International Collaborative Study of Cancer Risk among Radiation Workers in the Nuclear Industry

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Body of Abstract: Current estimates of cancer risk associated with external exposure to low linear energy transfer ionising radiation are mainly based on studies of groups exposed primarily at high dose rates, such as atomic bomb survivors and patients irradiated for therapeutic purposes. Radiation protection standards, however, are concerned with protection of the general population and workers, who receive mainly low-dose, protracted exposures. The use of data from populations who have received comparatively high radiation doses over short periods to predict carcinogenic effects in populations receiving generally lower doses over longer time involves uncertain extrapolations. Studies of populations receiving relatively low doses at different dose rates are therefore of interest to test the adequacy of extrapolation models. Studies of cancer risk among workers in the nuclear industry around the world are particularly well suited for the direct estimation of the effects of low doses and dose rates of ionizing radiation. The statistical power of individual studies carried up to now was, however, relatively low and most studies have provided little evidence of a dose-related increase in cancer mortality.

A large-scale multinational epidemiological study of cancer risk among nuclear industry workers has therefore been conducted in 17 countries, coordinated by the International Agency for Research on Cancer (IARC) in Lyon. The objective is to derive precise, direct estimates of cancer risk following low-dose protracted exposure to ionising radiation. The study covers 600,000 individually monitored workers from 70 different facilities. Much effort has gone into assessing and ensuring comparability, including the use of a common core protocol, agreed procedures, studies of comparability of coding of death certificates and assessment of heterogeneity of risk across the cohorts. A detailed study of biases and random errors in the radiation dose estimates has been carried out using questionnaires on dosimetry technology and monitoring and recording practices, as well as expert opinion on exposure conditions and practices. Quantification of these errors has been done using the information collected, complemented by results of dosimetric experiments on the energy and geometry response of old dosimeters.

Dose-response analyses have been carried out. Resulting risk estimates have been compared to risk estimates derived from atomic bomb survivors and other high dose studies. Particular attention has focused on risk of mortality from leukaemia (excluding CLL) and all cancers excluding leukaemia, the two main groupings of causes of death for which risk estimates have been derived from studies of atomic bomb survivors.