

## Welcome!

This is our first newsletter. We want to keep you informed of the accomplishments, current activities, and future plans of the Radiologic Technologists Health Study.

This study began in the early 1980s, to better understand the risk of cancer from repeated low-dose radiation exposures received over a long period of time. To do this, we identified all individuals who were certified by the American Registry of Radiologic Technologists (ARRT) for at least two years from 1926 to 1982. The study group is comprised of more than 146,000 men and women, most of whom responded to one or more detailed questionnaires. Even though the study is called the "Radiologic Technologists Health Study," the group is actually comprised of radiologic, radiation therapy, and nuclear medicine technologists, and a small number of radiologists.

In this issue, you will find information about why this study is important and what makes your group so unique. We have also answered some of the most commonly asked questions about the study. We hope that you find this newsletter interesting and informative. Please feel free to share it with your colleagues.

## Who Is Conducting This Study?

The Radiologic Technologists Health Study is a collaborative effort between the University of Minnesota School of Public Health, the National Cancer Institute, and the American Registry of Radiologic Technologists. The research team includes professionals from

## Thank You For Your Participation.

*We want to thank all of you who have participated in this study over the past fifteen years. To date, we have sent you two questionnaires—the first in the mid-1980s and the second during 1995-98. Your responses have been invaluable in studying whether repeated low-dose radiation exposures over many years causes cancer. We realize that completing the questionnaires was time consuming, and we sincerely appreciate your effort. We believe that the single most important factor in reaching our study goals is your continued support and participation.*

*For those of you who have participated in one of our blood collection studies, we extend an extra "thank you" for taking the time to have your blood drawn and shipped to the study laboratory. We commend you for your commitment to research.*

many different disciplines, including cancer epidemiology, radiation, genetics, biostatistics, survey research, data management, and computer science. This research is funded by the National Cancer Institute, which is part of the National Institutes of Health.



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## Why Is This Study Important and What Makes the Study Group Unique?

Most of the risk information on radiation exposure and cancer risk in humans comes from three sources: data on Japanese atomic bomb survivors; studies of medically irradiated patients; and occupational studies of nuclear, shipyard, and medical workers. The atomic bomb survivors were exposed to single, generally moderate to high, radiation doses. Medically irradiated patients typically received many doses that added up to exposures much greater than those of radiologic technologists. The occupational studies have provided some information on low-dose cancer risks among male workers, but none have been able to address cancer risks among women; further, many of these studies did not have precise radiation dose data or had doses too low to detect radiation-related cancer risks. They also lacked information on important health and lifestyle factors, such as cigarette smoking, that could influence cancer risk. One important consequence is that scientists have had to estimate cancer risks for low-dose exposures using high-dose data. While it is well established that radiation exposures at high doses are capable of causing cancer, it is not clear how large the cancer risk may be with repeated doses at low levels over many years.

Your group and the information you have provided are unique. First, the group is mostly female. Also, you have provided important information on cancer incidence and on many factors that may be related to cancer. This includes detailed information on gynecologic and reproductive histories for women, smoking and alcohol use for men and women, and many other variables. With this information, we can separate known risk factors and their effects from the potential effect of low-dose radiation. This is very important in investigating not only breast cancer, but other types of cancer (for example, lung) and non-cancer diseases. Finally, you have provided your detailed job histories. We are now estimating individual radiation doses so that we can

evaluate the low-dose cancer effects of radiation in more detail.

In April of 2000, an expert panel from the National Institutes of Health reviewed the Radiologic Technologists Health Study. The panel said that this study "can provide important information on the effects of low-dose ionizing radiation on the risks of developing cancers of the breast, thyroid, skin, and other organs, and leukemias and lymphomas." The panel recommended that the study be continued into the foreseeable future.

### HEAR WHAT YOUR COLLEAGUES ARE SAYING ABOUT THE STUDY...

*"I'm glad someone is finally taking the time to collect some data concerning this very important subject. Thank you for giving me the opportunity to participate."*

*"Thank you for doing this survey. I have felt it is long overdue. I have been active in my career on radiation protection."*

## Data Collection Efforts

To date, we have sent you two questionnaires, the first during the 1980s and the second between 1995 and 1998. We sent each survey to approximately 130,000 of you who were known to be alive and living in the United States at that time. More than 90,000 of you responded to each questionnaire, and an impressive 71,000 of you answered both surveys.

### **The First Questionnaire (Mid 1980's)**

The first questionnaire was designed to collect basic information on your employment history, whether you had cancer, and cancer risk factors. Based on the 90,305 responses to the first questionnaire (Boice et al. Cancer 1992; 69:586-598), you are:

1. 75% women; 25% men
2. 93% White; 3% Black; and 4% Hispanic
3. 53% attended a Radiologic Technology program as the highest level of training; and 40% attended some college

Also, about 75% of you were married when you completed the questionnaire; 55% were born before 1950; and 53% reported smoking more than 100 cigarettes (47% reported smoking at the time the survey was completed).

