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### Picture Perfect: Pediatric CT Utilization in Trauma

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# Picture Perfect Pediatric CT Utilization in Trauma

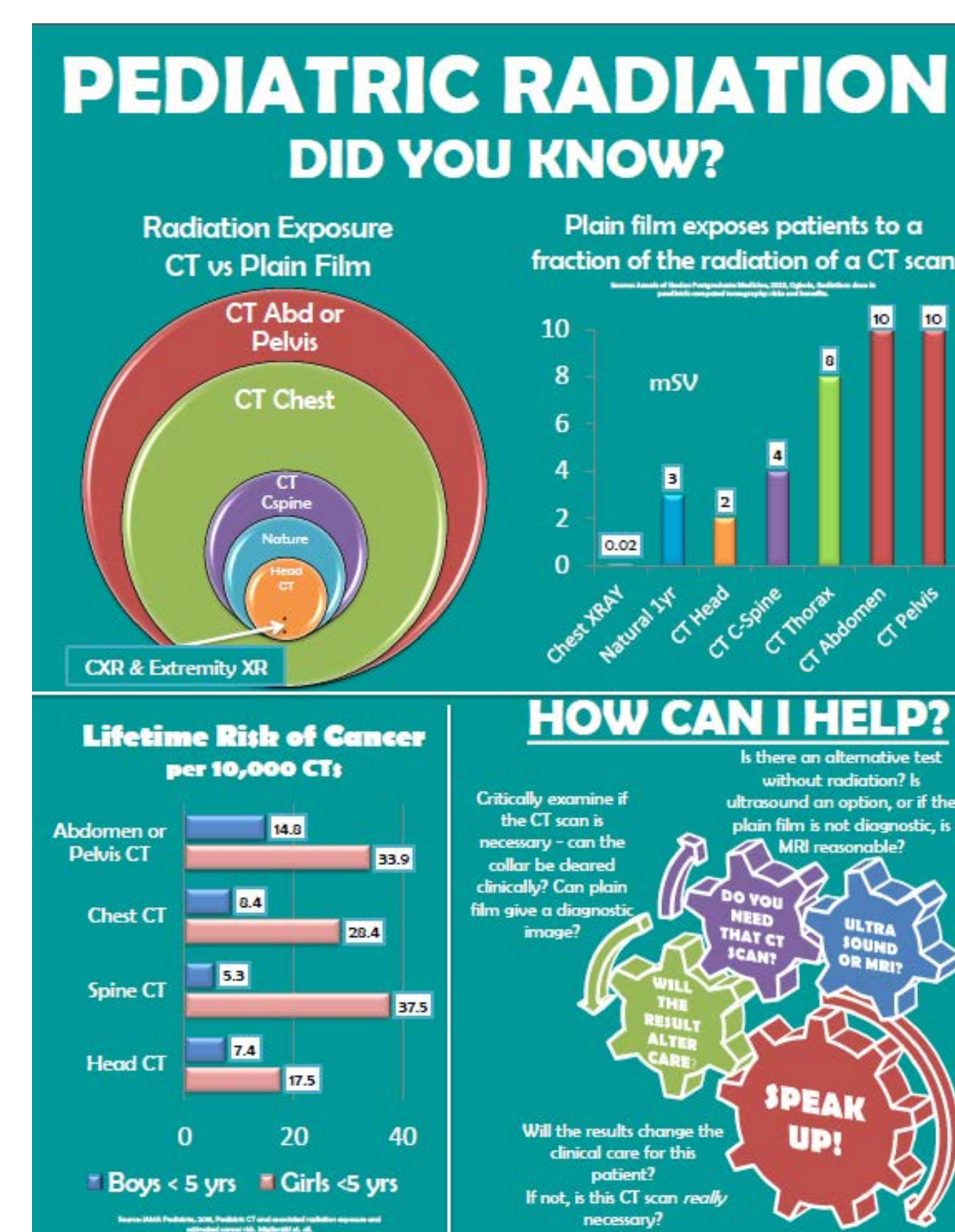
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## Introduction

- Radiation exposure poses a greater risk to children compared to adults. Children have a greater life expectancy than adult or geriatric patients, extending the amount of time potential cancer has to develop. Further, the body and organ size is much smaller, yet receives a similar dose of radiation when used as a diagnostic tool. The risk for developing radiation-related cancer can be higher for children exposed to diagnostic radiation than the risk for adults. Radiation exposure is quite common in trauma.

