



Welcome to the Agricultural Health Study

Home
Background
FAQs
Results
Other Resources
For Collaborators

Important Findings from the Agricultural Health Study

- ▶ [Fact Sheets](#)
- ▶ [Urinary Pesticide Concentrations Among Children, Mothers And Fathers Living In Farm And Non-Farm Households In Iowa](#)
- ▶ [Pesticide exposure and self-reported Parkinson's disease in the Agricultural Health Study](#)
- ▶ [Cancer Incidence in the Agricultural Health Study](#)
- ▶ [Mortality among participants in the Agricultural Health Study](#)
- ▶ [Reliability of reporting on lifestyle and agricultural factors by a sample of participants in the agricultural health study from Iowa](#)
- ▶ [Chemical predictors of wheeze among farmer pesticide applicators in the Agricultural Health Study](#)
- ▶ [Nested Case-control Analysis of High Pesticide Exposure Events from the Agricultural Health Study](#)
- ▶ [Retinal degeneration in licensed pesticide applicators](#)
- ▶ [A model for predicting the frequency of High Pesticide Exposure Events in the Agricultural Health Study](#)
- ▶ [Characteristics of persons who self-reported a high pesticide exposure event in the Agricultural Health Study](#)
- ▶ [Exposure opportunities of families of farmer pesticide applicators](#)

[TO TOP OF PAGE](#) ↴

Fact Sheets

The following fact sheets are distributed to the study participants to provide information about study procedures and findings of interest:

Iowa

- [Study Update](#) (2009)
- [Study Update](#) (2008)
- [Study Update](#) (2007)
- [Pesticide Residues in the Homes of Farm Families](#) (2007)
- [Study Update](#) (2006)
- [Lung Cancer](#) (2006)
- [High Pesticide Exposure Events Among Farmers](#) (2006)
- [Study Update](#) (2005)
- [Study Update](#) (2004)
- [Risk Factors for Injury from Livestock and Farm Machinery](#) (2004)
- [Study Update](#) (2003)
- [Prostate Cancer and Agricultural Pesticides](#) (2003)
- [Risk Factors for Agricultural Injury](#) (2003)
- [Study Update](#) (2002)
- [Buccal Cell Collection](#) (2002)
- [Retinal Degeneration in Licensed Pesticide Applicators](#) (2002)

North Carolina

- [Study Update](#) (2009)
- [Study Update](#) (2008)
- [Study Update](#) (2007)
- [Study Update](#) (2006)
- [Wheeze](#) (2005)
- [Incidence of Cancer](#) (2005)
- [Lung Cancer](#) (2005)
- [Prostate Cancer](#) (2005)
- [Study Update](#) (2002)
- [Buccal Cell Collection](#) (2002)
- [Retinal Degeneration and Fungicide Use](#) (2002)

[TO TOP OF PAGE](#) ↴

Urinary Pesticide Concentrations Among Children, Mothers And Fathers Living In Farm And Non-Farm Households In Iowa – [abstract](#)

Curwin BD, Hein MJ, Sanderson WT, Striley C, Heederik R, Kromhout H, Reynolds SJ, Alavanja MC.

Annals of Occupational Hygiene. 51(1): 53–65 (2007).

In the spring and summer of 2001, 47 fathers, 48 mothers and 117 children of Iowa farm and non-farm households were recruited to participate in a study investigating take-home pesticide exposure. Urine samples were collected from each person. The samples were analyzed for metabolites of atrazine, metolachlor, glyphosate and chlorpyrifos. The average level of the urine metabolite of atrazine was significantly higher in fathers, mothers and children from farm households compared to those from non-farm households. Urine metabolites of chlorpyrifos were significantly higher in farm fathers and marginally higher in farm mothers when compared to non-farm fathers and mothers, but metolachlor and glyphosate levels were similar between the two groups. Average levels of the urinary metabolites for chlorpyrifos, metolachlor and glyphosate were not significantly different between farm children and non-farm children. Farm children had significantly higher urinary atrazine and chlorpyrifos levels when these pesticides were applied by their fathers prior to sample collection than those of farm children where these pesticides were not recently applied.

[TO TOP OF PAGE](#) ↴

Pesticide exposure and self-reported Parkinson's disease in the Agricultural Health Study – [abstract](#)

Kamel F, Tanner CM, Umbach DM, Hoppin JA, Alavanja MC, Blair A, Comyns K, Goldman SM, Korell M, Langston JW, Ross GW, Sandler DP.
American Journal of Epidemiology. 165(4):364-374 (2006).

