

STUDY RELATES ECONOMIC STATUS TO DEATH RISK AMONG RADIATION WORKERS

RESearchers at Oak Ridge Associated Universities (ORAU) conducted a study of workers employed at Oak Ridge nuclear plants from 1943 through 1947 to develop an analytical method for evaluating age-specific death rates. The study found an "apparent lack of association" between radiation exposure and risk of death, while finding that socioeconomic status was strongly predictive of mortality over the thirty-year study period.

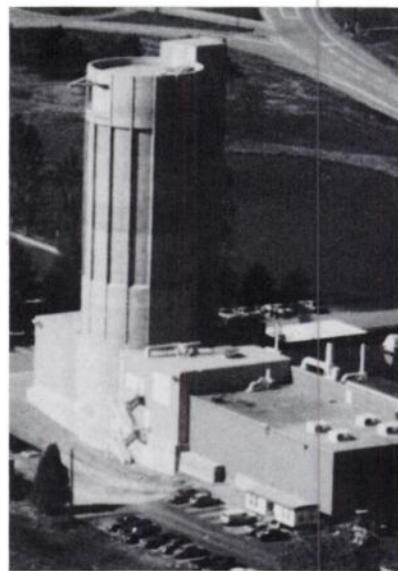
The study, "Poisson Regression Analysis of the Mortality Among a Cohort of World War II Nuclear Industry Workers," published last year in *Radiation Research*, was undertaken by Edward L. Frome, PhD, a statistician at ORAU; Donna L. Cragle, PhD, an epidemiologist at ORAU's Center for Epidemiological Research; and Richard W. McLain, MS, a former ORAU researcher, who is now a statistician at Warner-Lambert Company (1). The cohort consisted of 28,008 white males who worked in Tennessee at Oak Ridge National Laboratory, the Oak Ridge Y-12 Plant, or the Oak Ridge Gaseous Diffusion Plant for at least one month during 1943-1947 and who did not work there after 1947. According to Dr. Cragle, the average length of employment for those studied was about 1 1/2 years. The researchers studied the mortality of these men from 1950 through 1979, controlling for factors such as socioeconomic status, age, length of employment, specific facility of employment, and potential for radiation exposure.

The researchers determined employees' economic status based on their job titles. Those jobs requiring less than a high school education were classified as unskilled, those requiring at least a high school education

were designated skilled, and those requiring a college degree were labeled professional. Since film badges weren't worn during the study group's period of employment, job titles were used along with department names to determine which men were probably exposed to radiation. Workers were divided into two groups. The researchers classified the following group as not exposed to radiation: Those with a job title/department combination that implied "no rational expectation of continuing or even irregular contact with radioactive materials and sources and where there was no reasonable expectation that radioactive materials were used, transported, or stored." The remaining workers were classified as exposed to radiation.

The researchers had expected socioeconomic status to be a predictor of mortality, but, according to Dr. Cragle, they were surprised at how strong a predictor it was. The estimated effect of socioeconomic status on risk of death for the parameter professional versus skilled workers was -39.1 L% (logarithmic %) with a standard deviation (s.d.) of 4.8 L%, which is highly significant. (According to Dr. Cragle, an estimate becomes significant when the s.d. is less than half of the estimated risk figure; the lower the s.d. relative to the estimate, the more significant the estimate.) In this case, professional workers were much more likely to live longer over the 30-year study period than were the skilled workers.

While the researchers stressed the importance of the socioeconomic status effect, they downplayed the importance of not finding a radiation exposure effect. The researchers report that the estimated effect of radiation



Oak Ridge National Laboratory

exposure on risk of death during the study period was -2.2 L% with a s.d. of 2.1 L%, which renders the negative correlation insignificant. In their report, they state: "The [radiation exposure classification] procedure is subject to error that would result in misclassification of exposure status and lead to underestimation of risk in the exposed group. Also, since the radiation variable was dichotomous and many workers were employed less than six months, a worker may be classified as exposed where the exposure is not significantly different than [that received by] those in the unexposed category. Thus, the exposure variable may not be a sensitive measure of true differences in dose." The researchers also noted that the maximum length of employment was six years and that "it is possible that this is not a sufficient length of time to cause increased risk of death from cancer."

