

Cancer Mortality Risk among Military Participants of a 1958 Atmospheric Nuclear Weapons Test

ABSTRACT

Objectives. This study was undertaken to determine if Navy veterans who participated in an atmospheric nuclear test in 1958 were at increased risk of death from certain cancers.

Methods. Cancer mortality risk of 8554 Navy veterans who participated in an atmospheric nuclear test in the Pacific was compared with that of 14 625 Navy veterans who did not participate in any test. Radiation dosage information was obtained from film badges for 88% of the test participants.

Results. The median radiation dose for the test participants was 388 mrem (3.88 millisieverts [mSv]). Among participants who received the highest radiation dose (>1000 mrem, or 10 mSv), an increased mortality risk for all causes (relative risk [RR] = 1.23; 95% confidence interval [CI] = 1.04, 1.45), all cancers (RR = 1.42; 95% CI = 1.03, 1.96), and liver cancer (RR = 6.42; 95% CI = 1.17, 35.3) was observed. The risk for cancer of the digestive organs was elevated among test participants (rate ratio = 1.47; 95% CI = 1.06, 2.04) but with no significant dose-response trend. Many of the cancers of a priori interest were not significantly elevated in the overall test participant group or in the group that received the highest radiation dose.

Conclusions. Most of the cancers suspected of being radiogenic were not significantly elevated among the test participants. Nevertheless, increased risks for certain cancers cannot be ruled out at this time. Veterans who participated in the nuclear weapons tests should continue to be monitored. (*Am J Public Health*. 1995;85:523-527.)

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Introduction

From 1945 through 1962, the Manhattan Engineer District and its successor agency, the Atomic Energy Commission, conducted 235 atmospheric nuclear tests. The Department of Defense estimated that approximately 205 000 of its military and civilian personnel participated in the tests.¹ Film badge dosimeters were distributed to a representative sample of Defense Department personnel with exposure potential within each test site from 1945 to 1954 and to nearly all personnel with exposure potential in subsequent test series.² The film badges measured radiation exposure in millirem. (Rem is defined as the radiation absorbed, weighted by factors reflecting the biological effectiveness of the particular radiation.³) Most of the 205 000 test participants were exposed to low levels of radiation within the established federal limits of 5 rem (or 50 millisieverts [mSv]) per year.⁴

Studies of the mortality of A-bomb survivors indicate a significant dose-response relationship for leukemia; for cancers of the esophagus, stomach, colon, lung, breast, ovary, and bladder; and for multiple myeloma. Malignant lymphoma and cancers of the rectum, gallbladder, pancreas, uterus, and prostate were not found to be significantly increased.⁵

Analyses of combined mortality data on US nuclear industry workers who were exposed to chronic low doses of ionizing radiation at the Hanford site in Washington State, the Oak Ridge National Laboratory in Tennessee, and the Rocky Flats Nuclear Weapons Plant in Colorado provide no evidence of excess mortality from all cancers or from leukemia. Only one specific cancer, multiple myeloma, was found to be associated with radiation exposure.⁶

In 1979, the Centers for Disease Control presented a preliminary report

indicating that the participants in a nuclear weapons test (SMOKY) conducted in Nevada in 1957 had an excess of leukemia cases based on age- and sex-specific general population rates.⁷ Follow-up studies of the same cohort by Caldwell et al. and the National Academy of Sciences revealed further increases in leukemia incidence among the SMOKY participants.⁸⁻¹⁰ However, deaths from leukemia and other radiogenic cancers were not elevated among participants in several other test series that were studied.¹⁰ None of the studies of the test participants included a military nonparticipant control group for comparison purposes.

In light of the findings described above and of continuing concerns for the health of veterans who participated in the nuclear weapons tests, a study of the military participants of another test series was undertaken to determine whether they were at higher risk for dying from certain cancers. Hardtack I, a test series not included in previous studies, was selected because it had one of the highest proportions of participants with film dosimetry data.

Methods and Procedures

Identification of Study Subjects

A database of veterans who participated in nuclear weapons tests has been established by the Defense Department's

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Mortality Of Military Participants In Us Nuclear Weapons Tests

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Mortality Of Military Participants In Us Nuclear Weapons Tests:

The Five Series Study Institute of Medicine, Medical Follow-up Agency, Committee to Study the Mortality of Military Personnel Present at Atmospheric Tests of Nuclear Weapons, Heather O'Maonaigh, Harriet Crawford, William F. Page, Susan Thaul, 2000-03-02 More than 200 000 U S military personnel participated in atmospheric nuclear weapons tests between 1945 and the 1963 Limited Nuclear Test Ban Treaty Questions persist such as whether that test participation is associated with the timing and causes of death among those individuals This is the report of a mortality study of the approximately 70 000 soldiers sailors and airmen who participated in at least one of five selected U S nuclear weapons test series¹ in the 1950s and nearly 65 000 comparable nonparticipants the referents The investigation described in this report based on more than 5 million person years of mortality follow up represents one of the largest cohort studies of military veterans ever conducted

Mortality of Veteran Participants in the CROSSROADS Nuclear Test Committee on the CROSSROADS Nuclear Test, Institute of Medicine, 1996-11-25 In 1946 approximately 40 000 U S military personnel participated in Operation CROSSROADS an atmospheric nuclear test that took place at Bikini Atoll in the Marshall Islands Congress passed a law directing the Veterans Administration to determine whether there were any long term adverse health effects associated with exposure to ionizing radiation from the detonation of nuclear devices This book contains the results of an extensive epidemiological study of the mortality of participants compared with a similar group of nonparticipants Topics of discussion include a breakdown of the study rationale an overview of other studies of veteran participants in nuclear tests and descriptions of Operation CROSSROADS data sources for the study participant and comparison cohorts exposure details mortality ascertainment and findings and conclusions

