

Appendix E1

Re: Extrapolation Methods and Models Used in the UNSCEAR 2022 Report (3)

The recent report by UNSCEAR (3) was based on a UNSCEAR international survey launched in 2014. The responses to the survey cover data from the years 2009–2018, with the majority of data provided for the period 2014–2017. The number of countries providing data were variable (conventional radiology from 43 countries, computed tomography, and interventional radiology from 39 countries, dental radiology from 36 countries, nuclear medicine from 46 countries, and radiation therapy from 44 countries).

UNSCEAR investigated several extrapolation models. Their assessment ultimately used a continuous mathematical model in the form of a power function of the physician density in each country. Worldwide data were also categorized by income level of countries based on annual gross national income per capita using the 2016 World Bank classification of high ($> \$12,476$ US), upper middle ($\$4,036$ – $12,476$), lower middle income ($\$1,026$ – $4,035$) and low income ($\leq 1,025$) countries. Uncertainties were evaluated, and the total uncertainties were 28% for frequency estimates and 30% for collective effective dose estimates.

In general, both the NCRP and UNSCEAR reports used similar organization of the data. There were minor differences in categorization (eg, whether to include CT numbers and doses from PET/CT and SPECT/CT in the CT or in the nuclear medicine section or whether to include diagnostic coronary angiography in the conventional radiology or interventional section). There was no attempt in our comparison to recategorize these items since they account for very small percentages. The NCRP report did not assess the number of radiologists or other medical personnel nor attempt to estimate the number of machines involved. The UNSCEAR report does contain a large amount of such information.

Extrapolations were done somewhat differently in NCRP and UNSCEAR reports but the uncertainties in the reports are relatively close. The NCRP report estimated numbers of specific and categories of procedures but did not provide frequencies in terms of number per 1,000 population as was done in the UNSCEAR Report. Therefore, for comparison purposes, we calculated the frequencies for the general categories in the U.S. data.