

When innovation hurts: Increasing radiation doses from modern CT scanners in obese and overweight patients

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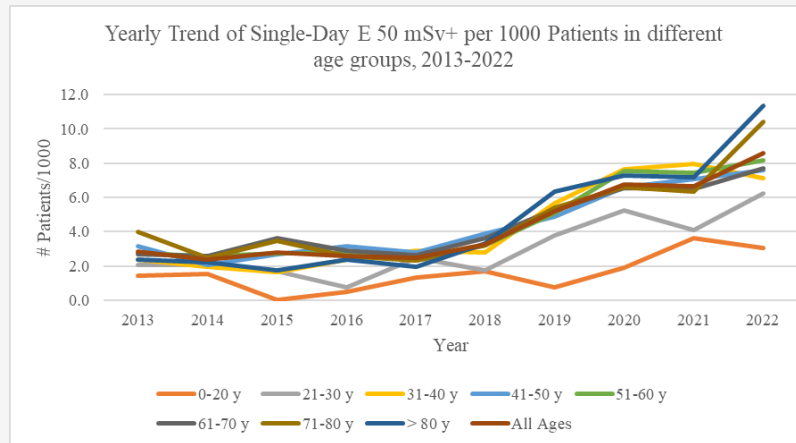
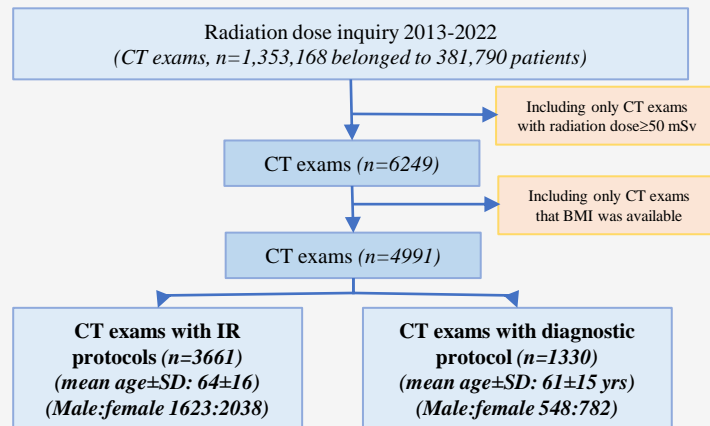
Goal

To assess the frequency and variations in the number of CT exams with individual exam effective dose ≥ 50 mSv over a 10-year period.

Method

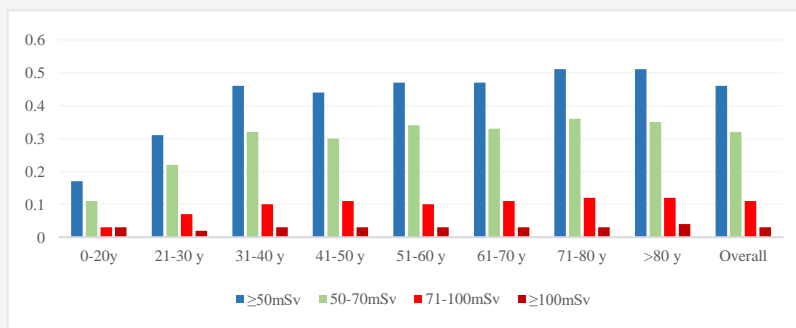
Data stratification:

- Into diagnostic and interventional CTs → To assess yearly trends in volume of each exam type
- Diagnostic CTs stratified by scanned body regions, protocol types, BMI categories, scanner vendor, and scanner names
- Interventional CTs stratified by procedure names
- Dose bands: 50-70 mSv, 71-100 mSv, and 100+ mSv
- Age bands: 0-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, and >80 years
- BMI: underweight <18.5 kg/m²; healthy weight 18.5-24.9 kg/m²; overweight 25-29.9 kg/m²; obesity >30 kg/m²



Line graph shows yearly trend of ≥ 50 mSv per 1000 patients in stratified age groups. There was a statistically significant increase ($p < 0.04$) in patients with ≥ 50 mSv from single CT exam between 2013-2022 for every age group. Compared to a shallow increase in the 0-30 years groups, the other age groups showed a similarly steep upwards trend from 2018.

Results



The percentage of CT exams with high dose, stratified for each age group.

Protocol	E ≥ 50 mSv		BMI Mean \pm SD	E ≥ 100 mSv		BMI Mean \pm SD
	Percentage	Median (IQ1-IQ3)		Percentage	Median (IQ1-IQ3)	
Coronary CTA	22.51% (824/3661)	66 mSv (57-80)	32 \pm 78	48.52% (82/169)	110 mSv (105-127)	34 \pm 19
CTA Aorta	50.94% (1865/3661)	59 mSv (54-71)	33 \pm 10	27.81% (47/169)	108 mSv (105-117)	38 \pm 15
CTA head/neck	8.99% (329/3661)	60 mSv (54-71)	32 \pm 13	12.43% (21/169)	109 mSv (106-118)	33 \pm 102
Spinal CT	3.03% (111/3661)	58 mSv (54-66)	37 \pm 12	3.55% (6/169)	127 mSv (113-163)	32 \pm 35
Abdomen pelvis CT	3.77% (138/3661)	56 mSv (52-64)	48 \pm 29	1.18% (2/169)	129 mSv (121-137)	43 \pm 23
Chest abdomen pelvis CT	2.68% (98/3661)	56 mSv (52-64)	39 \pm 12	0.59% (1/169)	121 mSv (121-121)	45 \pm 0

Data for 5 top CT exam diagnostic protocols associated with high dose (50 mSv+ and 100 mSv+)

Protocol	E ≥ 50 mSv		BMI Mean \pm SD	E ≥ 100 mSv		BMI Mean \pm SD
	Percentage	Median (IQ1-IQ3)		Percentage	Median (IQ1-IQ3)	
GI biopsy	90% (1191/1325)	65 mSv (56-82)	28 \pm 9	94% (163/173)	128 mSv (113-149)	27 \pm 6
Lung biopsy	4% (59/1325)	62 mSv (57-72)	29 \pm 7	2% (4/173)	123 mSv (113-131)	36 \pm 10
Spine myelogram	3% (45/1325)	60 mSv (56-67)	32 \pm 6	3% (5/173)	113 mSv (111-132)	37 \pm 9
Spine with hardware myelogram	2% (25/1325)	59 mSv (54-71)	27 \pm 6	1% (1/173)	126 mSv (126-126)	NA
IR ablation	1% (5/1325)	57 mSv (57-62)	47 \pm 6	0	0 (0-0)	0 \pm 0

Data for 5 top CT exam IR protocols associated with high dose (50 mSv+ and 100 mSv+)

Conclusions

- ✓ An exponential increase in proportion of CT exams with >50 mSv dose in recent years likely stemming from use of more powerful CT scanners and a lack of user-prescribed limit on scan phases, CTDIvol and DLP.
- ✓ Automation and innovations in CT technology requires careful setting of radiation dose limits, particularly for overweight and obese patients, to avoid unnecessary increase in radiation doses.