Possible Improvements of Methodology for Calculating Radiation Detriment in the Future

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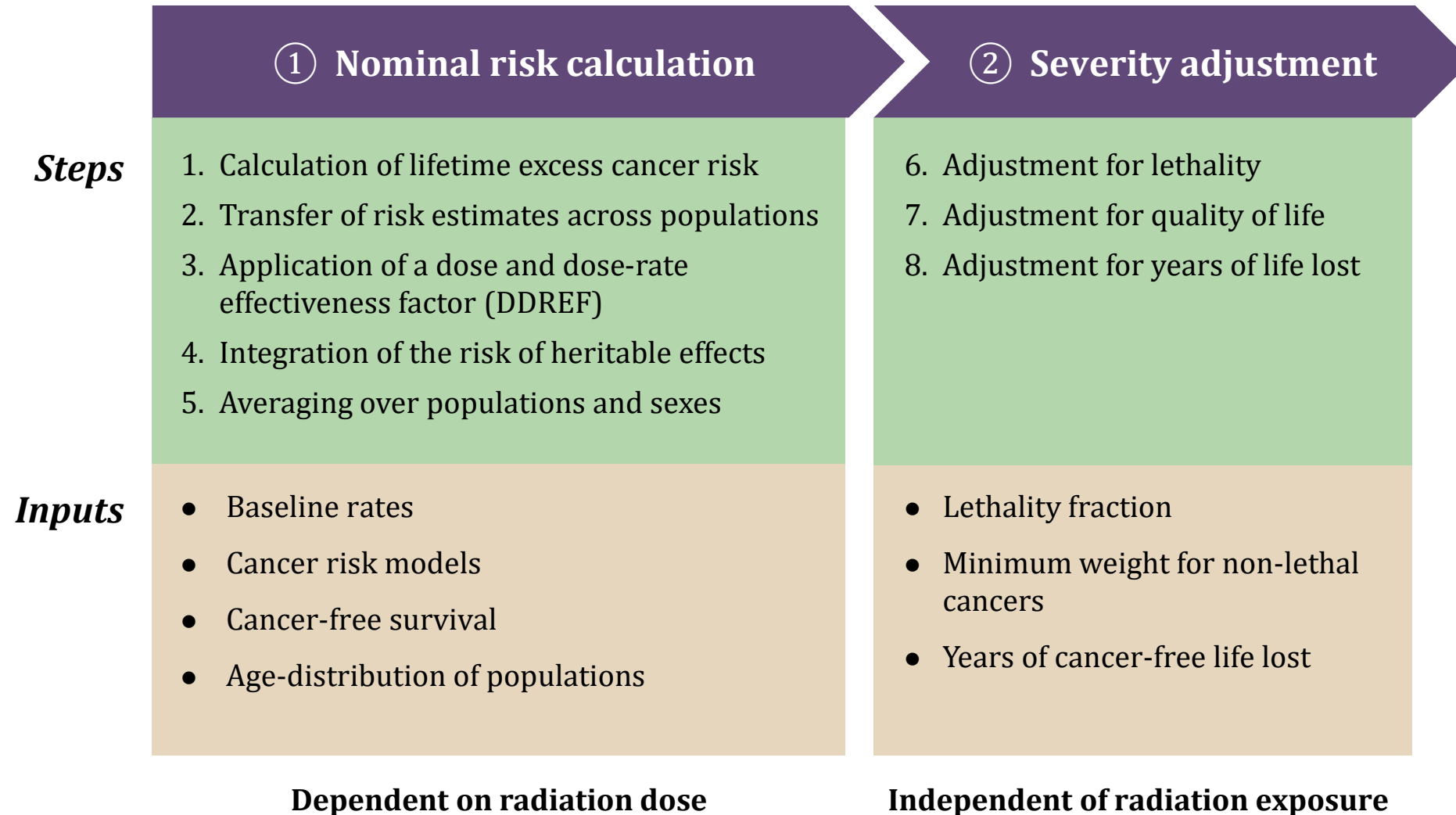Dominique Laurier (IRSN, France)

ICRP Task Group 102
Radiation Detriment Calculation Methodology

- Detail the detriment calculation in Publication 103

- Identify potential improvements in calculation procedures

Solid basis for future recommendations

Procedure for Calculating Radiation Detriment

① Nominal risk calculation	② Severity adjustment
Steps	
1. Calculation of lifetime excess cancer risk	6. Adjustment for lethality
2. Transfer of risk estimates across populations	7. Adjustment for quality of life
3. Application of a dose and dose-rate effectiveness factor (DDREF)	8. Adjustment for years of life lost
4. Integration of the risk of heritable effects	
5. Averaging over populations and sexes	
Inputs	
• Baseline rates	• Lethality fraction
• Cancer risk models	• Minimum weight for non-lethal cancers
• Cancer-free survival	• Years of cancer-free life lost
• Age-distribution of populations	
Dependent on radiation dose	**Independent of radiation exposure**