Parkinson's disease is a movement disorder that affects over one million people in the United States. Common symptoms are tremor, slow movements, poor balance and muscular rigidity. Scientific studies have suggested that pesticide exposure may increase the risk of developing Parkinson's disease. However, little is known about the specific pesticides involved or other aspects of exposure that may be important. To answer these questions, we studied people who did not have Parkinson's disease when they enrolled in the AHS but reported a diagnosis during the Phase 2 follow-up interview. We found that for both private applicators and their spouses individuals who had applied pesticides on more than 400 days in their lifetime had nearly a two-fold greater risk of Parkinson's disease compared to those who had applied pesticides for fewer days. Similarly, individuals who personally applied pesticides more than half the

time had a two-fold increase in risk. Applicators who had experienced an event involving high personal exposure to pesticides, and delayed washing for more than an hour, had a slightly increased risk, as did those who had exposures that caused symptoms requiring medical care. This study had some limitations, including the fact that the diagnosis of Parkinson's disease was self-reported, and the study was too small to provide accurate results for individual pesticides. We are currently working with researchers at The Parkinson's Institute in California to conduct a new study within the AHS. This study, called the FAME Study, is based on verified diagnoses and collected additional information on pesticide exposure. It will provide additional information about the relationship of pesticide exposure to Parkinson's disease.

[TO TOP OF PAGE](#) ↴

Cancer Incidence in the Agricultural Health Study – [abstract](#)

Alavanja MCR, Sandler DP, Lynch CF, Knott C, Lubin JH, Tarone R, Thomas K, Dosemeci M, Barker J, Hoppin JA, Blair A.
Scand J Work Environ Health, 31 (S1): 39–45 (2005).

The overall cancer occurrence among farmers and their spouses in the Agricultural Health Study (AHS) is significantly less than that expected compared to other men and women of the same age living in Iowa and North Carolina. Farmers have only 88% of the cancer expected and their spouses have only 84% of the cancer expected. Commercial pesticide applicators, on the other hand, were observed to have the same cancer frequency as that of other men in Iowa and North Carolina. The low overall cancer rates among farmers and their spouses are due in part to their less frequent use of tobacco products and possibly due to greater physical activity on the job. Nonetheless, a number of cancers are observed to occur with significantly greater frequency among farm families in the AHS. The risk of prostate cancer is significantly greater among farmers and commercial applicators. Female spouses had a significantly greater frequency of a serious type of skin cancer (i.e., melanoma) and female pesticide applicators had a significantly greater frequency of ovarian cancer. Although the overall cancer picture is generally encouraging for farm families, we are finding that some cancers including lung, colon and some blood related cancers may be related to specific occupational exposures on the farm. Our ongoing research should be able to identify the responsible agents of disease within the next few years.

[TO TOP OF PAGE](#) ↴

Mortality among participants in the Agricultural Health Study – [abstract](#)

Blair A, Sandler DP, Tarone R, Lubin J, Thomas K, Hoppin JA, Samanic C, Coble J, Kamel F, Knott C, Dosemeci M, Zahm SH, Lynch CF, Rothman N and Alavanja MCR.
Annals of Epidemiology, 15(4): 279-285 (2005).

The overall mortality rate among farmers and their spouses in the Agricultural Health Study (AHS) is significantly less than that expected when compared to other men and women living in Iowa and North Carolina. Particularly low rates of mortality were observed for cardiovascular disease, diabetes, chronic obstructive pulmonary disease and total cancer. Generally the mortality rate from these causes was only 60% of the rate experienced by others of the same age living in Iowa and North Carolina. Several factors may contribute to the low mortality observed in this population, including the healthy worker effect typically seen when cohorts of working people are compared to a general state-wide population rates, and a healthier lifestyle including lower cigarette use and greater physical activity on the job.

[TO TOP OF PAGE](#) ↴

Reliability of reporting on lifestyle and agricultural factors by a sample of participants in the agricultural health study from Iowa - [abstract](#)

Blair A, Tarone R., Sandler D., Lynch C. F., Roland A., Wintersteen W., Steen, W. C., Samanic, C., Dosemeci, M., Alavanja M. C. R.
Epidemiology, 13:94-99 (2002)

Repeat interviews from 4,088 Iowa pesticide applicators participating in the Agricultural Health Study provided the opportunity to evaluate the reliability of self-reported information on pesticide use and various demographic and life-style factors. Self-completed questionnaires were administered 1 year apart when participants returned to county agricultural extension offices for pesticide certification or training. Percentage agreement for ever-/never-use of specific pesticides and application practices was quite high, generally ranging from 70% to more than 90%, and did not vary by age, educational level, or farm size. Agreement was lower (typically 50-60%) for duration, frequency, or decade of first use of specific pesticides. Level of agreement regarding pesticide use in this population is similar to that generally found for factors typically used in epidemiologic studies such as tobacco use and higher than typically reported for diet, physical activity, and medical conditions.

