Adjustment for Smoking Reduces Radiation Risk - Fifth Analysis of Mortality of Nuclear Industry Workers in Japan, 1999–2010

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Many cohort studies among nuclear industry workers have been carried out to determine the possible health effects of low-level radiation. In those studies, confounding factors, for example, age was adjusted to exclude the effect of difference of mortality by age to estimate radiation risk. But there are few studies adjusting for smoking that is known as a strong factor which affects mortality.

Radiation Effects Association (REA) initiated a cohort study of nuclear industry worker's mortality in 1990. To examine non-radiation factors confounding on the mortality risk among the radiation workers, REA have performed life-style questionnaire surveys among the part of workers at 1997 and 2003 and found the correlation between radiation dose and smoking rate. Mortality follow-up were made on 75,442 male respondents for an average of 8.3 years during the observation period 1999-2010. Estimates of Excess Relative Risk percent (ERR%) per 10mSv were obtained by using the Poisson regression. The ERR for all causes was statistically significant (1.05 (90%CI 0.31 : 1.80)), but no longer significant after adjusting for smoking (0.45 (-0.24 : 1.13)). The ERR for all cancers excluding leukaemia was not significant (0.92 (-0.30 : 2.16)), but after adjusting for smoking, it decreased (0.36 (-0.79 : 1.50)).

Thus, smoking has a large effect to obscure a radiation risk, so adjustment for smoking is important to estimate radiation risk.

keywords: cohort study, cancer, confounding factor
Adjustment for Smoking Reduces Radiation Risk Estimate
Mortality Analysis of Nuclear Industry Workers in Japan, 1999–2010

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1. Background and Purpose
The Radiation Effects Association (REA) has been conducting a radiation-epidemiological study since 1990. In cohort studies among nuclear industry workers, however, there are few studies that adjust for smoking, which is known as a strong factor in mortality. We conducted a lifestyle survey among a group of workers in 1997 and 2003 and found a correlation that higher-dose groups had a higher percentage of current smokers (<10mSv 54%, 10-50mSv 58%, 50+mSv 60%). The purpose of the present study is to examine any confounding effects on radiation risk by comparing excess relative risk (ERR) with and without adjustments for smoking.

2. Study population
The study population was 75,442 males who responded to lifestyle questionnaire surveys administered to radiation workers registered in the Radiation Dose Registry by the end of March 1999. Mean age at the end of follow-up was 56, mean follow-up period was 8.3 years, and mean cumulative dose was 25.8 mSv.

3. Methods
- Vital status: Confirmed by obtaining residence registration card from municipality
- Causes of Death: Confirmed by data linkage with National Vital Statistics
- Radiation Doses: Provided by the REA’s Radiation Dose Registry Centre
- Lifestyle surveys: Self-reported
- Analysis: ERR%/10mSv was derived using Poisson regression
- Strata: Age, calendar period, region, lifestyle survey period (1st, 2nd)
- Smoking adjustment: Added dummy variables of smoking status to the model
- Dose lag: Two years for leukaemia, 10 years for other diseases

4. Results
Adjustment for smoking reduces ERR in most causes of deaths. For all cancers excluding leukaemia, ERR declined from 0.92 to 0.36.

5. Discussion
ERR reduction by adjustment for smoking shows that smoking is a confounding factor in radiation risk. Adjustment for socioeconomic status, such as type of employer (research institute, electric power company, contractors, etc.) showed smaller effects on ERR in our study. Adjustment for confounders that strongly affect mortality is crucial to estimating radiation risk.

6. Conclusions
We could thus quantify the effects of adjustment for smoking among the large-cohort studies of radiation risk and conclude that smoking is a strong confounder.

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