

A Cohort Study On Low Dose Exposure And Mortality In Nuclear Power Workers In Germany

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Introduction & Objective

Introduction

Standards in ionizing radiation protection rely mainly on the data obtained within the Life-Span-Study. The survivors of the A-bombs were exposed to ionizing radiation at high dose rates for a very short time. However, low and protracted doses are relevant for nuclear power workers. The investigation of health effects due to chronic exposure is an important research topic.

Objective

A retrospective cohort study of nuclear power workers in Germany estimated the overall mortality and cancer mortality related to external radiation.

Methods

Cohort

Nuclear industry workers in Germany are recorded by the Institution for Statutory Accident Insurance and Prevention. Information on name, address, date of birth, dates of employment and exposure data was provided for the cohort study. Individual information on socio-economic status was not available.

Workers from 17 nuclear power plants were considered. The cohort includes category A radiation workers with an effective dose that may exceed 6 mSv (p. a.) and who were employed for at least 90 days. Cohort inclusion period and end of Follow up: 1 Jan.1991 – 31Dec. 2008.

Exposure

All employees were monitored by officially approved film badges. The exposure to external photon radiation was measured.

Follow up

For every withdrawal or retirement an individual mortality follow up was carried out by sending inquiries to the municipal population registry of the latest known residence. Death certificates were obtained from the local health authority.

Statistical Methods

Mortality was compared to that of the overall population. Standardized mortality ratios (SMR) and 95% confidence intervalls (CI) were computed for all causes of death and all cancers.

Results

Cohort

A total of 9,210 workers were exposed to external photon radiation. From these 1,220 persons had to be excluded (no DOB, withdrawal before 1991, no information about period of employment). The cohort includes 7,990 workers.

	N	Person years
Men	7,810 (97.7%)	112,529
Women	180 (2.3%)	1,618
Σ	7,990 (100.0%)	114,147

The mean follow up time was 14.3 years.

At the 31st of December, 4,763 (59,6%) persons were still working as occupationally exposed persons. The mean age was 49,7 years at the end of the follow up.

Number of deaths

During the observation period a total of 237 deaths occurred. No women died. The cause of death could be traced in 96,2%. Among 97 cancer cases the most frequent were lung cancer (n=22), pancreatic cancer (n=11) and colorectal cancer (n=9). No leukemia case was observed.

Mortality

All-cause SMR: 0.43 (95% CI 0.38 – 0.49).

SMR for all-cancer diseases: 0.59 (95% CI 0.45 – 0.77).

The SMR for cancer increases with duration of observational period: 0.70 (95% CI 0.48 – 0.99) after 15-19 years of follow up.

Discussion & Conclusions

No increase in overall mortality and total cancer mortality was observed. The SMR values suggest a strong healthy worker effect. This is an expected result, since workers in the nuclear industry are relatively well-paid and educated. Individual information on socio-economic data were not available, but aggregated data on job titles confirm that 26% of the cohort members were higher educated, non-manual employees, 70% were skilled manual workers and 4% were trainees.

A dose-response analysis will be the next step. Due to data protection issues anonymised exposure data will be available after finalization of the follow up.