

# Lung Cancer in the Agricultural Health Study

Lung cancer is one of the most frequently diagnosed cancers in the world, and it is the leading cause of cancer death. The major cause of lung cancer is cigarette smoking. It is estimated that cigarette smoking is associated with over 85% of all lung cancers in the U.S., but other factors are known to cause this disease. As a group, farmers in the United States smoke less than the general population and, as a consequence, usually experience a significantly lower risk of lung cancer than the general population.

The Agricultural Health Study (AHS) includes 57,311 pesticide applicators and 32,347 spouses of farmer applicators from Iowa and North Carolina. From 1993 through 2001, 300 study participants were diagnosed with lung cancer—240 among pesticide applicators and 60 among spouses. Based on general population rates, over 600 lung cancers would have been expected.

In other words, pesticide applicators in the Agricultural Health Study and the spouses of farmer applicators had half the risk of lung cancer compared to the general population. Historically lower smoking rates among farmers (currently only 14% of farmers in the AHS versus 23% in the general population) undoubtedly contribute to the low rates of lung cancer.

However, exposures encountered while performing various farming related tasks may lead to higher risks for lung cancer among some members of the cohort than others. It is important to understand why some study participants get lung cancer and others don't. This will help researchers learn about other possible risk factors for lung cancer in addition to smoking.

## Risk Factors for Lung Cancer

Smoking and older age were associated with lung cancer risk in the AHS just as they are everywhere. Other factors associated with lung cancer in applicators included a history of pneumonia or other chronic lung diseases like bronchitis and emphysema, occupational (off the farm) exposure to asbestos and lead, and fewer years of school. Unlike other chronic lung diseases, asthma was not associated with lung cancer.

Among spouses, age and smoking were significant risk factors for lung cancer, but a history of pneumonia or other chronic lung disease was not.

High fruit and vegetable consumption, moderate alcohol consumption, and higher leisure-time physical activity lowered lung cancer risk in spouses somewhat but not among the applicators.

## Examining Lung Cancer and Pesticide Use

Fifty pesticides were evaluated for a possible role in the development of lung cancer. No association between lung cancer in spouses and direct use of any of the 50 pesticides was found. However, among applicators, some evidence was found when comparing lung cancer in the non-exposed group to those who were in four higher exposure categories for two widely used insecticides, *chlorpyrifos* and *diazinon* (see Figures 1 & 2 on next page).

For metolachlor and pendimethalin, two important herbicides, a lung cancer risk was observed but an elevated risk was limited to those in the group with the most days of use in a life time.



[www.aghealth.org](http://www.aghealth.org)

**The  
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Health Study  
seeks to  
identify  
factors that  
promote  
good health.**

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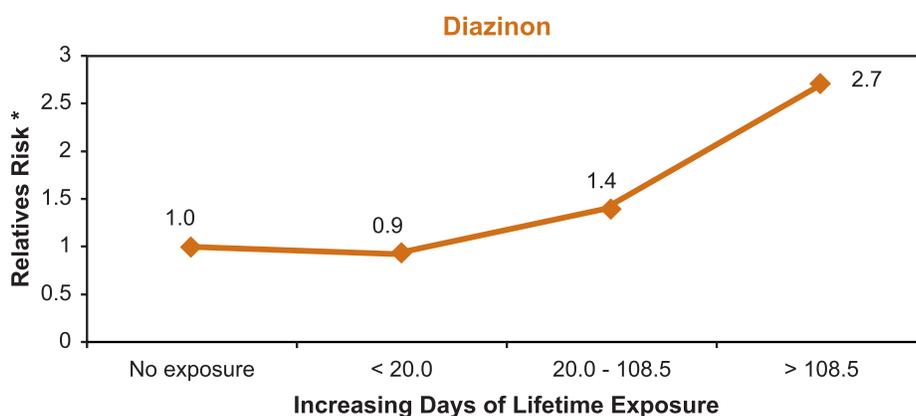
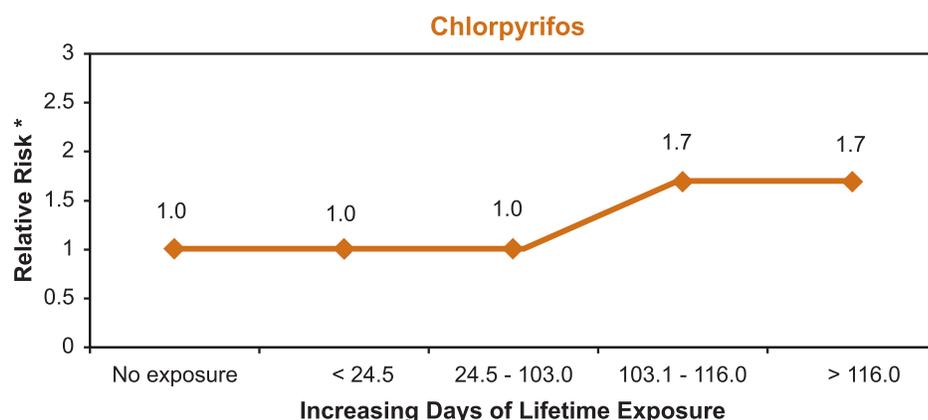
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**Figures 1-2. Pesticides significantly associated with lung cancer among AHS pesticide applicators, 1993-2001.**



\* All relative risks are computed with non-users of the chemical as a comparison group. They are adjusted for age, cigarette smoking, and other potential confounding factors. The relative risk is the ratio between the risk of lung cancer among users of the chemical and the risk of lung cancer among nonusers. A relative risk of 1 indicates no excess risk with exposure. A relative risk of 4 indicates a four-fold excess.

When compared to applicators who had never used these chemicals, those who had used *metolachlor* over 457 lifetime days had a four-fold risk of lung cancer. For those who had used *pendimethalin* more than 225 days, their risk was 3.5 times greater for developing lung cancer.

A substantial percentage of AHS applicators was exposed to at least one of the four pesticides. This lung cancer risk was observed even after taking into account a history of cigarette smoking, age, gender, and total days of any pesticide application.

The AHS is the first to report a possible link between some of these pesticides and lung cancer. It is still too early to say for sure that these pesticides cause lung cancer. Replication of these results through continued follow-up in the AHS cohort or in other studies is necessary before any firm conclusions can be reached. Nonetheless, it is always a good idea to use caution when handling pesticides.

## For More Information

More specifics regarding the lung cancer publication (Alavanja et al., *Am J Epidemiol*, 2004; 160:876-885) that was the source of these findings is available through our website at: [www.aghealth.org/publications.html](http://www.aghealth.org/publications.html). Other pesticide-specific publications addressing risk of various types of cancer are also available at the website.

**The Agricultural Health Study** is a long-term study to investigate the effects of environmental, occupational, dietary, and genetic factors on the health of the agricultural population. This study will provide information that agricultural workers can use in making decisions about their health and the health of their families. The study is conducted in Iowa by the Department of Epidemiology at the University of Iowa and in North Carolina by Battelle CPHRE. The study is directed by the National Cancer Institute, the National Institute of Environmental Health, and the US Environmental Protection Agency.

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