## Background

- Following an ACS consultative site visit for Level II Pediatric standards, a weakness was identified regarding over-utilization of computed tomography (CT) scans on pediatric trauma patients (defined as age <15). A multidisciplinary radiation reduction plan was devised. Cervical spine and thorax CT scans were named primary targets.



## Methods

Quality change:

- The radiology medical director and trauma liaison presented evidence in support of decreased CT utilization in the pediatric trauma population at the monthly trauma quality meeting, in conjunction with three pediatric case reviews of possible overutilization. The radiologist critiqued all three cases. Intense discussion sparked and the decision was made to perform this review at every pediatric trauma quality meeting (Radiation Roundup).

Pediatric Radiation Roundup July

DOS	Age	Trans In	ISS	Mechanism	Injuries/ Add'l Notes	CT Scans Performed
[Redacted]	N	34	Pedestrian vs Auto	Severe multitrauma/ Peer reviewed	CT head x6, c-spine, chest, abdomen, face, repeat CAP	
[Redacted]	N	5	Jetski vs Boat	Abrasion, contusions, concussion/ Suspect high speed	CT head, c-spine	
[Redacted]	N	2	Jetski vs Boat	Abrasion, contusions, concussion/ Suspect high speed	CT head, c-spine	

Operational change:

- CT c-spine and thorax were removed from the initial resuscitation order form so that these scans must be intentionally written-in
- Pediatric emergency medicine physicians were incorporated into response to pediatric trauma alerts to allow for board certified, pediatric specific input while deciding on CT scans

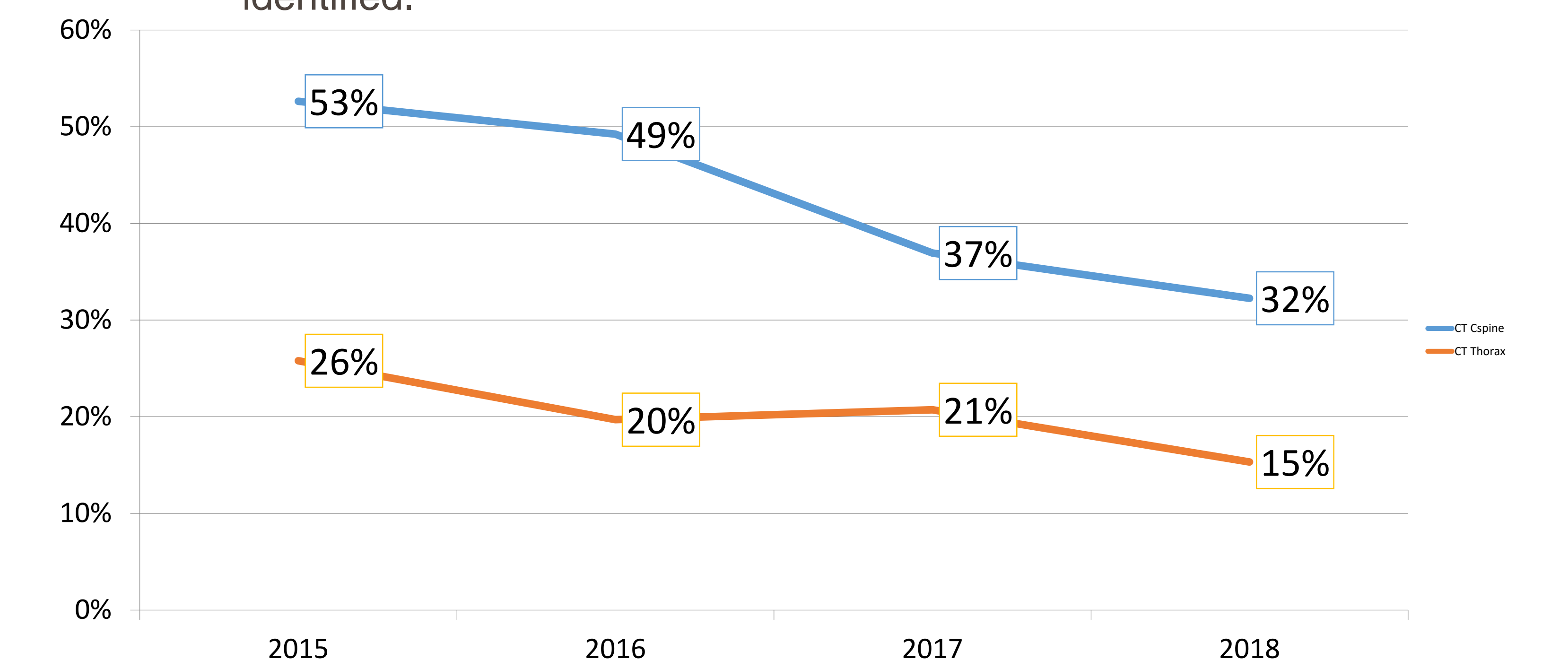
Education change:

