

**First imaging modality in  
childhood appendicitis:  
Does the presence of a dedicated pediatric  
emergency physician effect modality  
choice?**



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# Background

- Appendectomy: most common surgery in children in the United States  
76,228 appendectomies/year in children in the United States<sup>1</sup>
- 48% of children with a final diagnosis of appendicitis undergo  
computed tomography (CT) or sonography(US) during their admission<sup>2</sup>
- American College of Radiology (ACR) recommendation (2011)<sup>3</sup>:
  - > *“In children, ultrasound is the preferred initial examination, as it is nearly as accurate as CT for the diagnosis of appendicitis without exposure to ionizing radiation.”*
  - > Reserve CT/MRI for patients where sonographic findings are equivocal

# Purpose

- To compare adherence to the ACR “ultrasound-first” guideline in children with acute appendicitis presenting to emergency rooms with and without a dedicated pediatric emergency room physician (PEP).
- To compare temporal trends in the first imaging modality used in emergency rooms with and without a PEP.

# Methods

- Retrospective study (Jan 1, 2004 - Dec 31, 2015)
- Institutional Review Board approved
- HIPPA compliant
- Multicenter institution
  - > 1 ER with PEP(PEPER)
  - > 3 ER's without PEP(non-PEPER)

# Methods

- Hospital's integrated radiology information service search
- Patients  $\leq 18$  years old with primary discharge diagnosis of acute appendicitis during study period
- Identify first imaging modality *ordered* in each emergency room (CT or US)
- Correlate study modality with
  - > Presence or absence of a PEP
  - > Patient age
  - > Patient gender
- Descriptive statistics (averages, medians, range, standard deviation, and odds ratio calculated)

# Results:

Distribution of patients and type of study ordered as a function of ER type

	Male:Female <sup>*</sup>	US Studies	CT Studies	# of Patients
PEPER	167:126	133 (45.4%)	160 (54.6%)	293 (100%)
Non-PEPER	60:54	17 (14.9%)	97 (85.1%)	114 (100%)
Total	227:180	150	257	407

\*No significant difference in choice of first imaging modality was found based on gender

# Results: Patient age

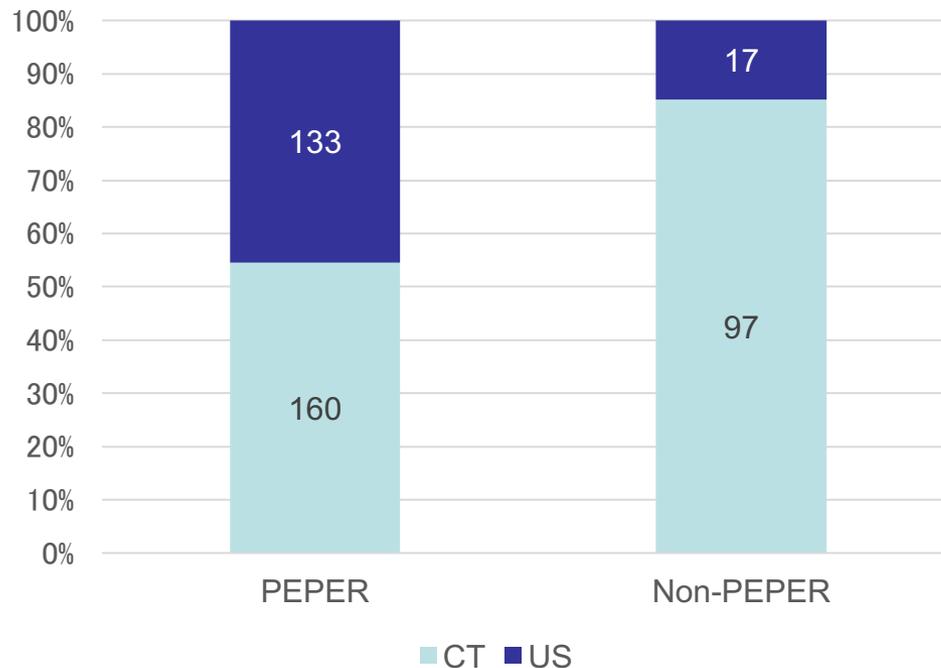
- Mean age of all patients **12.7y**  
(range 2-18y, median 13y)
- Mean age patients presenting to PEPER **10.9y**  
(range 2-18y, median 12y)
- Mean age patients presenting to non-PEPER **14.6y**  
(range 7-18y, median 16y)

# Results: Imaging modality and patient age

- Mean age US as first diagnostic modality, all patients: 9.8 y  
(range 2-18 y, median 11 y)
  - Mean age CT as first diagnostic modality, all patients: 13.2 y  
(range 3-18 y, median 15 y)
- (p < 0.0001)
- Mean age **US** or **CT** as first diagnostic modality did not significantly differ between PEPER and nonPEPER
  - Younger patients ( $\leq 11$  y) are more likely to undergo US as the first imaging modality for suspected acute appendicitis regardless of ER type (PEPER ( $p < 1.0 \times 10^{-5}$ ) ; non-PEPER ( $p < 0.03$ ))

