

Supplementary Online Content

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eFigure 1. Distribution of radiation doses to the (A) brain, (B) red bone marrow, (C) thyroid, (D) breast, (E) lungs, and (F) colon wall by age at exam and anatomic area imaged by computed tomography (CT).

eFigure 2. Projected number of future radiation-induced cancers that could be related to one year of imaging with the most commonly performed pediatric computed tomography (CT) exams in the US, assuming doses parallel those we observed in clinical practice.

This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix

Methods for Estimating Radiation Dose from CT

From each CT examination, we abstracted scan length, slice thickness, kilovolt peak (kVp), milliamperere (mA) or mA seconds (mAs), rotation time, pitch, and CT manufacturer and model. We used a combination of manual abstraction from stored CT images and a computer program that extracts parameters from the Digital Imaging and Communications in Medicine (DICOM) tags stored in files in the picture archiving and communication system (PACs). We estimated organ doses using a newly developed method based on skeleton dosimetry²⁸ that uses improved gender- and age-specific computational anatomy phantoms called hybrid phantoms.^{29,30} The phantoms represent the gender-specific 50th percentile body size for newborns and children at ages 1, 5, 10, and 15.³⁰ Organ doses were estimated from a pre-calculated dose matrix covering the whole body with a series of continuous 1-cm thick axial slices. The organ dose matrix was calculated from the hybrid phantom series using Monte Carlo methods that have been experimentally verified using simulations of a Siemens SOMATOM sensation 16 scanner.³¹ The calculations accounted for the radiation output characteristics of the CT manufacturer/models used for each examination. We calculated effective dose by summing organ doses weighted by the tissue-weighting factors provided in the International Commission on Radiological Protection (ICRP) Publication 103.³²

eTable1. Reason for pediatric abdomen/pelvis computed tomography exams, among those with available information (N=149).

Indication	N	Percent
Pain	59	40%
Appendicitis	17	11%
Suspected cancer	17	11%
Cancer surveillance/staging	13	9%
Renal	11	7%
Infection	10	7%
Gastrointestinal symptoms	6	4%
Congenital/developmental issues	4	3%
Follow-up from other Imaging	4	3%
Trauma	5	3%
Other	3	2%

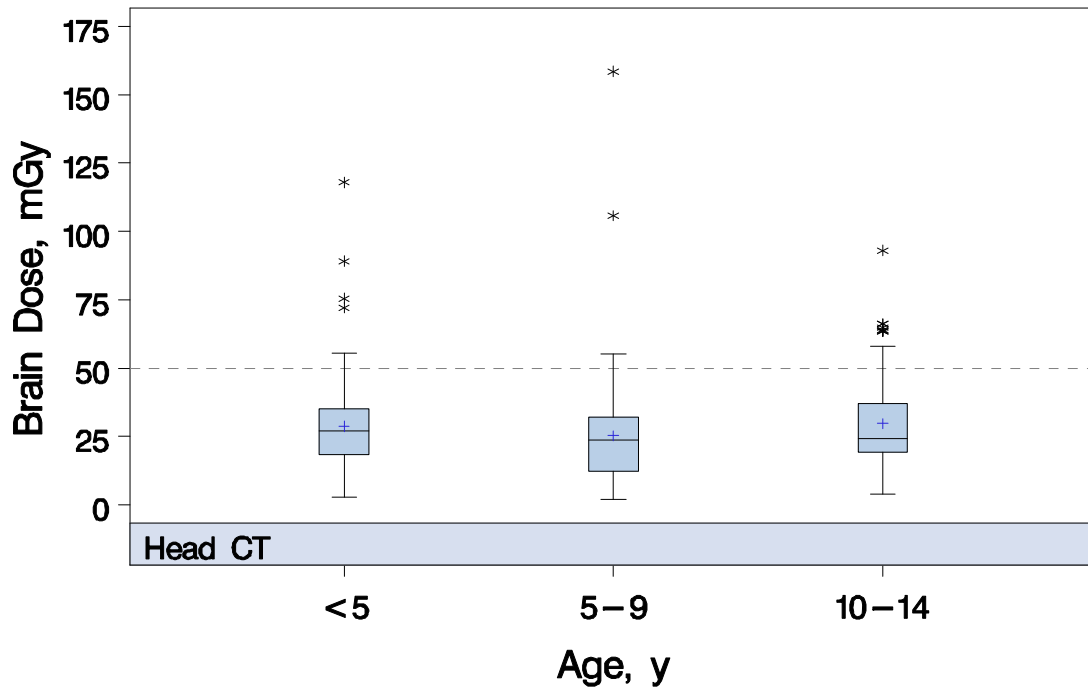
eTable2. Reason for pediatric head computed tomography exams, among those with available information (N=149).