- Trauma and radiology created an educational flyer, posted in the trauma resuscitation bays, pediatric ED area, triage, CT scan control rooms, physician lounge, resident lounge and PICU.
- Pediatric trauma imaging algorithms, including PECARN for mild TBI and the Trauma Association of Canada pediatric c-spine clearance and imaging recommendations were changed in every trauma bay.
- The "departure to CT" checklist was modified, and a pediatric version was created to include consideration of risk vs. benefits for diagnostic radiation in pediatric patients.

Study	Average Radiation Dose	Indications	Alternative or Adjunctive studies
CT Head	2 mSv or 100 CXRs	AMS, GCS <5, LOC, not acting normally Pulsatile skull or 2/3 basilar skull fx, non-frontal hematomas Vomiting, severe headache, or severe mechanism	Observation MRI brain
CT Face	4 mSv or 200 CXRs	Evidence of facial fracture on exam, severe pain or soft tissue swelling severe enough to limit exam Flattening of the nasal dorsum Limited extraocular mobility or decreased visual acuity Deformity, crepitus, step-off on facial bone palpation	Plain film may be used to screen but not diagnostic Isolated jaw: panoramic plain film
CT C-Spine	6 mSv or 300 CXRs	Unable to clinically clear collar (NEXUS + Flex/extension and rotate 45 degrees without pain) Unstable clinical exam Abnormal neurologic exam	AP/ lateral/Obtoid Xray MRI C-spine
CT Thorax	7 mSv or 350 CXRs	Suspected tracheobronchial injury Suspected aortic injury (mechanism, exam or CXR findings) or great vessel injury Abnormal respiration or lung sounds Tenderness on chest wall palpation Abnormal chest Xray	Chest xray FAST ECMO for BCI
CT Abdom/Pelvis	10 mSv or 500 CXRs	Visible abdomen trauma or seatbelt signs, GCS <14, abd tenderness, thoracic wall trauma, 2/3 abd pain, decreased breath sounds or crepitus Suspect of intubation or painful distracting injury	FAST Formal abd ultrasound Labs: LFTs, UA, urine

## Results

- In calendar year 2015, 53% of pediatric trauma patients received a CT of the cervical spine, dropping to 37% in 2017, and in 2018 only 32% of pediatric trauma patients received a CT of the cervical spine. CT thorax utilization in 2015 was 26%, dropping to 21% in 2017 and further to 15% in 2018.
- Further measurement involves comparison of injury severity score (ISS) before the initiative, and after. In 2017, prior to the initiative, the average ISS of a pediatric trauma patient receiving a CT c-spine was 4.8. 72% of those cases had an ISS < 9. Calendar year 2018, the average ISS is 7.6, with 57% cases with an ISS < 9 receiving a CT c-spine. In 2017, of patients who received a CT thorax, 45% sustained an ISS < 9. In 2018, only 30% of patients who sustained an ISS < 9 underwent CT thorax. Also importantly, zero missed injuries have been identified.



## Conclusion

- Pediatric radiation exposure is a critical element for trauma programs that treat children, regardless of verification level, to routinely evaluate and can be significantly impacted in a short period of time.