As a group, your average length of time employed as a radiologic technologist was 12 years. Nearly 4% of you reported having some kind of cancer, mainly of the skin (1,517) or breast (665).

### ***The Second Questionnaire (1995-1998)***

We conducted the second questionnaire to get updates and more details on job histories, gynecologic and reproductive histories, cigarette smoking, and other cancer risk factors, and to identify new cancers that occurred since the first survey. Based on the 91,173 responses, we are evaluating whether work, treatment, and diagnostic radiation exposures, as well as reproductive history, family cancer history, vitamin supplements, and many others factors affect the risk of various cancers. Some analyses of mortality and cancer incidence have been completed, as discussed in the next section.

## **Research Findings to Date**

### ***Mortality Patterns (1926-1990)***

One of the first things we did was look at the causes and rates of death for radiologic technologists in the study. The results, published in the journal *Cancer Causes and Control* in 1998 (volume 9; pp 67-75), showed that, overall, the mortality rate for the group was lower than for the entire US population. This difference is due, in part, to the fact that radiologic technologists work in or retired from an occupation that is physically demanding. Similar to other occupational groups, you tend

to be healthier than the general population, which includes chronically ill people. This kind of difference is often found when comparing workers to the general population and is known as the "healthy worker effect."

We also found that the breast cancer death rate was higher for women who were first certified before 1940 and for those who were certified for 30 or more years. Among women first certified before 1940, risk rose with more years certified. This trend was not seen in women who were first certified in 1940 or later. These patterns are being explored using updated information that includes technologists who died after 1990.

Another analysis looked at deaths specifically among Catholic nuns who were certified as radiologic technologists (Doody et al. *American Journal of Industrial Medicine* 2000; 3:339-348). For nuns matched with women in the general population of similar age, the nuns had a lower death rate than the comparison group. However, there was a slight increased risk of breast cancer. Moreover, for the nuns who were certified before 1940, when radiation doses were likely highest, the risk was nearly double. This may be explained by the reproductive and lifestyle factors of nuns as a group; however, the possibility of a radiation-related excess risk for breast cancer cannot be ruled out and will be explored further.

### ***Breast Cancers Reported on the First Questionnaire***

To date, one study has focused specifically on breast cancer. In comparisons of radiologic technologists diagnosed with breast cancer and a similar group of radiologic technologists without breast cancer, there was no difference in risk between the two groups for jobs involving radiotherapy, radioisotopes, or fluoroscopic equipment; nor was there a risk from personal exposures to fluoroscopy or multifilm procedures. There was a small risk associated with working more than 20 years—but this estimate of risk could have occurred by chance (Boice et al. *Journal of the American Medical Association* 1995; 274:394-401).

In a later analysis, we found no increased risk of breast cancer associated with performing a variety of procedures or the number of times they were performed. Procedures evaluated included: fluoroscopy, portable radiograph, routine radiographs, multifilm procedures, dental x-rays, radium therapy, orthovoltage, cobalt-60, betatron, other radiograph teletherapy, other radioisotope therapy, diagnostic radioisotopes, microwave/ultrasound diathermy, diagnostic ultrasound, and CAT scan (Doody et al. *Journal of Occupational and Environmental Medicine* 1995; 37:321-27).

## Current and Future Research

In addition to the analyses described above, much of our focus has been on locating individuals and obtaining completed surveys from as many study participants as possible. Considering the size of the study group (146,000), the wide age range of individuals, nationwide span and trend towards mobility, and the fact that 73% of the study group are female (and often have name changes), this has been no small task. We're grateful to the ARRT for helping us with this effort.

### *Analyses of Cancer Risk*

We are updating the first mortality study, using data through 1997, and we will look carefully at breast cancer risk related to the calendar periods in which you worked and the total number of years you worked. Analyses are underway to see if there is an excess risk for malignant leukemias, lymphomas, and multiple myelomas; and we will begin analyses for thyroid, prostate, colon, and melanoma cancers. The results of these analyses should be available in 2002.

### *Exposure Measurements*

During the past year, we began working with health physicists and industrial hygienists from the National Institute for Occupational Safety and Health (NIOSH) to develop more precise exposure estimates for individuals in the study group. Ultimately, we plan to have measure-

ments of exposure, based on dose records, work histories, and using statistical methods to fill in missing values where needed. In the analyses to date, exposure has been represented by the "number of years certified (or worked)" and "type of procedures used."

