

Agent Orange & Birth Defects

THE LEGACY CONTINUES

By Betty Mekdeci

The soldiers are dying. But, even more tragically, the children they have left behind are suffering. Sometimes at Birth Defect Research for Children we hear from veterans, but usually it is wives and children who send us poignant messages:

“I lost my husband from a cancerous brain tumor 13 months ago. My son has many disabilities, including Tourette’s syndrome, mental retardation, mild cerebral palsy, hydrocephalus, and he is profoundly deaf. He will never be able to live on his own.”

“My father passed away in 1998. He had many health problems, including type II diabetes. He was only 50 years old. Agent Orange has been a part of my life from the moment I was born. I was born without my right leg, several of my fingers, and my big toe on my left foot. My mother had three miscarriages. My younger brother (age 29) has to wear bifocals and suffers from chronic joint pain.”

“I served four tours in Vietnam. We have three children: one daughter with a heart defect, another with scoliosis and digestive problems, and a son born with a defective optic nerve that has left him blind in the right eye. There is no history of birth defects on either side of our family.”

Since 1991, we have recorded thousands of such cases in our National Birth Defect Registry.

Some 2.8 million Americans served in the Vietnam theater of operations. Three-to-six percent of Vietnam veterans’ children are born with some kind of birth defect (Emory University School of Medicine reports a 3-4 percent birth-defect rate among the general population). An impressive body of scientific evidence points to increases in birth defects and developmental problems in the children of Vietnam veterans and others exposed to dioxin-like chemicals.

Agent Orange was a combination of two defoliants, 2,4,5-T and 2,4-D contaminated by dioxin (TCDD), a toxic byproduct of the chemical production process. More than 19 million gallons of herbicides were sprayed in Vietnam between 1962-71. More than 11.2 million gallons sprayed after 1965 were dioxin-contaminated Agent Orange. Agents Purple, Pink, and Green used before 1965 were even more highly contaminated with dioxin.

According to Barry Commoner and Thomas Webster in their 2003 book *Dioxins and Health*, “the current scientific evidence argues not only that dioxin is a potent carcinogen, but that the non-cancer health and environmental hazards of dioxin may be more serious than believed previously.” They report that dioxin appears to act like a persistent synthetic hormone that interferes with important physiological signaling systems that can lead to altered cell development, differentiation, and regulation. The most troubling consequence is the possibility of reproductive, developmental, and immunological effects at the levels of dioxin-like compounds present in the bodies of the average person.

Since studies of Vietnam veterans exposed to herbicides in Vietnam have found much higher levels of dioxin in their bodies than the average person, these effects also should be detectable in their children.

In 1996, the National Academy of Sciences found “limited/suggestive” evidence of an association between Agent Orange exposure and spina bifida, a neural tube defect, in the children of Vietnam veterans. In 2000, Dr. H.K. Kang of the Environmental Epidemiology Service of the Veterans Health Administration published a study that found that the risk of moderate-to-severe birth defects was significantly associated with the mother’s military service in Vietnam. As a result of these findings, the VA now funds assistance programs for spina bifida in the children of male or female Vietnam veterans and for all birth defects without other known causes in the children of female veterans.

The Australian Department of Veterans Affairs (without acknowledging a link to Agent Orange exposure) provides treatment to the children of Vietnam veterans with spina bifida, cleft lip or palate, acute myeloid leukemia, and adrenal gland cancer.

Other studies offer evidence that many more birth defects may be associated with dioxin-contaminated herbicide exposure in Vietnam. In 1990, an independent scientific review of the literature was sponsored by Vietnam Veterans of America, the American Legion, and the National Veterans Legal Services Project. Seven prominent, independent scientists and physicians on this Agent Orange Scientific Task Force concluded that elevated incidences of birth defects in the children of Vietnam veterans were found in several studies. These included spina bifida, oral clefts, cardiovascular defects, hip dislocations, and malformations of the urinary tract. In addition, defects of the digestive tract and other neoplasms such as neuroblastoma also were higher in Vietnam veterans’ children.

Aschengrau and Monson of the Harvard School of Public Health conducted a study published in 1990 in the *American Journal of Public Health* on paternal military service and the risk of late pregnancy outcomes. The scientists reported that Vietnam veterans’ risk of fathering an infant with one or more major malformations was increased at a statistically significant level.

The Air Force Ranch Hand study of Vietnam veterans involved in herbicide spraying has been analyzed several times for adverse reproductive outcomes. A 1995 analysis found modest, but significant, increases in spontaneous abortion, defects of the circulatory system and heart, all anomalies, major birth defects, and some developmental delays in the Ranch Hand veterans’ children. There also was an increase in spina bifida in the children of Ranch Hand veterans with high dioxin levels.

More recent studies have found additional evidence of increases in birth defects in the children of both male and female veterans. Researchers at the University of Texas, the University of Queensland, and the University of Sydney collaborated on a meta-analysis (a review of the combined data from many studies) of Agent Orange and birth defects in the *International Journal of Epidemiology*. They identified all studies from 1966-2002 that had examined an association between Agent Orange or dioxin and birth defects. The study authors identified 22 studies, including thirteen Vietnamese and nine non-Vietnamese studies.

