

Patient Effective Dose and Radiation Biological Risk in the Chest and Abdominopelvic Computed Tomography

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1 Introduction

- **Stochastic Risk:** Ionizing radiation induces non-threshold stochastic effects (carcinogenesis, hereditary defects).
- **Metrics Limitation:** Effective dose measures whole-body detriment for population baseline comparisons, not individual patient risk.
- **Objective:** Quantify organ dose, effective dose, and stochastic cancer risk in routine chest and abdominopelvic CT.

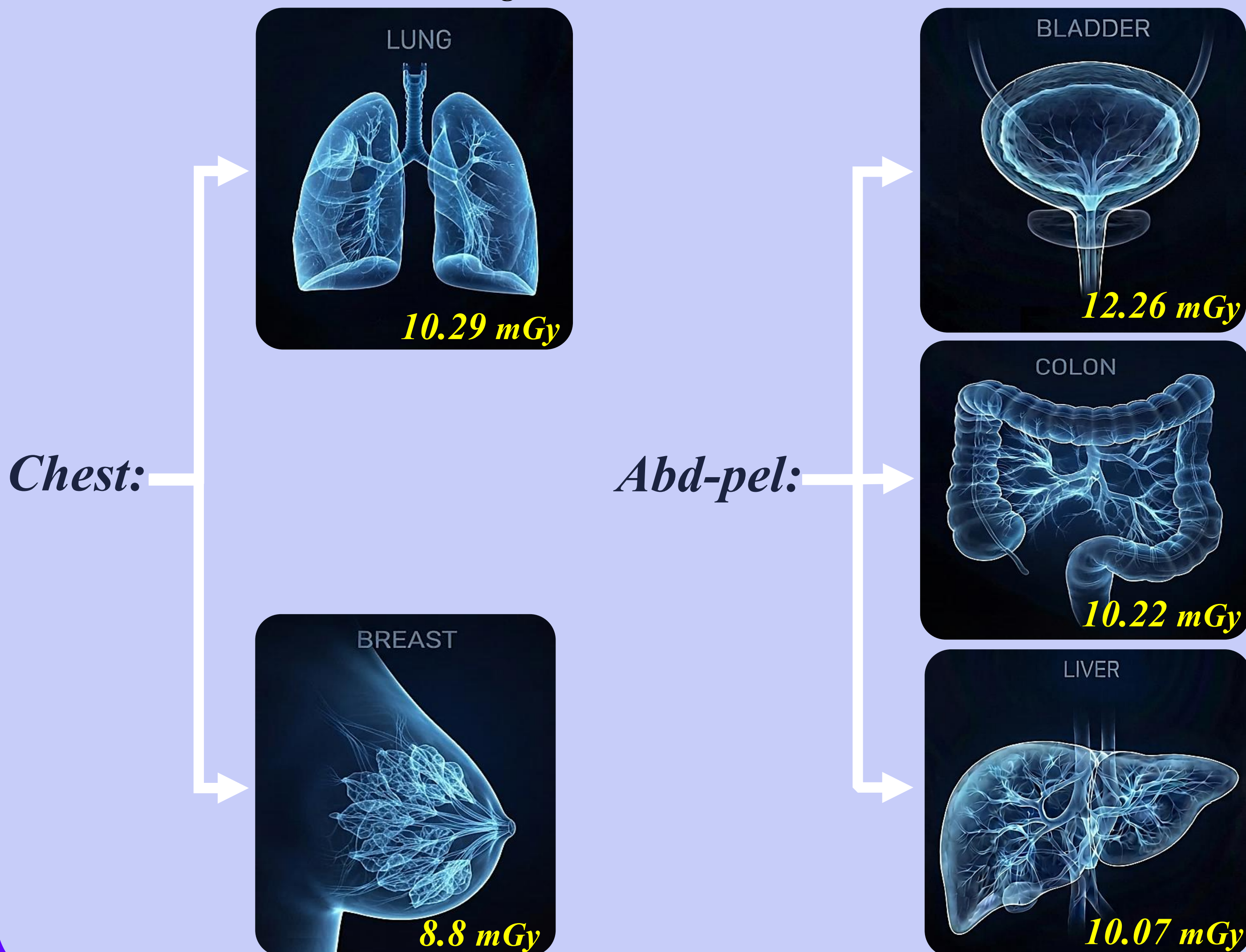
2 Methodology

- **Study Cohort:** Retrospective dosimetry analysis of 2,473 adult patients: 1,293 Chest CT (52.3%) and 1,180 Abdominopelvic CT (47.7%).
- **Scanner & Protocols:** Non-contrast routine exams acquired on a 64-slice scanner (Siemens SOMATOM Sensation 64); angiography excluded.
- **Dosimetry Extraction:** Derived exposure metrics: CTDI_{vol} and DLP.
- **Dose Modeling:** Organ dose and effective dose computed via ImPactDose Monte Carlo simulation software.

