

# "Veterans and Agent Orange Update 1996: Summary and Research Highlights" by the US National Academy of Sciences' Institute of Medicine

In March 1996, the National Academy of Sciences of the United States released "Veterans and Agent Orange Update 1996: Summary and Research Highlights," which summarized research on the health effects of Agent Orange and other herbicides used in the Vietnam War. In their 1996 report, the National Academy connects Agent Orange exposure with two health conditions: spina bifida, a birth defect that occurs when the spinal cord develops improperly, and peripheral neuropathy, a nervous system condition in which the peripheral nerves are damaged. Spina bifida was the first birth defect to be linked to Agent Orange exposure. The resulting disability compensation for affected children, as a result of the conclusions in the 1996 report, marked the first time that the US Veterans Administration addressed the health outcomes of veterans' families, and not exclusively veterans themselves.

During the Vietnam War, United States armed forces carried out a military campaign called Operation Ranch Hand, which used chemical defoliants to eliminate plant cover and destroy enemy food crops. Herbicides such as Agent Orange, Agent White, and Agent Blue, named for the colored stripe on their steel drum containers, were used between 1962 and 1971 as part of that operation. Agent Orange, the most extensively used defoliant, comprised roughly eleven million gallons of the approximate nineteen million gallons of herbicides dispersed through Vietnam as part of Operation Ranch Hand.

In the mid-1960s, lobbying efforts by scientists led the US Congress to mandate studies to determine the possible toxicity of the herbicides used in Operation Ranch Hand. In 1969, the private research firm Bionetics Laboratories in Yorktown, Virginia, reported that one of the main components of Agent Orange contained a dioxin pollutant called TCDD (2,3,7,8-tetrachloro-dibenzo-para-dioxin) that caused birth defects in rodents exposed to the compound in utero. Scientists later found dioxins to be toxic to humans, causing health problems such as skin diseases, respiratory illnesses, and cancer. The US military subsequently halted spraying Agent Orange in 1970 and discontinued Operation Ranch Hand in 1971.

Beginning in the late 1960s, reports surfaced of increased rates of birth defects and stillbirths in Vietnamese villages that had been sprayed by Agent Orange. Vietnam veterans returning to New Zealand, Australia, and the United States also reported health problems such as cancer and skin disease. Though occupational and environmental studies linked TCDD exposure with adverse health outcomes, studies conducted on veterans and civilians produced varying results. The Centers for Disease Control conducted two health studies on Vietnam veterans in the 1980s that were inconclusive.

Due to public debates about the possible long-term health consequences of Agent Orange, US Congress enacted Public Law 102-4, also called the Agent Orange Act of 1991, in February 1991. In the act, Congress defined service-connected diseases as diseases that had been linked to dioxin exposure. Despite the current lack of proof that Agent Orange caused certain veterans' health issues, the Veterans Administration presumed that certain diseases were related to veterans' service experiences, and would provide disability compensation for such diseases. Congress directed the National Academy of Sciences to review and evaluate new scientific literature in order to compile a list of service-connected diseases for the Secretary of Veterans Affairs and the Department of Veterans Affairs. The Act listed the first three service-connected diseases: non-Hodgkin's lymphoma

and soft-tissue sarcoma, two types of cancers, and chloracne, a skin disease.

In the first National Academy report in 1994, the committee added five more service-connected diseases to the group of health conditions compensated by the Veterans Administration. In addition to reviewing scientific literature, they met with veterans, government agencies, and environmental groups. They categorized all of the health outcomes that might be associated with herbicide exposure under one of four categories: no association, insufficient evidence of an association, limited association, and suggestive evidence of an association. The Veterans Administration compensated families of veterans who had health categorized as limited association and suggestive evidence of an association.

In the next report, "Veterans and Agent Orange Update 1996," the committee added two more service-connected diseases, spina bifida and peripheral neuropathy. Because a large portion of the 1996 document listed the same health outcomes and conclusions as the initial 1994 report, the committee released a secondary document, "Veterans and Agent Orange Update 1996: Summary and Research Highlights" to emphasize the two changed conclusions.

At fifty-seven pages, the abridged "Summary and Research Highlights" report consists of three chapters, "Executive Summary," "Research Highlights," and "References." The first chapter, "Executive Summary," which was taken from the initial 1994 report, included a historical overview of the post-Vietnam War period relating to Agent Orange issues and the changes in the new 1996 report. Specifically, the authors move spina bifida, a type of nervous system birth defect, from the category "Inadequate/Insufficient Evidence to Determine Whether an Association Exists" to the category "Limited/Suggestive Evidence of an Association." The authors also add peripheral neuropathy, which involves damage to the peripheral nerves, to the category "Limited/Suggestive Evidence of an Association." The authors further explain the two new conclusions in the second chapter, "Research Highlights."

The authors split the second chapter, "Research Highlights," into two sections titled "Birth Defects," and "Peripheral Neuropathy." In the "Birth Defects" section, the committee reviews studies about the potential association between paternal herbicide exposure and birth defects.

The committee examined four studies that studied whether or not male workers were affected by exposure to dioxin, either at herbicide factories or through spraying herbicides. The committee summarizes the results of the four studies, citing that in the factory studies, the children of workers did not present a higher rate of birth defects. However, they note that in the fourth study, the herbicide sprayers had higher than normal odds of fathering infants with birth defects. The authors also briefly note the limitations of each of the four studies.