Their review indicated that parental exposure to Agent Orange was associated with an increased risk in birth defects. The association increased with greater degrees of exposure rated on intensity and duration of exposure. Although other researchers have pointed out weaknesses in the studies of birth defects from Vietnam, the birth defect association with Agent Orange exposure was statistically significant even when the Vietnamese studies were excluded.

Genetic damage in New Zealand Vietnam War veterans was investigated in a study published this year in *Cytogenetic & Genome Research* by researchers from the Institute of Molecular Biosciences at Massey University in New Zealand. A significantly higher frequency of genetic damage was found among New Zealand Vietnam War veterans compared to a control group. The authors suggested that New Zealand Vietnam veterans had been exposed to a harmful substance that could cause genetic damage. Although the authors recommended caution in interpreting specific health outcomes, they concluded that genetic damage to any degree has the potential to result in adverse health effects. The greatest concern about genetic damage is that it can be passed on to future generations.

Important new research on birth defects in the children of Vietnam veterans was presented at the 2006 meeting of the Society for Epidemiological Research in Boston. Three researchers conducted a study of neural tube defects (anencephaly, encephalocele, spina bifida) in the offspring of Vietnam veterans. They found that paternal blood levels of TCDD were significantly associated with neural tube defects in their children and that a particular paternal genotype (genetic predisposition) could enhance this association.

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Since 1990, Birth Defect Research for Children has collected data on birth defects and developmental disabilities in the children of Vietnam veterans. The National Birth Defect Registry is a collaboration among seven prominent scientists to identify patterns of birth defects and disabilities in children with similar prenatal exposures.

When compared to non-veterans' children in the registry, the children of Vietnam veterans have shown consistent increases in learning, attention, and behavioral disorders; all types of skin disorders; problems with tooth development; allergic conditions and asthma; immune system disorders including chronic infections; some childhood cancers; and endocrine problems including thyroid disorders and childhood diabetes. More and more studies of prenatal exposures to dioxins and similar chemicals are adding support for these associations.

According to Linda Birnbaum of the U.S. Environmental Protection Agency, dioxin can modulate growth and development. In the embryo and fetus, dioxin-altered programming can result in malformations, anomalies, fetal toxicity, and functional and structural deficits that often are not detectable until later in life.

In a paper published in *Environmental Health Perspectives*, Birnbaum discusses research that demonstrates that prenatal exposures to endocrine disruptors (chemicals that can disrupt hormone activity) such as TCDD can alter hormones, reproductive tissue development, and increase susceptibility to potential carcinogen exposure in the adult.

Increased susceptibility to chronic childhood infections and cancers later in life may be a result of dioxin's effects on the developing immune system. Researchers in 2000 investigated the immunological effects of everyday exposures to PCBs and dioxins in preschool-age Dutch children. The researchers found that prenatal exposure to these chemicals was associated with changes in the T-cell population. They concluded that the effects of prenatal background exposure to PCBs and dioxins persist into childhood and could be associated with a greater susceptibility to infectious disease.

Another 2003 study by a team of researchers from Quebec reported their finding of a chemical imbalance that could be a marker for prenatal immune damage caused by organochlorines (which include dioxin-like compounds). The researchers found that the lymphocyte cells of newborns exposed to higher concentrations of these chemicals during prenatal development secreted fewer cytokines than those of a control group of newborns. These alterations of the immune system could lead to increased susceptibility to infection.

A growing body of evidence is linking prenatal exposures to dioxin-like chemicals to learning and behavioral deficits. At a Children's Health Meeting in 2000 sponsored by the National Institute of Environmental Health Sciences, Jerry Heindel reported on several studies of pregnant women who had consumed several meals of PCB-contaminated fish per month during pregnancy and who gave birth to infants with small but detectable learning and behavioral deficits. The children with the highest exposure averaged six points lower in IQ compared to children with lower levels of exposure.

A 2007 study from the Department of Preventive Medicine at Kyungpook University in South Korea reported associations between blood concentration of persistent organic pollutants (including dioxins) and increases in learning and attention disorders in children in the general population.

Thomas Zoeller, an endocrinologist at the University of Massachusetts, has found that dioxin-like PCBs activate cellular machinery that can alter the structure of other, non-dioxin-like PCBs. Some of these dioxin-induced metabolites can act directly on the thyroid hormone receptor. In the fetal brain, this could alter the course of development leading to learning and developmental disabilities.

The new research on dioxin and dioxin-like chemicals holds the promise of unraveling the intricate ways in which these chemicals can alter embryonic development. The research should continue, but it is now 35 years since Agent Orange was first sprayed in Vietnam. And the calls keep coming.

In *Dioxins and Health*, Thomas Webster and Barry Commoner comment: "Much of the media coverage of the dioxin debate has consisted of trying to convince the public that their common sense is wrong and that experts know best. In this case, the public's view has been largely correct. Dioxin is a dangerous and unwanted chemical pollutant."

Vietnam veterans who would like to add information about their children's birth defects or disabilities to the National Birth Defect Registry sponsored by Birth Defect Research for Children can register online at www.birthdefects.org

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