Cancer Risk = Radiation Dose × ICRP 103 Risk Coefficient

3 Results

- **Effective Dose:** Mean effective dose for abdominopelvic CT (5.23 mSv) is nearly double chest CT (2.73 mSv), driven by extended scan length and tissue density.
- **Peak Organ Doses (D_{organ}):**



4 Discussion and Conclusion

- **Double Stochastic Risk:** Abdominopelvic CT doubles chest CT cancer risk (29.8 vs. 15.6 per 10⁵), aligning with higher effective dose.
- **Sex Disparity:** Female chest CT dose is ≈ 43% higher (3.21 vs. 2.25 mSv), driven by breast organ weighting factor and BMI.
- **Clinical Translation:** Organ and effective dose modeling converts raw CT metrics into actionable stochastic cancer risk estimates.
- **Justification & ALARA:** Diagnostic benefit outweighs risk for justified scans; clinical priority.

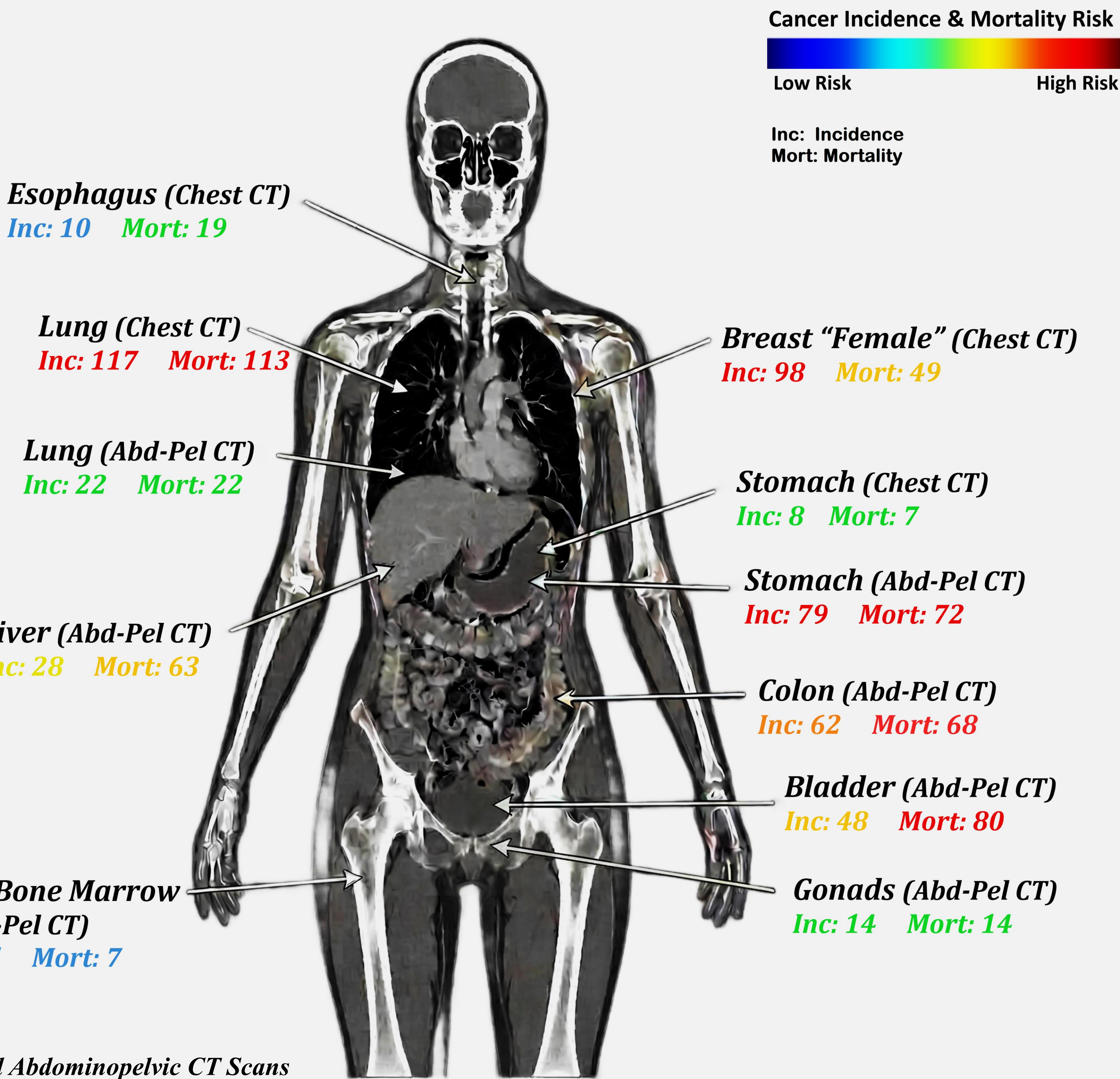


Figure 1. Organ-Specific Cancer Incidence and Mortality Risks Associated with Chest and Abdominopelvic CT Scans