[TO TOP OF PAGE](#) 

Chemical predictors of wheeze among farmer pesticide applicators in the Agricultural Health Study - [abstract](#)

Hoppin J. A., Umbach D. M., London S. J., Alavanja M. C. R., Sandler D. P.
Am J Resp Crit Care Med, 165(5), 683-9 (2002)

This paper looks at the role of pesticide exposure and a common respiratory symptom, wheeze, among 20,000 farmers who are licensed pesticide applicators. These farmers are participants in the Agricultural Health Study, an on-going study of approximately 60,000 licensed pesticide applicators and their spouses in Iowa and North Carolina. Pesticide use and wheeze information was obtained using questionnaires completed by the farmers at home. Individuals who used particular pesticides were more likely to wheeze than those who did not use these chemicals. The pesticides most strongly associated with wheeze were paraquat, EPTC, parathion, malathion, and chlorpyrifos. This association could not be explained by other risk factors for wheeze such as age, smoking, asthma and allergy history, or other farm activities such as contact with animals, grains and dusts. The chance of wheezing was greater with more days of application. The herbicides, atrazine and alachlor were associated with wheeze, especially among those with more than 20 application days in a year. All pesticide application methods had an increased change of wheeze, but no significant differences were observed for common crop application methods. Pesticide application to animals was associated with wheeze; the strongest effect was for fogging and misting animals. This analysis is the first to describe chemical-specific contributors to wheeze among farmers. The associations with these pesticides were small, but since farmers are generally healthier than the general population and may avoid exposures and activities that contribute to respiratory and other symptoms, these results suggest that further investigation of these chemicals is warranted.

For more information on this paper, please contact Jane Hoppin, ScD at hoppin1@niehs.nih.gov or at (919) 541-7622.

[TO TOP OF PAGE](#) 

Nested Case-control Analysis of High Pesticide Exposure Events from the Agricultural Health Study - [abstract](#)

Alavanja, MC, Sprince NL, Oliver E, Whitten P, Lynch C, Gillette PP,

Logsdon-Sackett N, Zwerling C.
American Journal of Industrial Medicine, June 39(6):557-63 (2001)

Six out of 1,000 farmers in the Agricultural Health Study reported an event that resulted in an unusually high pesticide exposure in 1997, which we believe to be a typical year. At this annual rate we would expect to find that approximately 14 percent of the farmers in the Agricultural Health Study would have experienced such an event in their working life-time, which is a confirmation of our earlier studies. In a special study of applicators who reported such an event in 1997 compared to some of those who did not, we found that applicators who reported they could not afford certain protective equipment were four-times more likely to have a high pesticide exposure event than those who could afford such equipment. Those who voiced opinions such as "farming is more dangerous than jobs in industry or manufacturing" that "accidents are just one of the occupational hazards of farming that you must accept if you are going to be in the business" and "to make a profit, most farmers take risks that might endanger their health" were almost four times as likely to experience an event resulting in usually high pesticide exposure. Our results, together with results from previous studies, suggest that multiple factors influence who experiences an unusual pesticide exposure. Any approach to preventing such events will need to be multifaceted. Scientists working on the Agricultural Health Study are continuing to research the causes and health consequences of these high exposure events and expect to publish results from a new study on this topic in the near future. Additionally, we will be working with scientists at Universities in Iowa and North Carolina, and with experts at the state Department of Agriculture and Agricultural Extension Service to formulate plans to help reduce these potentially dangerous high pesticide exposure events.

[TO TOP OF PAGE](#) ↴

Retinal degeneration in licensed pesticide applicators - [abstract](#)

F. Kamel, PhD, MPH , W. K. Boyes, PhD , B. C. Gladen, PhD , A. S. Rowland, PhD , M. C. R. Alavanja, DrPH 3, A. Blair, PhD , D. P. Sandler, PhD
American Journal of Industrial Medicine, 37:618-628 (2000)

Retinal degeneration is the leading cause of visual impairment in older adults, but little is known about its causes. We used data from the self-administered questionnaires completed by farmers who enrolled in the Agricultural Health Study to compare the farming practices and pesticide use of the 154 applicators who reported a doctor diagnosis of retinal degeneration and over 17,000 applicators who did not report this condition. We found that those who reported retinal degeneration were more likely to have orchards and to report using fungicides. There were also associations between use of other chemicals and having this condition, but results were not the same in both states. The fungicide results were seen in both states and the association got stronger with increasing lifetime-days of fungicide use. The association was not restricted to one specific fungicide. However, the association was not due to use of other chemicals that were used at the same time. Whereas much of the association with orchard fruit could be explained by use of fungicides, the fungicide association was not restricted to those who raised orchard fruit. Because this is the first study to report this association, the diagnoses were not verified by a medical exam, and because information on exposures and retinal degeneration were reported at the same time, it will be necessary to carry out additional studies before any firm conclusions or recommendations can be made. The long-term follow-up of the cohort and the special studies planned for the future will provide an opportunity for the investigators to learn more about this important vision problem.

