2. doi: 10.1093/carcin/bgaa104. PubMed PMID: 33017841.
10. Mabuchi K, Preston DL, Brenner AV, Sugiyama H, Utada M, Sakata R, et al. Risk of Prostate Cancer Incidence among Atomic Bomb Survivors: 1958-2009. *Radiat Res.* 2021;**195**(1):66-76. doi: 10.1667/RR15481.1. PubMed PMID: 33181833. PubMed PMCID: PMC7849930.

11. Tomonaga M. The atomic bombings of Hiroshima and Nagasaki: A summary of the human consequences, 1945-2018, and lessons for homo sapiens to end the nuclear weapon age. *Journal for Peace and Nuclear Disarmament*. 2019;**2**(2):491-517. doi: 10.1080/25751654.2019.1681226.
12. Ozasa K. Epidemiological research on radiation-induced cancer in atomic bomb survivors. *J Radiat Res*. 2016;**57**(Suppl 1):i112-7. doi: 10.1093/jrr/rrw005. PubMed PMID: 26976124. PubMed PMCID: PMC4990102.
13. Ozasa K, Grant EJ, Kodama K. Japanese Legacy Cohorts: The Life Span Study Atomic Bomb Survivor Cohort and Survivors' Offspring. *J Epidemiol*. 2018;**28**(4):162-9. doi: 10.2188/jea.JE20170321 PubMed PMID: 29553058. PubMed PMCID: PMC5865006.