The Agricultural Health Study has the largest, most comprehensive study of agricultural health ever conducted in the United States. Several features make the study unique and valuable.

• The study design allows scientists to evaluate many diseases at the same time.

• Because the study started with a defined population, it follows the participants into the future, and updates information every few years, the information collected is of high quality.

• The agricultural exposure and lifestyle information is the most detailed ever collected.

• The study is the first large epidemiologic study comprehensively at the health of women in an agricultural community.

• The Agricultural Health Study is one of several long-term health studies to collect genetic samples. The scientists invited participants to provide a DNA sample using a simple technique: rinse and spit. Those who agreed to submit a saliva sample provided mouthwash and a sample container. They rinsed the mouthwash into the container and returned the sample to the scientists. The scientists check DNA from the inside lining of the mouth. Like other cells in the body, all cells contain DNA. By collecting DNA samples, scientists will be able to learn more about the disease process, including why some people exposed to certain substances and disease patterns.

Participants reflect North Carolina and Iowa Agriculture

By comparing agricultural census data, scientists have found that the study participants and their families spend a good deal of their time in North Carolina and Iowa:

- Iowa: Farmers grow mainly corn and soybeans and raise hogs. North Carolina farmers grow corn and soybean as well as tobacco, peanuts, cotton, and such vegetable crops as tomatoes and watermelons. They also raise beef, hogs, and poultry.
- Iowa: Iowa farms have an average of 146 acres, nearly three times the average size of an Iowa farm. Iowa farms are larger than North Carolina farms. Farmers in both states are predominantly white men. African-Americans make up a small minority of North Carolina farmers.
- Iowa: The study has also learned:
  - More than one-half of the farmers’ spouses report being active in farm work.
  - Iowa commercial agricultural workers are younger on average (39 years) at enrollment than the farmers in the pesticide applicator cohort.
  - About 3% of pesticide applicator cohort farms are women.

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questions

Through the Agricultural Health Study, scientists are looking for answers to many questions raised about cancer and other health issues in the agricultural population. The study is a long-term follow-up study called a prospective cohort study. This means the study involves a large group of volunteer participants (the cohort) who are followed for many years to determine who gets sick and who does not. The scientists look for associations, or links, between substances the participants are exposed to and the health problems they have over time. Follow the steps the scientists take as they navigate a maze of information to discover the answers to these questions.

1. Enroll people into the study

The study population is North Carolina and Iowa farmers who are certified pesticide applicators. Scientists also enroll 10,000 non-farm participants, and licensed commercial applicators from Iowa. About two-thirds of the 20,000 people in the study are applicators, and one-third are spouses. Farmers and commercial applicators volunteer to participate in the study at Cooperative Extension pesticide applicator training classes held from 1993 to 1997. Spouses enrolled through the mail or over the phone.

2. Collect exposure and health information from participants

Applicants fill out surveys at the pesticide safety class and at home. Spouses fill out surveys at home or on the phone. Participants provide information about children under age 18. For participants, every step of the process is completely voluntary. Scientists keep all information confidential, and secure, reporting results only in summary form so that no individual information is ever reported. There were about 250 questions in the initial survey, including questions about:

farm-work-related exposures and practices

Participants were asked details about their use of chemicals, including solvents, fertilizers and 50 specific pesticides, their method of applying pesticides, and the personal protective equipment they used. Other questions addressed exposures such as dust, insecticides and toxins.

environmental exposures

Participants were asked about their environment, such as sources of drinking water, family and friends’ working practices, and home location in relation to fields, to assess any potential for harmful exposures.

lifestyle choices

Participants provided information about their diet and cooking practices, smoking, alcohol consumption, and physical activity.

medical history and health status

Participants gave details about their medical history: whether they or their close family members have been diagnosed with such diseases as cancer, arthritis and Parkinson’s disease; symptoms related to asthma and other respiratory problems; and symptoms like numbness and blisters. Women provided details about their menstrual cycles, pregnancies, and other aspects of their reproductive health.

3. Develop and test pesticide exposure estimates

The scientists develop a formula to estimate pesticide exposure based on participants’ pesticide use and work practices, using data from the Pesticide Handlers Exposure Database and published exposure studies as a guide. The formula estimates a level of exposure for each person in the study for each chemical they used. To test the formula scientists measured pesticide levels in urine and in a small number of samples from 100 farm families before, during, and after a pesticide application. The end result of other pesticide studies is summarized in Understanding the Agricultural Health Study Part 2: Pesticide Exposures.

4. Collect a genetic sample from participants

Our DNA serves as a genetic blueprint—the instructions for how our bodies function, including how our bodies break down chemicals we are exposed to. Many study participants volunteered to submit DNA samples through the quick and easy time- and expense-efficient method. Scientists will use these samples to learn more about how chemical exposure leads to illness.

5. Collect information from health databases

Every year, scientists check North Carolina and Iowa cancer registries for newly diagnosed cancer cases in study participants. They also check the North Carolina and Iowa death certificate databases and the National Death Index to learn if any participants have died.

6. Analyze the exposure and health information

A primary purpose of a long-term follow-up study is to determine disease rates, focusing on the diseases that are diagnosed in participants after enrollment. The scientists are interested in the overall rate of cancer and the rates of particular cancer study participants. After adjusting for gender and age, they compare rates of cases and controls to those of the general population in North Carolina and Iowa for the same diseases. If the disease is a human one and the study is the Agricultural Health Study, scientists want to know why. Scientists assess whether participants were exposed to substances that may be associated with specific health outcomes. Scientists compare the exposure rates of participants with the same rate of the disease.

The scientists conduct cross-sectional studies to evaluate a range of substances and occupational or environmental exposures. These studies help scientists learn about the rates of diseases other than cancer. Scientists can also use these databases to determine cancer rates in populations and conduct case-control studies. Scientists may follow up these studies with more in-depth laboratory studies. Some cross-sectional studies evaluate the biological plausibility of disease associations, and others are applied to environmental exposure or early signs of disease. For example, a study of cows and horses examined measures of pesticide residues in urine to see whether the pesticide system function in relation to pesticide application over a 12-month period.

The scientists look for clues, or associations, between factors that may contribute to health by conducting cross-sectional studies. The scientists look for patterns in the various exposure and lifestyle factors in people in the cohort diagnosed with the disease (cases) compared to those of people in the cohort without the disease (controls). A Parkinson’s disease study uses DNA from the entire cohort and others are scheduled.

7. Repeat Steps 2, 5 & 6

Collect new or updated information from participants and databases. As they follow the participants in the Agricultural Health Study into the future, scientists use periodic telephone interviews and farm surveys to collect new or updated health information each year. The scientists will continue to follow participants over their lifetimes. Scientists continue to include them in the study as long as they agree to remain in the study.

Appendix A: Nesting used to control confounding in the Agricultural Health Study scientists will update a lifetime history of DNA from participants with suppliments to the database.

Additional notes about use of DNA in the study: scientists will update a lifetime history of DNA from participants with supplements to the database.