

Fitting quadratic and linear-quadratic models in a cohort of Japanese nuclear workers

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[Aim] The male cohort of atomic bomb survivors showed an upward curving increase in solid cancer incidence. The purpose of the present study was to apply quadratic term to the cohort of epidemiological studies conducted by the Radiation Effects Association to confirm whether the results would be similar to the atomic bomb survivors.

[Methods] The cohort consisted of male nuclear workers employed by March 1999 and whose vital statuses were verified. The Poisson regression was used, with attained age, calendar year, and region as adjustment variables. Linear (L), quadratic (Q), and linear-quadratic (LQ) models were applied. Goodness of fit was confirmed by AIC.

[Results] The cohort size was 204,103. For all cancers except leukemia, the best-fitting model was the LQ, with a negative quadratic term (i.e., downward curve). The results of analyses for site-specific cancers were similar. For liver cancer, L was the best fit, while the quadratic term in LQ was also negative.

[Discussion] The reason why the quadratic term in LQ was negative was likely caused by the healthy worker survival effect (i.e., mortality rates decrease for those who have worked longer (\approx high-dose group)). To confirm this, we calculated the relative risk of death by duration of employment and found that the relative risk decreased with increasing duration of employment. This may be due to the fact that atomic bomb survivors are a resident cohort, whereas nuclear workers are an occupational cohort.

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