# Results: Imaging modality by ER type

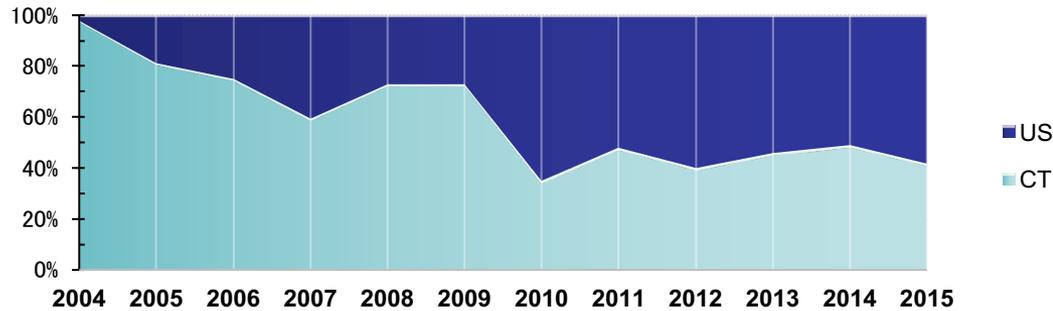
First Imaging Modality by ER type



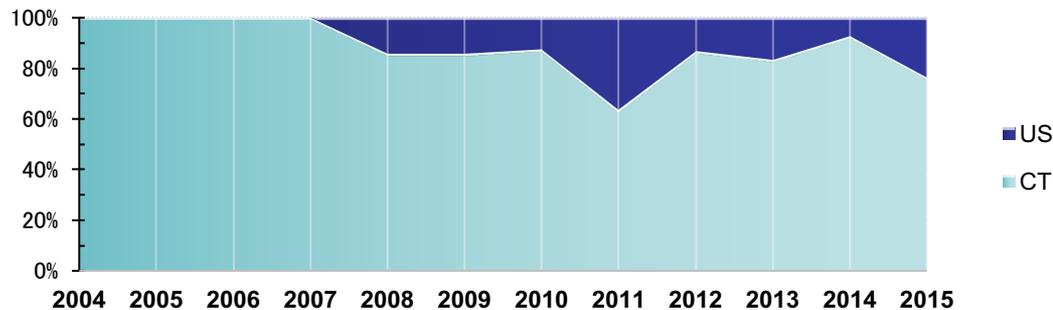
Patients presenting to a PEPER were 4.7 times [95% CI 2.7-8.3] more likely to undergo US as the initial imaging modality ( $p < 1.0 \times 10^{-8}$ ) than patients presenting to non-PEPERs

# Results – Trends (2004-2015)

First Modality in PEPER



First Modality in non-PEPER



- PEPER

Decrease in CT as first imaging modality in pediatric acute appendicitis from 98% to 42%

- non-PEPERs

Decrease in CT as first imaging modality in pediatric acute appendicitis from 100% to 76%

2011 ACR guidelines

# Discussion

- Differences between choice of imaging modality in PEPER and non-PEPER exist
- Children presenting to a PEPER are almost 5 times as likely to receive an US as the first imaging modality than those presenting to non-PEPERs.
- However, in both PEPER and non-PEPER young patients are more likely to receive an US as first imaging modality.
- Greater reduction in CT scans as the first imaging modality in children presenting to PEPER compared to the non-PEPERs between 2004-2015

# Discussion

- PEPs may be more up to date on radiation safety guidelines in children.
- Non-PEPs may be more prone to managing children in the same manner as adults; ACR recommends CT as first imaging modality in adults for appendicitis
- PEPERs often affiliated with Children's Hospital; after hours US availability and US technologists' experience/expertise with children may differ in PEP vs non-PEPER.
- On site pediatric surgeon at PEPER may be more accepting of diagnosis of acute appendicitis based on US exam.

# Conclusions

- Increased educational efforts on dose reduction in children should be directed to ERs without dedicated pediatric ER physicians
- The trend towards the increased use of MRI in children with appendicitis will likely alter ordering patterns.

# References

1. Kids' Inpatient Database (KID) 2012: Agency for Healthcare Research and Quality; 2012.
2. Bachur RG, Hennelly K, Callahan MJ, Monuteaux MC. Advanced radiologic imaging for pediatric appendicitis, 2005-2009: trends and outcomes. *J Pediatr* 2012;160:1034-8.
3. Rosen MP, Ding A, Blake MA, et al. ACR Appropriateness Criteria(R) right lower quadrant pain--suspected appendicitis. *J Am Coll Radiol* 2011;8:749-55.