### *Genetic Studies*

In the last decade, scientists made great progress in understanding the biology of cancer. These advances include the identification of genetic markers that may be related to the risk of cancer. We have begun a collection of genetic materials (e.g., blood) which will allow us to look at the interaction between low-dose job-related radiation exposure and genetic susceptibility to cancer. Genetic susceptibility is an inherited trait that increases the risk of cancer; but we still know very little about which genes are involved, how they can be found, how strong their effects may be, and how the information can be used to prevent cancer.

Currently, about 2,000 radiologic technologists, with and without cancer, are being invited to donate blood samples. These samples are being collected and stored to test for genetic markers of cancer risk. Participants typically have had their blood sample drawn by their own health care provider, using a pre-assembled blood collection kit provided by the study lab. Participation in this study has been very high; more than 1,000 blood samples have already been collected and stored for future study.

Our initial efforts focused on collecting blood samples from those of you who have had early-onset or multiple primary cancers (two or more different kinds of cancers). During the past year, we expanded the effort to include all technologists currently known to have had breast cancer. In the coming year, we will be asking some of you who have not had cancer to provide blood samples for comparison.

## Questions and Answers

**Q. I am no longer employed as a radiologic technologist. Should I still be in the study and complete any additional questionnaires I receive?**

A. Yes. The continued follow-up of your health and lifestyle factors is crucial in evaluating the risks of low dose radiation exposure. All the information you provide will be used in future analyses.

**Q. I was certified as a radiologic technologist, but did not work in the field or worked a very short time. Should I be in the study?**

A. Yes. It is important that you remain in the study and complete all questionnaires that you receive. Your participation is needed because, in order to evaluate the risks from various doses, a comparison group of persons who were not exposed or exposed to very low doses is needed. Apart from the exposure of interest, this latter group should be as similar as possible to the exposed groups. Thus, your participation is vital!

**Q. There are several radiologic technologists at my workplace who are not in the study. How can they join?**

A. Many younger radiologic technologists have expressed a desire to participate in the study. We appreciate their interest; however, the aim of the study is to evaluate the long-term effects of low-dose, repeated radiation exposure. Therefore, we must follow the same study participants for many years. Of course, radiologic technologists who are not in the study will certainly benefit by what is learned.

**Q. How can I obtain more detailed results of the studies to-date?**

A. The journal articles referenced in this Newsletter are available in medical school libraries and on line with PUBMED and other medical library database resources. We have also created an internet web site for viewing and downloading these articles. The address is: <http://dceg.cancer.gov/radtechs>. Copies of specific papers published from the study may also be obtained by writing to Dr. Bruce Alexander, Division of Environmental

and Occupational Health, University of Minnesota, MMC 807 Mayo Memorial Building, 420 Delaware St. S.E., Minneapolis MN 55455.

**Q. I was just diagnosed with cancer. Was this cancer caused by working as a radiologic technologist?**

A. We can only speak in broad statistical terms about any causal relationship between an exposure and a cancer outcome. Given our scientific knowledge, it is essentially impossible to determine the cause of a cancer for a specific person. One of the goals of our study is to determine the cancer risk –across the entire group– of low dose, occupational radiation exposure. Further, we hope to quantify the risk as a function of dose, but we will not be able to determine whether any specific individual's cancer was caused by his or her exposure.

If you have concerns or questions about your health, we encourage you to discuss these matters with your personal physician. The study staff regret that they are unable to respond to questions about individual medical conditions.

**Q. Is another questionnaire planned and when?**

A. Yes. Long-term follow-up is very crucial in this study because many of the cancers we are investigating occur later in life. We are now considering development of a third survey that would be sent to you in about two years. In the meantime, we may send you an abbreviated questionnaire to obtain information on new cancers you have had since the last survey.

**Q. I am a male and a large percentage of the study participants are female. Should I continue to participate, especially if many of the analyses focus on breast cancer?**

A. Yes. The cohort is unique in having such a large percentage of women. We want to take advantage of this in studying female cancers (such as those of the breast and ovary). However, we plan to study cancers that affect only males such as prostate and testicular cancer. In addition, we will be investigating the cancer risk for a variety of sites that affect everyone, such as the colon and the lung.

## ***Request for Assistance in Finding Historical Dose Data***

As mentioned elsewhere in the newsletter, individual radiation doses help us identify trends, if any, between radiation exposures and risks for diseases such as cancer. For the time period since 1965, we have been able to identify extensive dose records for radiologic technologists. However, prior to 1965, the records are difficult to locate and are often sparse.

If you know about any collections of dose records for years prior to 1965, please contact us. Please call Thurman Wenzl at 1-800-356-4674 or write to him at:

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