Presenting the Consultation Document:
"Reference Organ Absorbed and Effective Dose Coefficients for Computed Tomographic Examinations"

Interpretation of Dose Coefficients — What do they mean and what not

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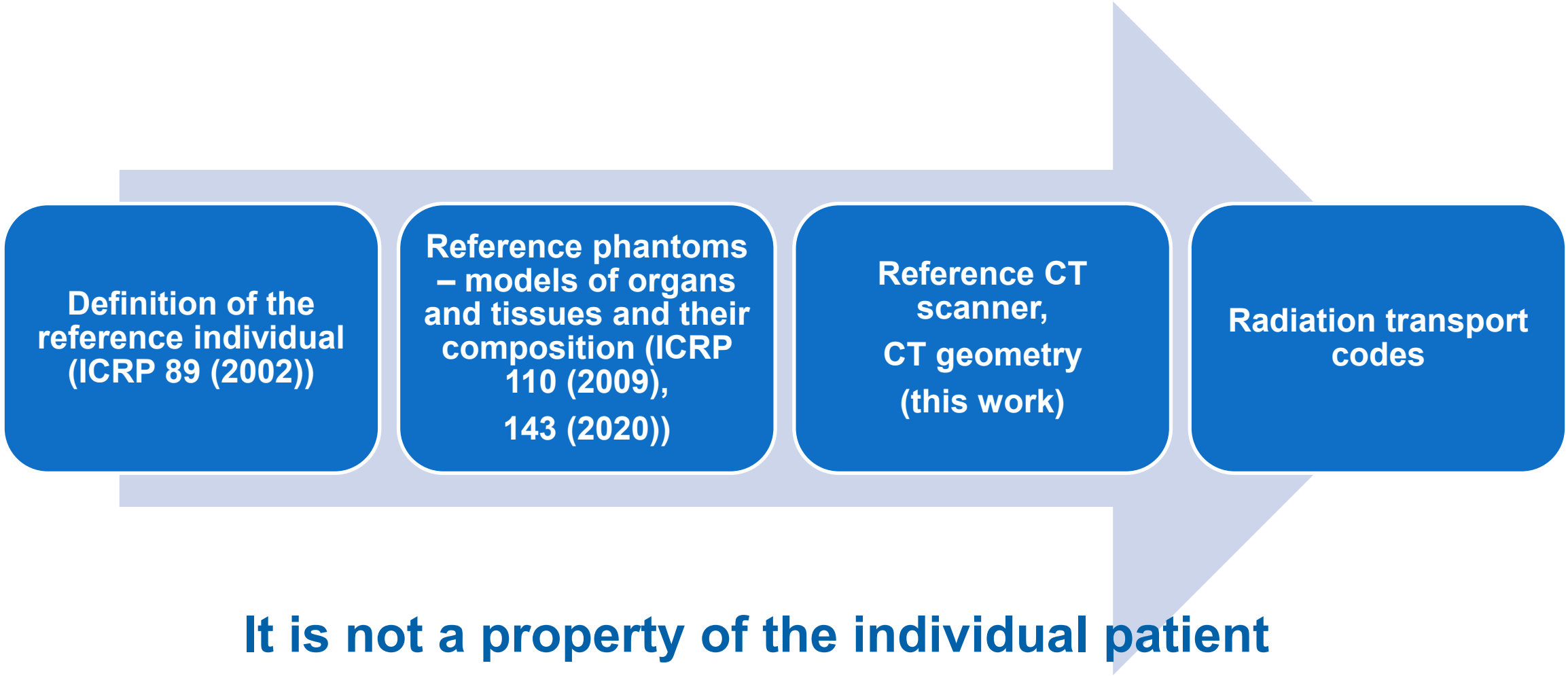
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Data files provided with this Publication— What do they mean and what not

- The data files provide reference organ absorbed dose coefficients per phantom slice for both male and female phantoms and each reference age
- They also provide, for each phantom a coefficient for either

$$\sum w_T \times H_T^M \quad \text{or} \quad \sum w_T \times H_T^F .$$

The reference dose coefficient is estimated for the reference individual and the reference scanner



It is not a property of the individual patient

The role of the ICRP reference phantoms

- **Reference phantoms provide standardized computational anatomy for radiation protection.**
- **Standardization is the strength of the method: results can be reproduced and compared across studies.**
- **Reference phantoms are not intended to reproduce the anatomy of a specific patient.**
- **Standardization is also the fundamental limitation for individual dosimetry.**