The researchers used a refined version of the standardized mortality ratio

(continued on page 24N)

NEWS BRIEFS

(continued from page 23N)

of new radiopharmaceuticals." Dr. D'Auria adds that while there are excellent undergraduate radiochemistry programs in the United States, there are no programs that combine radiochemistry with organic chemistry. "These are two very different disciplines, but, with the advent of PET, organic chemists increasingly require training in radiochemical techniques. We want to supplement their knowledge and experience."

According to Dr. D'Auria, the program is open to individuals with a postgraduate degree in organic chemistry who wish to work in the radiopharmaceutical field, for example, at one of the new PET centers being established in the U.S. or in the pharmaceutical industry, where radiotracers are used in research and development.

Structured in week-long individual "modules," the six-week program will be held May-June 1991 at SFU. "The participants can select modular topics they feel suited to or they can take the entire six-week program," says Dr.

D'Auria. The majority of each module, Dr. D'Auria adds, will concentrate on lab activities to delineate the basic principles of nuclear science, with examples related to generators, the growth and decay of isotopes, and the use of various counting equipment as well as rapid synthesis and purification, quality control, and the determination of specific activity. "While most of the lab work will demonstrate standard synthesis of radiopharmaceuticals," says Dr. D'Auria, "the final week will offer a series of options, including the syntheses of PET radiopharmaceuticals and monoclonal antibodies." These sessions will also include field trips to PET centers and clinical nuclear medicine laboratories and special lectures by invited speakers.

"Such programs are useful if the students already have a solid background in radiopharmacy, because a month-long program can only provide a veneer of good training," says Walter Wolf, PhD, professor, division of biomedical chemistry, School of Pharmacy, University of Southern Califor-

nia, Los Angeles, California. "But there should be more programs like this, and they should be expanded, especially in the United States." Dr. Wolf comments that "a serious shortage of trained radiochemists currently exists in both academia and industry . . . there has to be put forth a concerted national effort in order to adequately resolve the shortage we face."

The two-year old Institute is currently seeking applicants for its 1991 summer program. The program costs approximately \$860 (U.S.) per module or \$4,730 (U.S.) for all six modules. This expenditure includes tuition, materials, room, board, and transportation. Prospective participants should confirm attendance — with 10% deposit — by March 15, 1991. For further information contact: Thomas J. Ruth, PhD, TRIUMF, University of British Columbia Campus, 4004 Wesbrook Mall, Vancouver, BC, Canada, V6T 2A3, (604) 222-1047 or: John M. D'Auria, PhD, department of chemistry, SFU, Burnaby, BC, Canada, V5A 1S6, (604) 291-4607. ■

Radiation Workers

(continued from page 22N)

(SMR) analysis to compare the cohort's mortality with that of the control group, which was comprised of the general white male U.S. population during the 30-year study period. The SMR for all causes of death was 1.11, an 11% higher mortality than the control group. Some of the workers studied were employed by coal mining companies, the chemical industry, and other heavy industries prior to their Oak Ridge employment, which might be a contributing factor to the cohort's higher mortality due to respiratory diseases.

Dr. Cragle cautioned that because many variables in this study could not be precisely tracked, results from the

study should not be treated as definitive and may be subject to change when the researchers complete further, more rigorous studies based on data from later years. Dr. Cragle and her colleagues at the ORAU Center for Epidemiological Research are currently conducting another study on workers at the same three Oak Ridge plants. They will study personnel who wore film badges so the radiation doses they received will be known. They will use data from the late 1940s through 1984 and expect to publish their results in 1992. The researchers will use a refined version of the Poisson regression analysis model that they developed during the earlier study. They will also employ the model in an ORAU study of workers at the Savannah River

nuclear plant in South Carolina, the Fernald nuclear facility in Ohio, and other selected nuclear plants.

The World War II nuclear workers study thus provides a starting point for ongoing analysis of the health and mortality of radiation workers. The ORAU researchers conclude that "the importance of the study lies in clearly showing that future studies, which will have more complete [radiation] exposure data, should not ignore the very strong socioeconomic status effects for most causes of death."

Joan Hiam

Reference

1. Frome EL, Cragle DL, McClain RM. Poisson regression analysis of the mortality among a cohort of World War II nuclear industry workers. *Radiation Research* 1990;123:138-152.