



Agricultural Health Study

STUDY UPDATE

2022

MESSAGE FROM THE EXECUTIVE COMMITTEE

We hope you've fared well during the continuing COVID-19 pandemic. We thank you for your continued participation and interest in the Agricultural Health Study (AHS). Your involvement in the study since it began almost 30 years ago has enabled us to learn important information about the health of families living on the farm. We also want to thank the more than 32,000 participants who completed our fourth cohort-wide follow-up survey, which is now closed. Your responses are essential to the success of the study and will contribute to ongoing and future research!

In this annual newsletter, we share some of our recent research findings. If you would like to learn more, please visit <https://aghealth.nih.gov/>. If you have questions, you can call 1-800-4-AGSTUDY (1-800-424-7883).

AGRICULTURAL PESTICIDE USE AND THYROID CANCER

Thyroid cancer rates have been increasing in the United States and other countries, but the reasons for the increases are not clear. Many pesticides are known to disrupt thyroid gland function, but few studies have examined the relationship between exposure to pesticides and the risk of developing thyroid cancer. Thyroid cancer is rare, and women experience higher rates than men. In the AHS, 85 men developed thyroid cancer between enrollment in the mid-1990s and 2015. We compared the rate of thyroid cancer incidence among applicators who used and did not use any of the 50 pesticides we first asked about when the study began. We found that applicators who used the fungicide metalaxyl develop thyroid cancer at a rate two times higher than those who did not. Those who used the organochlorine insecticide

lindane were 1.7 times as likely to be diagnosed with thyroid cancer compared to those who did not use it. In contrast, use of the herbicide chlorimuron-ethyl and the insecticide carbaryl were associated with reduced rates of thyroid cancer. Because this is the first study to evaluate thyroid cancer and long-term exposure to most of these pesticides, more research is needed to understand the potential role of these chemicals in the development of thyroid cancer. Because the rates of thyroid cancer in general are very low, the actual difference in the number of cases among those who did or did not use these pesticides was small.

Lerro et al., Environment International, 2021

AGRICULTURAL PESTICIDES AND SHINGLES RISK IN AHS PRIVATE APPLICATORS

There is growing evidence that some pesticides can affect immune function. In the AHS we have previously identified pesticides associated with diseases related to immune system, such as rheumatoid arthritis and lymphoid cancers, and we wanted to know whether pesticides might also affect susceptibility to infections. Shingles is a painful condition caused by the loss of immune control and symptomatic reactivation of the varicella zoster virus (the same virus that also causes chickenpox). Risk is greater for immunosuppressed individuals and increases with age. As many as



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AHS EXECUTIVE COMMITTEE

Laura Beane Freeman, PhD

Jonathan Hofmann, PhD,
MPH

National Cancer Institute
Rockville, MD

Christine Parks, MSPH, PhD

Dale P. Sandler, PhD

National Institute of
Environmental
Health Sciences
Research Triangle Park, NC

Kent Thomas, BSPH

U.S. Environmental
Protection Agency
Research Triangle Park, NC

1 in 3 adults may develop shingles in their lifetime. For unknown reasons, and despite the availability of vaccines for chicken pox and shingles, rates have been increasing in recent decades.

In the AHS, we studied over 12,000 farmers who were followed for an average of 12 years and found that developing shingles was associated with increased use of several pesticides. These included four commonly used insecticides (malathion, carbaryl, diazinon, and lindane), two fumigants

(methyl bromide and carbon tetrachloride), and two herbicides (2,4-D and trifluralin). These findings support the idea that certain pesticides may influence immune functions essential for controlling latent varicella zoster infection, similar to the effects of aging or use of immunosuppressive medications, resulting in a greater risk of shingles. If these results are confirmed in other studies, these findings may have implications for other types of infections and vaccine effectiveness.

Parks et al., *Environmental Health Perspectives*, 2021

AGRICULTURAL PESTICIDE USE, KIDNEY CANCER, AND OTHER KIDNEY DISEASE

In some previous studies, agricultural work and occupational pesticide use have been associated with increased rates of renal cell carcinoma (RCC), the most common form of kidney cancer. However, few of those studies had investigated links to specific pesticides. We evaluated associations with 38 pesticides that were relatively commonly used at enrollment among pesticide applicators in the AHS, including 308 individuals who developed RCC during follow-up until 2015. We found that the highest users of the herbicide 2,4,5-T were approximately three times as likely to develop RCC compared with those who never used this pesticide. Use of 2,4,5-T was banned in the U.S. in the mid-1980s due to its contamination with dioxin (TCDD), a known cause of cancer. Because RCC can take many years to develop, we also looked at associations with past pesticide use (up to 20 years before diagnosis). In these analyses, we saw increased rates of RCC among applicators with the highest numbers



of days of use for chlorpyrifos, chlordane, cyanazine, paraquat and atrazine. Atrazine, an herbicide that is still widely used, has been associated with increased rates of end-stage kidney disease among pesticide applicators in the AHS and, more recently, with diminished kidney function. We are continuing to evaluate how certain pesticides and other agricultural exposures might influence the development of kidney disease and kidney cancer.

Andreotti et al., *Environmental Health Perspectives*, 2020
Lebov et al., *Occupational and Environmental Medicine*, 2016
Shearer et al., *Environmental Research*, 2021

EARLY LIFE EXPOSURES IN AGRICULTURE



We will soon invite adult children of AHS participants to enroll in a new study

focused on how growing up on a farm may impact health in early adulthood and beyond.

We will ask this group to answer online surveys about their health and childhood activities, including activities on the farm. You may hear about this from your children!

The AHS is a collaborative effort of the National Cancer Institute, National Institute of Environmental Health Sciences, and U.S. Environmental Protection Agency.



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