

New report calls for health monitoring and research program on Gulf War and post-9/11 veterans

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To help determine if the descendants of Gulf War and post-9/11 veterans are at risk for health effects resulting from the service members' exposure to toxicants during deployment, a new report from the National Academies of Sciences, Engineering, and Medicine recommends the creation of a health monitoring and research program (HMRP). The committee that carried out the study and wrote the report assessed the available evidence on the reproductive, developmental, and generational health effects related to exposures that may have occurred during the Gulf War and post-9/11 conflicts. While there is a growing base of human and animal evidence on the reproductive and developmental effects of many toxicants of concern, there is a dearth of information on the specific effects of veterans' exposures on their children, grandchildren, and great-grandchildren.

Almost 700,000 U.S. troops were deployed to the Persian Gulf region during the height of Operation Desert Shield and Operation Desert Storm in 1990-1991. The U.S. military engaged in further conflicts in the Middle East following the terrorist attacks of Sept. 11, 2001, with troops stationed in and around Afghanistan and in Iraq. In any war, deployed service members may be exposed to potentially hazardous agents and situations—some intentionally and others unknowingly, the report says. These may include chemicals that are used in everyday civilian life, such as pesticides and solvents, as well as chemical and biological agents, mandatory vaccines, smoke from burn pits and oil-well fires, dust, high ambient temperatures and heat stress, and depleted uranium.

Because there was little or no information on specific effects in veterans for many of the toxicants, the committee relied on studies that examined occupational or residential cohorts, who were exposed to some of the same toxicants as

Gulf War and post-9/11 veterans were. The committee was unable to determine how relevant the exposures in these non-[veteran](#) studies are to those experienced by deployed veterans in terms of the [exposure](#) magnitude, duration, frequency, mixtures, and co-exposures. The ability to generalize associations found in such studies to veterans is also limited by differences in population characteristics such as gender, age, ethnicity, and lifestyle. Therefore, such exposures should be studied specifically in active-duty service members and veterans in order to confirm that the associations are valid for those populations.

The committee came to more than 50 conclusions in five categories of association between the deployment exposures and reproductive effects, adverse pregnancy outcomes, or developmental effects. No toxicant had sufficient evidence of a causal association between exposure and reproductive or developmental effects, nor did any toxicant have limited/suggestive evidence of no association between exposure and reproductive or developmental effects. Among the conclusions, the committee found sufficient evidence of an association between prenatal exposure to organophosphate pesticides and neurodevelopmental effects; prenatal exposure to particulate matter and adverse pregnancy outcomes, such as low birth weight and preterm birth; and prenatal exposure to benzene and childhood leukemia. In addition, the committee found limited/suggestive evidence of an association between sulfur mustard and [reproductive effects](#) in men, and between prenatal exposure to particulate matter and pregnancy-induced hypertensive disorders, and respiratory or neurodevelopmental effects in children.

The HMRP would be a collaboration among a number of government and nongovernmental

organizations. The report describes a recommended generational [health effects](#) framework for development of an HMRP, including veterans' health research programs, such as the the following priorities, which will be critical to implementing a useful HMRP: Million Veteran Program and the Millennium Cohort Study, the report says.

- The collection, storage, and maintenance of comprehensive baseline and longitudinal data and biospecimens from veterans, their partners, and their descendants;
 - Detailed exposure characterization and assessment during and after deployment; and
 - The development, evaluation, standardization, and interoperability of biomarkers of exposure, susceptibility, and biological effects.
- The costs of designing and conducting an HMRP for any veteran cohort will be considerable, as demonstrated by the cost of similar programs such as the National Institutes of Health's National Children's Study and the All of Us Research Program, the report says. However, the costs of some of the underlying technologies—for example, whole-genome sequencing—have declined dramatically, and research results from the health monitoring program may translate into significant cost savings for the nation.

"Addressing the priorities outlined in this report will require substantial resources, long-term commitment by the departments of Defense and Veterans Affairs and other governmental organizations, and considerable engagement by past, current, and future veterans and their families," said committee chair Kenneth S. Ramos, associate vice president for precision [health](#) sciences, professor of medicine, and executive director of the Center for Applied Genetics and Genomic Medicine at University of Arizona. "However, the results that arise from studying generational effects will ultimately be rewarded with new knowledge of veterans' exposures, their reproductive health, and the health of their children and grandchildren. Importantly, the new understanding derived from these investments will be relevant to the health of all Americans now and for future generations."

The study was sponsored by the U.S. Department of Veterans Affairs. The National Academies of Sciences, Engineering, and Medicine are private, nonprofit institutions that provide independent, objective analysis and advice to the nation to solve complex problems and inform public policy decisions related to science, technology, and medicine. They operate under an 1863 congressional charter to the National Academy of Sciences, signed by President Lincoln. For more information, visit nationalacademies.org. A committee roster follows.

More information: www.nap.edu/catalog/25162

Provided by National Academies of Sciences, Engineering, and Medicine

There are numerous considerations that must be addressed to implement a large-scale HMRP, such as financial and human resource costs, the availability and expertise of adequately trained personnel, the time required for project completion, ready access to well-curated data, the maintenance of confidential human health data, ethical considerations for investigations that include parents and children, and the implementation of appropriate health and risk communication strategies between and among organizations and veterans and their families. Given these considerations, a practical approach to exploring

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