[TO TOP OF PAGE](#) ↴

A model for predicting the frequency of High Pesticide Exposure Events in the Agricultural Health Study - [abstract](#)

D. T. Mage, M.C. Alavanja, D. P. Sandler, C. J. McDonnell, B. Kross, A. Rowland, A. Blair.
Environmental Research, 83(1):67-71 (2000)

We found that inexperienced applicators had more accidental exposures than expected based on the data from those who reported more lifetime days of pesticide use. For all other applicators, the chances of having an accidental high exposure each time pesticides are applied does not change with time, but the lifetime risk is increased. In other words, the more days pesticides are applied, the more chances there are of experiencing a spill. Important factors that may contribute to high pesticide exposure events are inexperience, and random events such as breaking a hose. The results suggest that special precautions may be needed to protect infrequent users. Additional research is now being conducted.

[TO TOP OF PAGE](#)

Characteristics of persons who self-reported a high pesticide exposure event in the Agricultural Health Study - [abstract](#)

Michael C. R. Alavanja, Dale P. Sandler, Cheryl J. McDonnell, David T. Mage, Burton C. Dross, Andrew S. Rowland, Aaron Blair
Environmental Research, 80(2):180-186 (1999)

A relatively high exposure to pesticides can result from pesticide spills, equipment maintenance accidents, accidental immersions or certain spot spraying operations. Approximately fourteen percent of licensed pesticide applicators in the Agricultural Health Study reported having had such an experience during their working life. Our goal is to understand factors associated with these potentially dangerous exposure events. After taking into account total number of lifetime applications made and education we saw that women had significantly fewer events than men who applied pesticides. North Carolina applicators had fewer events than Iowa applicators and private applicators had fewer events than commercial applicators. Work practices more common among both private and commercial applicators with a high exposure event included delay in changing clothing or washing after pesticide application, mixing pesticide application clothing with the family wash, washing up inside the house after application rather than outside the house, applying pesticides within 50 yards of the home well, and storing pesticides in the home. Job characteristics more common among those with a high pesticide exposure event included self-repair of pesticide application equipment and the first use of pesticides more than 10 years ago. While the demographic, work practice and job characteristics identified in this investigation were not necessarily the cause of the high pesticide exposure, identifying these factors is a first step in the eventual prevention of these potentially hazardous events. Scientists with the Agricultural Health Study are now taking the next steps to understand the cause of these exposure events and to determine whether they are associated with ill health and disease.

[TO TOP OF PAGE](#)

Exposure opportunities of families of farmer pesticide applicators - [abstract](#)

Beth C. Gladen , Dale P. Sandler, PhD , Shelia H. Zahm, ScD , Freja Kamel, PhD, MPH, Andrew S. Rowland, PhD , Michael C.R. Alavanja, DrPH
American Journal of Industrial Medicine, 34: 581-587 (1998)

The Agricultural Health Study is unique among studies of occupational groups in that the wives of farmers who apply pesticides and their children are included in the study. Since farmers generally "live where they work", their families have many opportunities to come into contact with pesticides and other farm hazards. By studying these family members whose exposures are often more like those in the general non-farm population, we have the potential to learn things about the health effects of pesticides that are applicable to the population at large. In this paper we document that farm

families do in fact have many opportunities for exposure - both directly and indirectly - to pesticides. We found, for example, that 21% of homes are within 50 yards of the pesticide mixing area, that 27% of applicators store pesticides in their homes (including attached garage or basements), and that most pesticide-contaminated clothing is washed in the same machine as other laundry. Furthermore, at least half of the wives reported working the fields, 40% reported mixing or applying pesticides, and more than half of the children over age 11 did farm chores that potentially put them into contact with pesticides. Thus, it will be important to study the health consequences of such exposures and to identify methods for minimizing the exposures of family members.

[Home](#) | [Background](#) | [FAQs](#) | [Results](#) | [Other Resources](#) | [For Collaborators](#)
[Accessibility](#) | [Viewing Files](#) | [Privacy Policy](#)

