**Dose reconstruction and calculation of organ dose**

Historical dose reconstruction was performed for workers who were presumed to work before 1996 based on birth year and NDR data among 12 906 workers who linked the questionnaire survey data with NDR data. The number of workers who had reconstructed historical dose was 2751 (21.3% of the total population), and we used a model in which yearly doses were taken as a log-linear function of time and age (Equation 1).[1]

$$logD = \beta_0 + \beta_1(y2000) + \beta_2(a35) \quad (1)$$

where D is the annual badge dose, y2000 is the year at exposure centered at 2000, and a35 is the age at exposure centered at 35 years. Annual doses were calculated by combining the quarterly badge readings of the workers enrolled in the NDR. The lowest detectable quarterly level of the national dosimetry registry, 0.01 mSv, was taken as 0.005 mSv to minimize bias in the estimated doses.

After reconstructing radiation doses, we estimated organ doses by considering relevant uncertainty factors such as apron usage, badge location, and dominant energy of the diagnostic radiation field used in dose reconstruction for the US radiologic technologists study.[2 3] However, unlike the US radiologic technologist dosimetry, which provides multiple realizations each annual dose, our current dosimetry is a deterministic system that provides only a single estimate for each annual dose. Heart organ dose was estimated with the following equation: $D_o = D_c \times R_{coef} \times (P_{NoA} + AA \times P_{AO} + P_{AU})$, where $D_o$ is the organ dose; $D_c$ is the personal cumulative badge dose; $R_{coef}$ is the conversion coefficient at mean value between 30 and 40 keV in the anterior to posterior direction of exposure (i.e., the conversion coefficients were 0.39 for men and 0.45 for women); $P_{NoA}$ is the probability of not wearing aprons at work (i.e., 0.25, 0.5, 0.75, 1); $P_{AO}$ is the probability of wearing aprons with the badge outside; $P_{AU}$ is the probability of wearing aprons with the badge inside (i.e., 0, 0.25, 0.5, 0.75); and AA is the apron attenuation factor. We assumed an 80% reduction in exposure beneath and apron based on a previous Korean study.[4]

## References

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