Indication	N	Percent
Trauma	54	23%
Upper respiratory issues*	52	22%
Headache	40	17%
Cancer surveillance/staging	22	9%
Infection	10	4%
Seizure	11	5%
Congenital, developmental	9	4%
Suspected bleeding, follow-up bleeding	7	3%
Suspected stroke	6	3%
Follow up from other Imaging	3	1%
Suspected cancer	3	1%
Syncope, vertigo, dizziness	2	1%
Confusion, altered mental state	2	1%
Other	16	7%

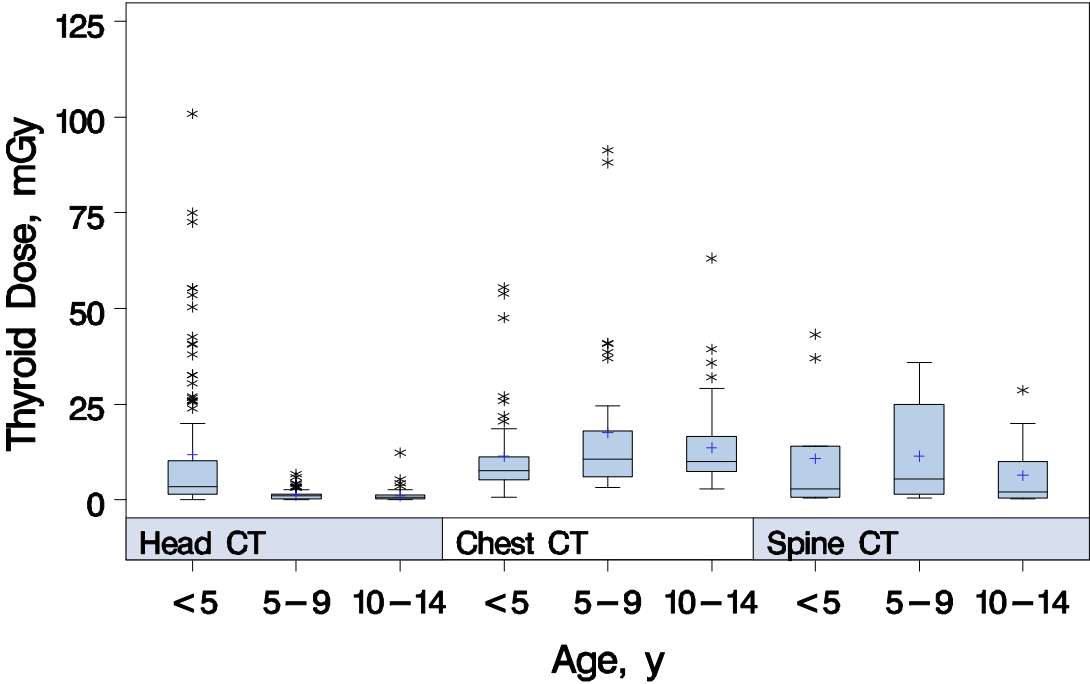
* Upper respiratory issues includes upper respiratory infections, sinusitis, congestion, and ear symptoms

eFigure 1. Distribution of radiation doses to the (A) brain, (B) red bone marrow, (C) thyroid, (D) breast, (E) lungs, and (F) colon wall by age at exam and anatomic area imaged by computed tomography (CT).