The Million Person Study of Low-Dose Radiation Health Effects John D. Boice Jr, André Bouville, Lawrence T. Dauer, Ashley P. Golden, Richard Wakeford, 2024-11-25 This book presents original research findings of The Million Person Study of Low Dose Radiation Health Effects MPS the largest and most comprehensive epidemiologic study of its kind to investigate the health effects of low level chronic radiation exposure on American workers and veterans throughout the 20th century Since the early 1900s epidemiologists have studied the consequences of radiation exposures yet the health effects of low levels received gradually over time remain unresolved This uncertainty comes at a time when the public and workers are experiencing ever increasing levels of radiation exposure from advances in medical radiation imaging techniques e g CT scans frequent flying at high altitudes and environmental and occupational exposures The MPS is providing answers by studying 30 radiation exposed U S populations including workers at nuclear power plants radiologists workers at former Manhattan Project sites nuclear submariners nuclear weapons test participants atomic veterans industrial radiographers and radium dial painters Ongoing for more than 20 years and coordinated by the National Council on Radiation Protection and Measurements Vanderbilt University Medical Center and Memorial Sloan Kettering Cancer Center the MPS is a national effort supported by the Department of Energy National

Aeronautics and Space Administration U S Navy Defense Threat Reduction Agency Nuclear Regulatory Commission Centers for Disease Control and Prevention and the Environmental Protection Agency Unparalleled in scope and quality the MPS provides an understanding of low dose health effects that is desperately needed for decision makers and the radiation protection community as society continues to increase the uses of radiation technologies Individual chapters were originally published in the International Journal of Radiation Biology

Improving the Presumptive Disability Decision-Making Process for Veterans Institute of Medicine, Board on Military and Veterans Health, Committee on Evaluation of the Presumptive Disability Decision-Making Process for Veterans, 2008-06-15 The United States has long recognized and honored the service and sacrifices of its military and veterans Veterans who have been injured by their service whether their injury appears during service or afterwards are owed appropriate health care and disability compensation For some medical conditions that develop after military service the scientific information needed to connect the health conditions to the circumstances of service may be incomplete When information is incomplete Congress or the Department of Veterans Affairs VA may need to make a presumption of service connection so that a group of veterans can be appropriately compensated The missing information may be about the specific exposures of the veterans or there may be incomplete scientific evidence as to whether an exposure during service causes the health condition of concern For example when the exposures of military personnel in Vietnam to Agent Orange could not be clearly documented a presumption was established that all those who set foot on Vietnam soil were exposed to Agent Orange The Institute of Medicine IOM Committee was charged with reviewing and describing how presumptions have been made in the past and if needed to make recommendations for an improved scientific framework that could be used in the future for determining if a presumption should be made The Committee was asked to consider and describe the processes of all participants in the current presumptive disability decision making process for veterans The Committee was not asked to offer an opinion about past presumptive decisions or to suggest specific future presumptions The Committee heard from a range of groups that figure into this decision making process including past and present staffers from Congress the VA the IOM veterans service organizations and individual veterans The Department of Defense DoD briefed the Committee about its current activities and plans to better track the exposures and health conditions of military personnel The Committee further documented the current process by developing case studies around exposures and health conditions for which presumptions had been made Improving the Presumptive Disability Decision Making Process for Veterans explains recommendations made by the committee general methods by which scientists as well as government and other organizations evaluate scientific evidence in order to determine if a specific exposure causes a health condition

Cancer Epidemiology and Prevention David Schottenfeld, Joseph F. Fraumeni, 2006-08-24 Drawing widely from international sources the new edition of this reference book on cancer causes incidence mortality and survival patterns also includes chapters on social class obesity physical activity and chemoprevention plus other related topics in the field *Final*

Report of the Advisory Committee on Human Radiation Experiments United States. Advisory Committee on Human Radiation Experiments, 1996 This book describes in fascinating detail a variety of experiments sponsored by the U S government in which people were exposed to radiation without their knowledge After reviewing hundreds of thousands of documents from the Atomic Energy Commission and other agencies the Advisory Committee appointed by President Clinton in January 1994 found that nearly 4 000 human radiation experiments most involving very low doses of radioactive tracers were sponsored by the federal government between 1944 1974 This book documents these findings to provide a fascinating if not disturbing reminder of both the shocking standards for human experimentation and the practice of government secrecy in recent history Carried out at the height of the Cold War experiments included feeding radioactive cereal to teenagers at a school for the mentally retarded irradiating the testicles of prison inmates injecting plutonium into hospital patients and intentional releases of radiation into the environment The book places these experiments within their historical context and a review of the relevant government policies and ethics standards at the time is included The analysis is then applied to contemporary research on human subjects The book concludes with a discussion of the Committee s key findings and a set of recommendations for changes in institutional review boards the interpretation of ethics rules and policies the conduct of research involving military personnel the oversight and accountability for ethical violations compensation for research injuries and balancing national securities interests with the rights of the public This compelling volume will prove to be a landmark in the development of standards for human experimentation Ethicists public health professionals and those interested in the history of medicine and Cold War history will be intrigued by the findings in this volume Publisher description LoC

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