In the News

Expert Panel Urges Aggressive Research Initiative to Study Health Effects of Low-Dose Radiation

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The US government should fund a robust, multiyear research program to study how low-dose radiation affects health risks for cancer and other diseases, according to a new consensus study report from the National Academies of Science, Engineering, and Medicine (NASEM).

This initiative, said the expert committee who wrote the report, would leverage advances in biotechnology and research infrastructure that were not harnessed by previous low-radiation research. Such advances, including greater computing power, data-sharing systems, and tools for measurement and genetic manipulation, have fostered innovation and transformative discoveries in areas such as cancer diagnosis and treatment and vaccine production.

The report notes that increasing numbers of individuals are exposed or potentially exposed to ionizing radiation in medical, industrial, military, and commercial settings from a range of sources, including medical imaging such as x-ray or computed tomography (CT) scans or air travel, as well as mining of rare earth elements and lithium, which have become important for applications that include green energy. Medical diagnostic procedures, particularly CT scans, comprise the largest human-made source for radiation for the US population.

However, the health effects of exposures to low-level radiation and the biological mechanisms underlying these effects are not fully understood, the report said, underscoring the need for an aggressive research effort into the effects of exposures to low-dose radiation. The committee also noted that uncertainties and concerns related to low-dose radiation influence patient acceptance of medical diagnostic procedures involving radiation, decisions by the US government regarding the future of nuclear power and clean energy policies, management of nuclear waste, plans for responding to radiological threats, and continuing efforts to assess radiation-related health effects of “legacy exposures” to fallout from the production and testing of nuclear weapons.

“There is much we don’t know about the impacts of low-dose radiation exposures on our health—but recent advances in research, new tools, and a coordinated multidisciplinary research program could help us fill those gaps,” Joe W. Gray, PhD, of the University of California, San Francisco, and chair of the committee that wrote the report, said in a statement. “This is especially important as science seeks to provide answers to concerned individuals and to communities that have been involuntarily exposed to radiation, including Indigenous communities, atomic veterans, nuclear workers, and others impacted by the legacy of US nuclear weapons testing and production.”

Cancer is the condition most commonly studied for its association with low doses of radiation, and—although evidence is sparse—heritable genetic effects are assumed to be associated with low-dose exposures. But there is also increasing evidence that exposure to low-dose radiation (defined as doses below 100 milligray, a measurement of the absorbed dose) or low dose rates (radiation delivered at rates below 5 milligray per hour) may be associated with other conditions, such as cardiovascular disease, neurological disorders, immune dysfunction, and cataracts.

The US Department of Energy (DOE) initiated a low-dose radiation research program in 1999 but terminated it in 2016 to focus on other priorities. However, Congress passed legislation for the program to resume in 2018 and approved additional legislation in 2021 that asked NASEM to develop a long-term plan for low-dose and low-dose-rate research.

Noting that research in low-dose radiation in the United States “is currently limited and fragmented, lacking leadership and an overarching prioritized strategic research agenda,” the report...
proposes priorities for epidemiological and biological studies on low-dose radiation, as well as for creating a research infrastructure.

For example, priorities for epidemiological research include developing better analytical tools for studying low-dose radiation's effects and improving estimation of the risks from low-dose radiation with respect to cancer and other health outcomes. Such studies should also identify factors that can modify these effects, including genetic, lifestyle, and environmental factors, the report said.

The NASEM committee noted that applying new and developing technologies will enable scientists conducting biological studies to more precisely define processes at the cellular and molecular level that are affected by low-dose and low-dose-rate exposures. Priorities for such studies include developing appropriate model systems, developing biomarkers for radiation-induced adverse health outcomes, and defining the dose-response relationships for low radiation exposure, linking specific doses of radiation to health effects at the cellular level.

Priorities for developing a research infrastructure outlined in the report include creating tools for sensitive detection of radiation and precise characterization of cell and tissue changes, harmonizing research databases, and ensuring researchers' access to low-dose exposure facilities. The committee determined that achieving these and other priorities in the research agenda will require substantial funding in the next 15 years, including the $30 million and $40 million authorized by Congress for 2023 and 2024, respectively, followed by $100 million annually through 2037.

Although the DOE has been the only federal agency with the congressionally mandated responsibility to conduct low-dose radiation research, the report said that the proposed research agenda should be jointly led by the DOE and the National Institutes of Health, in part because of concerns raised by members of affected communities about "inherent conflicts" stemming from the DOE both leading low-dose radiation research and regulating radiation exposures. The committee also noted that members of the research community "have cited DOE's shortcomings related to management of the previous low-dose radiation program."

In addition, because the research agenda exceeds any single agency's capabilities, the committee said that "a partnership with an agency whose mission is to enhance health would be warranted," with the DOE spearheading research relating to computational and modeling research and the National Institutes of Health leading epidemiological and biological research.

ARTICLE INFORMATION

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