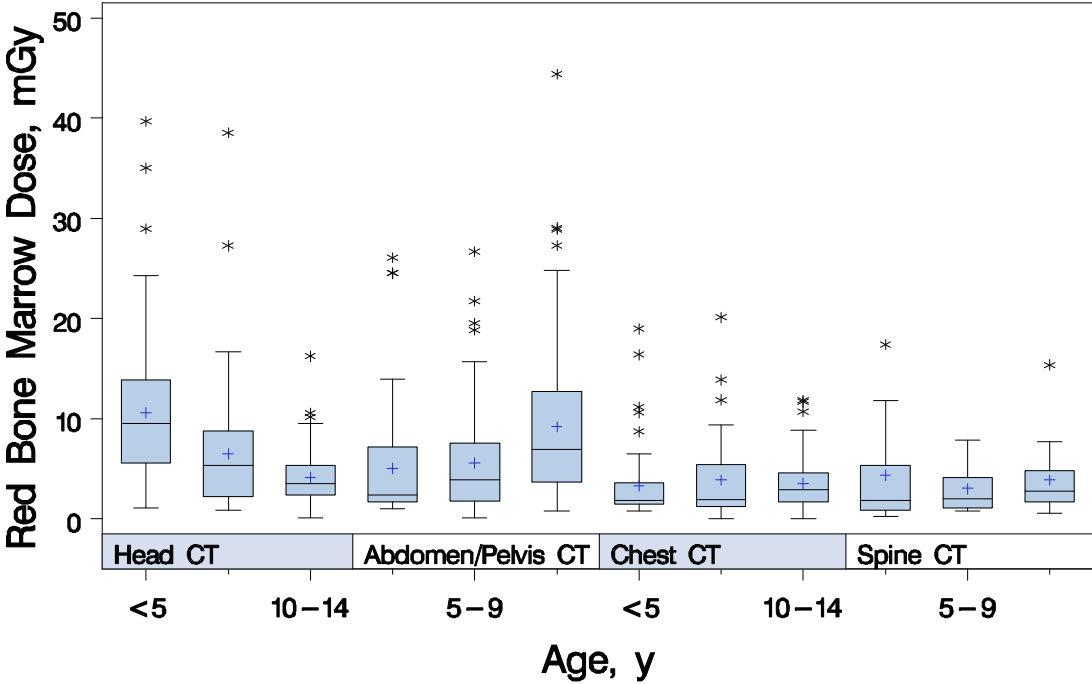
(A) Brain Dose



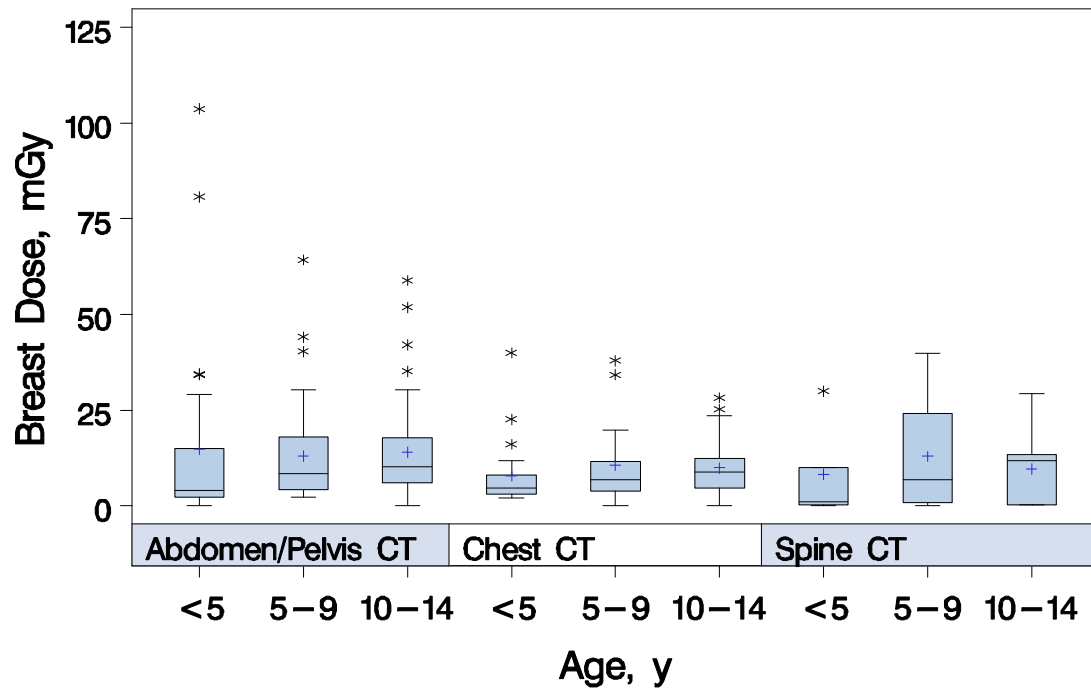
(B) Thyroid Dose



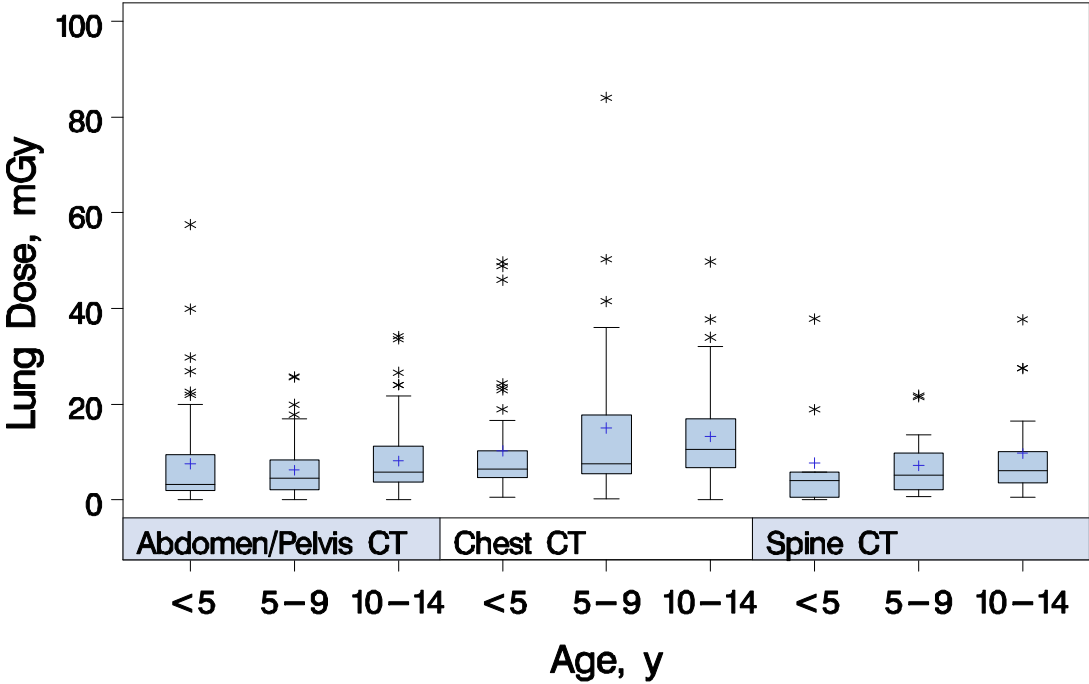
(C) Red Bone Marrow Dose



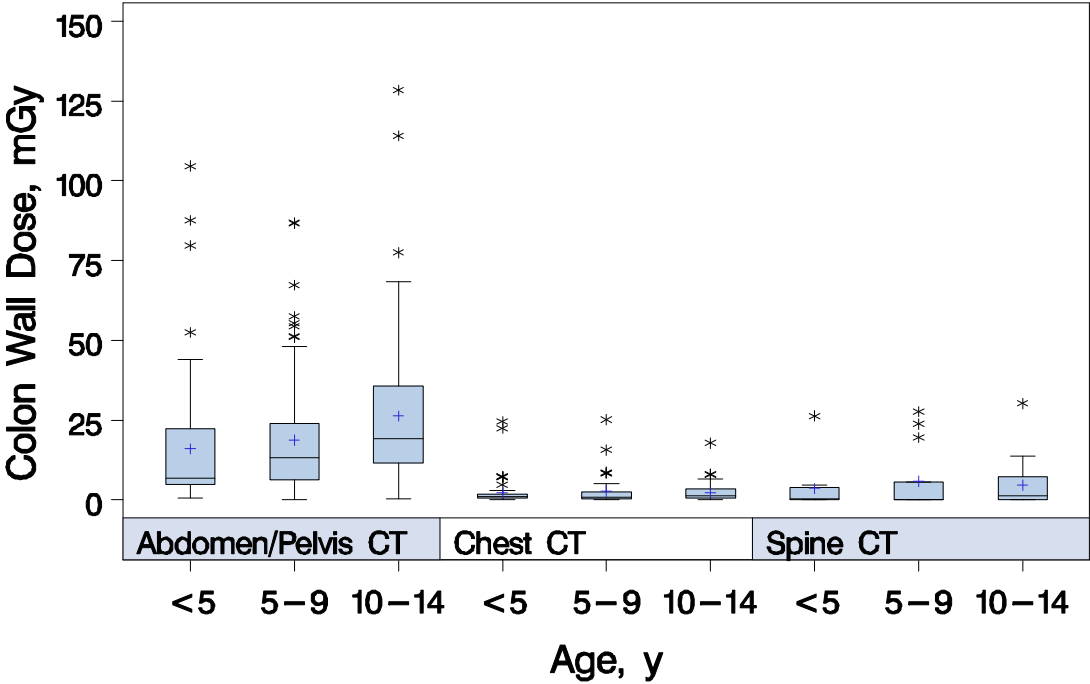
(D) Breast Dose



(E) Lung Dose



(F) Colon Wall Dose



eFigure 2. Projected number of future radiation-induced cancers that could be related to one year of imaging with the most commonly performed pediatric computed tomography (CT) exams in the US, assuming doses parallel those we observed in clinical practice. Error bars indicate 95% uncertainty limits estimated from the coefficients of variation for cancers included in Table 12-10 of the BEIR-VII report (only available for breast, lung, stomach, liver, colon, bladder, ovary, and leukemia).¹⁰