Areas for Improvement

- Update of baseline data and parameters

- Revision of risk models

- Handling of variation with sex and age

- Increasing transparency and comprehensibility

- Consideration of non-cancer effects

Update of Baseline Data and Parameters

- Cancer incidence rates and mortality rates

- Populations other than selected Asian and Euro-American

- Severity adjustment
  - Update of lethality fractions and years of cancer-free life lost
  - Revision of QOL factors
  - Review of the way of adjusting severity (Consideration of using QALY or DALY)

Revision of Risk Models

- Update of the LSS model with longer follow-up
- Consideration of modifying factors other than sex and age
- More cancer site-specific models
- Models based on epidemiological studies other than LSS
- Validation of underlying assumptions
  - Dose response, DDREF
  - Risk transfer scheme
- Revision of the risk estimates for heritable effects

Variation with Sex
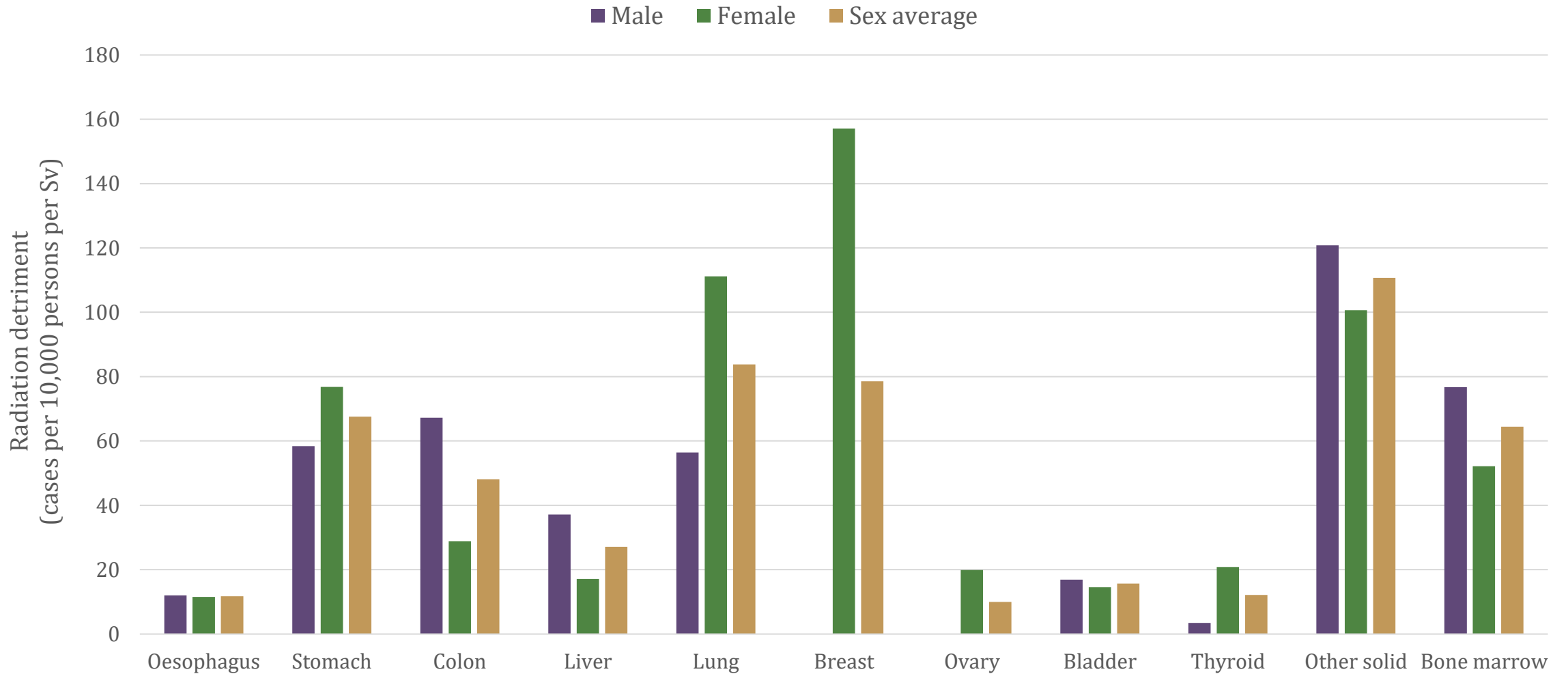
Variation with Age at Exposure
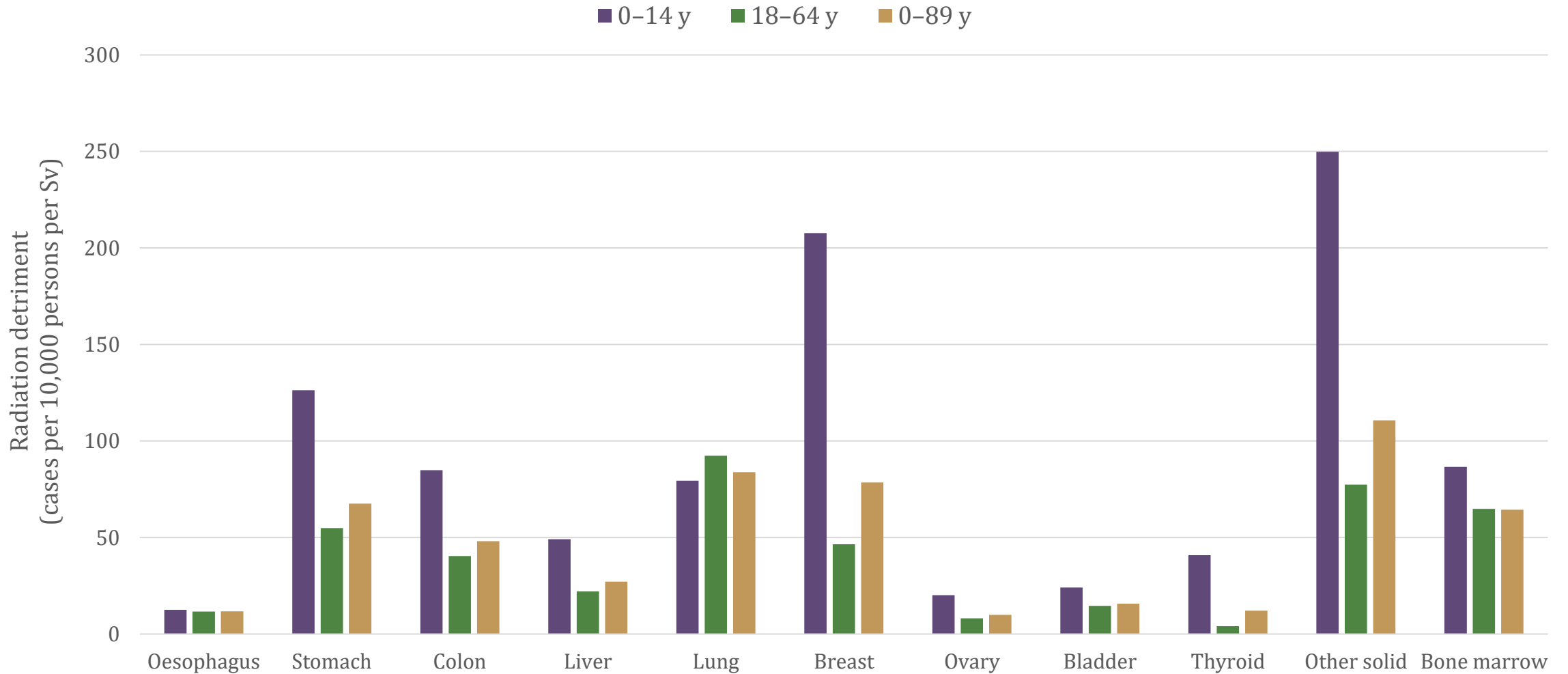
Handling of Variation

- **Risk estimation process**
  - Calculate lifetime risks (relative detriments) separately for sexes, ages/age groups, and other influential factors.

    → Science-based risk assessment

  - Average the estimates in the last stage.

    → Integration of information for RP purposes

- **Consideration of exposure scenario**

Increasing Transparency and Comprehensibility

- Full description of the calculation steps

- Development of an open-source software

- Way of expressing detriment
(Alternative to the radiation detriment)

- Illustration of the data on reference populations

Consideration of Non-Cancer Effects

- Disease of the circulatory system (DCS) and cataract

- Uncertainty in dose response at low/moderate doses

- Classification of effects

- Statistics on baseline rates

- Adjustment for severity

- Target tissues for DCS

Ongoing Work in ICRP Committee 1

- Dose response, DDREF $\rightarrow$ Task Group 91

- Consideration of DCS $\rightarrow$ Task Group 119

- Cancer risk models

- Severity adjustment $\rightarrow$ C1 Subgroups

- Risk of hereditary effects