The Institute of Medicine committee then examined environmental studies that addressed whether people exposed to herbicides in the environment had increased rates of birth defects in their children. One study from Vietnam evaluated the prevalence of birth defects in an area that the US military had sprayed with herbicides during the war. Authors of the study found strong associations between birth defects and maternal exposure to herbicides. However, the Institute of Medicine committee questioned the accuracy of the data and the diagnosis of birth defects. Despite similar evidence from other Vietnamese studies, the committee again highlighted methodological issues, such as poor reporting and lack of validation of reported birth defects, as reasons for skepticism towards the results. They stated that overall, the environmental studies did not provide sufficient evidence to conclude a link between spina bifida and dioxin exposure.

Finally, the Institute of Medicine committee reassessed studies connecting birth defects and Vietnam veterans' Agent Orange exposure. The majority of the studies were conducted prior to 1994 and reviewed in the first 1994 report, but an updated study in 1995 presented new information. The studies addressed in the first report included two studies that the Centers for Disease Control (CDC) conducted at their primary laboratories in Atlanta, Georgia, and another study an independent research team conducted at Boston Hospital for Women in Boston, Massachusetts.

In the two CDC studies, researchers investigated whether the reproductive outcomes of Vietnam veterans were affected by their war service. In both studies, the researchers found some association between Agent Orange exposure and birth defects in the veterans' children, specifically spina bifida.

However, the researchers ultimately determined that the results were inconclusive, and attributed the spina bifida-related findings in both studies to incidental statistical anomalies or confounding biases.

In the third study, researchers Ann Aschengrau and Richard R. Monson reviewed obstetrics records and parental service records from patients of the Boston Hospital for Women in Boston, Massachusetts. In those records, they found only a slight increased risk for congenital anomalies among Vietnam veterans. The authors concluded that there was no association between paternal military service in Vietnam and the risk of major malformations in offspring. However, they also stated that their study was too small to draw many meaningful conclusions, and therefore their results were tentative.

In 1995, the US Air Force published the results of an ongoing health study that caused the Institute of Medicine committee to change its decision regarding spina bifida in the 1996 report update. In the study, which began in 1982, Air Force researchers compared 872 soldiers who had handled and sprayed herbicides during the war, with 1,036 Air Force veterans who had been in Southeast Asia at the same time but were not exposed to herbicides. By 1995, the research team had conducted four comprehensive physical examinations in 1982, 1985, 1987, and 1992, which included laboratory tests. In addition to blood and urine samples, they measured the dioxin levels in the veterans to test if veterans with higher levels of dioxin also had adverse reproductive outcomes. Though the study continued, the researchers released a 1995 update highlighting their finding of a slightly higher proportion of birth defects among children whose fathers encountered Agent Orange than among those whose fathers had not.

The new findings in the Air Force Health Study led the Institute of Medicine committee to acknowledge at the end of the "Birth Defects" section that dioxin exposure was possibly linked to neural tube defects in the offspring of Vietnam veterans. The authors cite the CDC Birth Defects Study, the CDC Vietnam Experience Study, and the Air Force Health Study as evidence of a possible association between herbicide exposure and increased risk of spina bifida. However, the Institute of Medicine committee concluded that there was still inadequate evidence linking herbicide exposure with other birth defects.

In the next section, "Peripheral Neuropathy," the committee reviews occupational and environmental studies that studied the link between herbicide exposure and the occurrence of peripheral neuropathy. Occupational studies showed that herbicide sprayers lost feeling in their peripheral nerves, the nerves which travel from the spinal cord to all the areas of the body. Regarding environmental studies, the committee examines reports from a chemical dioxin explosion in Seveso, Italy. In 1976, an accident at a chemical manufacturing plant in Seveso led to the dispersion of approximately half a pound of dioxin over an area inhabited by 40,000 people. Health studies of the residents showed increased rates of peripheral nerve damage. The committee concludes that there was limited evidence that herbicide exposure was related to peripheral neuropathy.

After the 1996 report was published, the US Department of Veterans Affairs recommended that the Secretary of the Department of Veterans Affairs, Jesse Brown, add prostate cancer, peripheral neuropathy, and spina bifida to the list of service-connected diseases. Veterans Affairs also recommended that the Secretary support increased research efforts into studying the possible link between herbicide exposure and the development of birth defects, including spina bifida. While prostate cancer was linked to Agent Orange exposure in the first 1994 report, Brown had initially concluded that the scientific evidence of an association was insufficient to warrant policy changes. However, in a news conference on 28 May 1996, the President of the United States, Bill Clinton, and Brown announced that they would implement all of the recommendations.

In July 1996, Brown sent a draft bill to Congress that addressed how Veterans Affairs would provide for the needs of Vietnam veterans' children with spina bifida. Veterans Affairs needed additional legislation because the department only had authority to presume service-connected diseases for veterans and not for veterans' families. According to Veterans Affairs records, Congress incorporated the proposal into the 1997 appropriations bill. On 26 September 1996, Clinton signed Public Law 104-204, called the Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1997. Among other issues, the bill asserted that a link

between herbicide exposure and spina bifida existed and gave Veterans Affairs the legal authority to provide for the needs of children of Vietnam veterans born with spina bifida.

Though the initial Agent Orange Act of 1991 directed the Institute of Medicine committee to produce reports every two years for ten years, the Veterans Education and Benefits Expansion Act of 2001 (PL 107-103) extended those updates until 2014. By 2016, Veterans Affairs acknowledged fourteen diseases or categories of diseases as presumed service-connected diseases for which veterans and their family members may be eligible for benefits. Spina bifida remained the only birth defect to be classed as a service-connected disease, following the conclusions of the Institute of Medicine committee in the "Veterans and Agent Orange Update 1996" and the "Veterans and Agent Orange Update 1996: Summary and Research Highlights."

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