Population dosimetry: the intended strength

- **Reference coefficients enable standardized estimation across large patient groups. Examples:**
  - **Comparing typical organ doses between protocols.**
  - **Evaluating dose trends between institutions and countries.**
  - **Estimating population exposures for epidemiological studies.**
  - **Supporting optimization and radiation protection decisions.**
  - **Providing standardized input to risk models.**

Effective dose

- **Effective dose is a risk-adjusted protection quantity, primarily for stochastic effects such as cancer.**
- **Assumptions: Use of a Linear No Threshold (LNT) model for stochastic effects in the low-dose range; validity of temporal additivity of dose in the low-dose range. Sex averaging.**
- **Recognised differences in detriment and relative detriment (the contribution of the various organs and tissues to total detriment) as a function of age at exposure are not considered.**

risk of fatal cancer

≈ 5% Sv^{-1}



Effective dose (2)

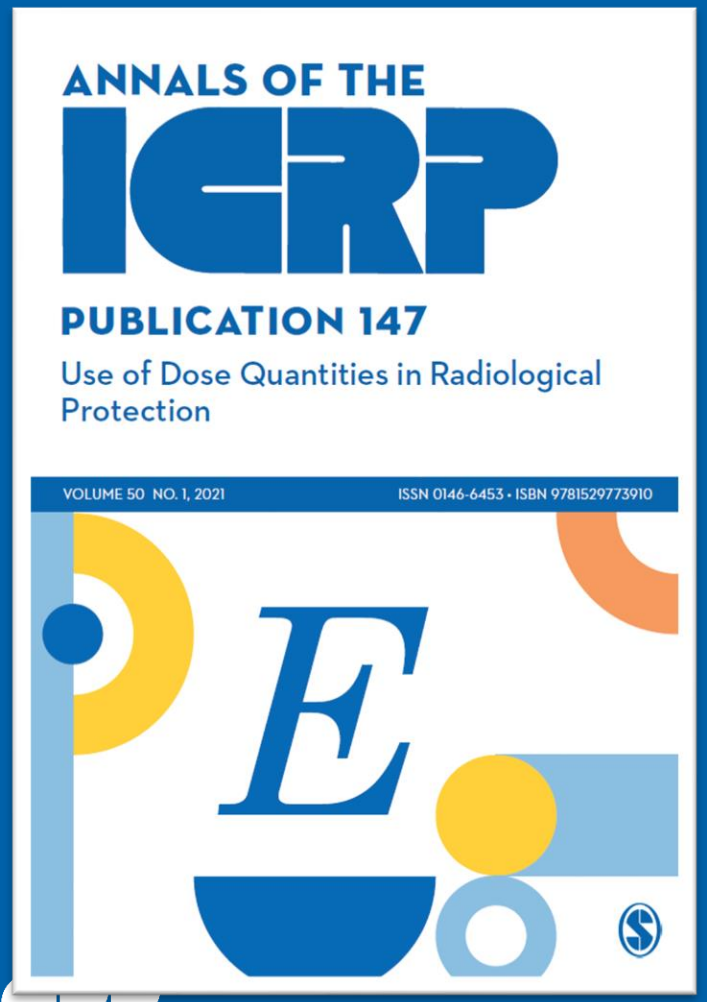
Age at exposure can introduce substantial variation in radiation detriment; this variation could be approximately up to a factor of three.

Therefore, effective dose is an indicator for stochastic risk but it is not intended for the assessment of risks of individuals

(because of the uncertainties in the low-dose range, underlying approximations, simplifications, sex and age-averaging).

However: in practice, it is often used as a first estimate for risk, e.g. in radiological diagnostics.

ICRP 147: Appropriate uses of effective dose in medicine



- **Useful for comparing different diagnostic examinations or procedures when patient populations are reasonably comparable.**
- **Useful for communicating broad differences in radiation risk between procedures—not for predicting an individual's outcome.**
- **Useful for optimisation, justification and protection decisions where a generic risk-related quantity is appropriate.**
- **Effective dose can be considered as an approximate indicator of possible risk.**
- **But it should not substitute a specific risk analysis when an individual assessment is required.**

Conclusions

- **Organ dose coefficients calculated with ICRP reference phantoms and Monte Carlo methods are standardized model-based conversion factors.**
- **When applied to clinical CT examinations, result to organ doses estimated under assumptions about anatomy and irradiation conditions.**
- **For an individual patient, anatomical and technical differences can produce substantial deviations from the reference calculation.**
- **Therefore, these coefficients are appropriate for reference/population dosimetry and comparative assessment; they should not be interpreted as individual patient's absorbed organ dose.**
- **Effective dose is a generic, risk-related protection quantity and therefore and indicator of stochastic risk —not an individual cancer risk prediction.**



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