Who needs 24/7 coverage in paediatric radiology

- Children!
  ...and parents...

- New-borns

- Physicians
  - GP and paediatricians
  - Emergency units
  - Units within Hospitals (ICU and others)

- Law, regulations...
  and Lawyers!

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Everyone wants everything

Now!

What could be the answers
Why 24/7…?
Time/day of arrivals in a paediatric Emergency Room

CHU Brest France

Among the week
Epidemiology in Emergency Room
Age and pathologies

- Trauma 39%
  - + Head trauma 3%
- Fever 21%
- Digestive tract 11%
- Respiratory symptoms 7%
- ENT pathologies 3%
- Psychiatric diseases 1%

CHU Brest, France

<table>
<thead>
<tr>
<th>Age</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 month</td>
<td>0.5</td>
</tr>
<tr>
<td>1 month – 1 year</td>
<td>11</td>
</tr>
<tr>
<td>1 to 2 years</td>
<td>10</td>
</tr>
<tr>
<td>2 to 6 years</td>
<td>29</td>
</tr>
<tr>
<td>&gt; 6 years</td>
<td>49</td>
</tr>
</tbody>
</table>

Top 10 associated categories of ICD-9 codes

- Trauma and injuries 69 658 32
- Rheumatologic/musculoskeletal symptoms 46 255 22
- Pulmonary symptoms 23 461 11
- Unspecified symptoms 17 198 8
- Congenital/perinatal 14 768 7
- Gastrointestinal symptoms 11 925 6
- Genitourinary symptoms 10 423 5
- Neoplasms 4 442 2
- Neurologic symptoms 3 196 1
- Cardiovascular symptoms 3 236 2


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Evolution of patients in the paediatric ER

French Court of Audit: total patients in emergency unit in France, 2014

The Evolving Role of Emergency Departments in the United States. RAND Corporation, 2013
Evolution of number of patients in the paediatric ER

CHU Bordeaux, France

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Evolution of number of patients

• Selected reasons for most recent emergency room visit among children aged 0–17 years
  - Doctor's office not open 80%
  - Problem too serious for doctor's office 55%
  - Emergency room is closest provider 30%

• But also:
  - More people without insurance coverage
  - More people without medical knowledge
### Need for imaging studies for ER patients

Which exam for what?

<table>
<thead>
<tr>
<th>Type of Condition</th>
<th>Imaging Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeletal trauma</td>
<td>Plain X rays</td>
</tr>
<tr>
<td>Polytrauma, head trauma</td>
<td>CT</td>
</tr>
<tr>
<td>Neurologic symptoms</td>
<td>CT, MRI</td>
</tr>
<tr>
<td>Acute abdomen</td>
<td>US</td>
</tr>
<tr>
<td>Thorax</td>
<td>Plain X rays</td>
</tr>
</tbody>
</table>

- **Plain x rays**: 56%
- **Sonography**: ≈ 1%
- **CT**: < 1%

*CHU Brest, France*

*IPR 2016 - Chicago*
Frequency of paediatric medical imaging examinations


Portelli JL. Frequency of paediatric medical imaging examinations performed at a European teaching hospital over a 7-year period. Eur Radiol. 2016. In press
Specific trends for paediatric imaging

- plain X-rays: slight decrease
- Sonography: increase
- CT: stability???
- MR: increase, mainly in neurological presentation (stroke, encephalitis, acute cord disease)

Portelli JL. Frequency of paediatric medical imaging examinations performed at a European teaching hospital over a 7-year period. Eur Radiol. 2016. In press
Introduction  |  Emergency Room  |  Challenges  |  Propositions  |  Conclusion

Own experience in Bordeaux

• Out of hours organization (6.30 PM to 8.30 PM)
  ▪ 2 residents for emergency CT examination (adults and children)
  ▪ 1 paediatric senior radiologist on call (team of 5) for US and MRI
  ▪ Possibility to read all imaging examinations at home (VPN)
  ▪ Secondary reporting for plain X rays (next day morning)
Own experience in Bordeaux

- Out of hours Exams repartition
- US 347
  - Abdomen 258
  - Scrotum 20
  - Brain 23
  - Others 46
- Intussusception 17
- MRI 79
- Others 34
- Home reading (CT) ?
  (2015: 792 CT for paediatric ER)

Displacement to the hospital
Evolution last 5 years
+125%
Challenges - demography

- More patients...
- More imaging examinations
- What about the number of radiologists?
- What about the number of paediatric radiologists?
  - France: less than 200
  - U.S.: 3% of total, round 1000

Merewitz L, Sunshine JH. A Portrait of Pediatric Radiologists in the United States. AJR. 2006;186:12

- “35% of pediatric radiologists wanted less work, whereas no respondents in this subspecialty wanted more work”

Soni K. Who's underworked and who's overworked now? An update on radiologist shortage and surplus. AJR. 2010;194:697
Challenges - limitation of exposition to radiation

- CT
  - Polytrauma
  - Head trauma with positive NICE criteria
  - Acute abdominal pain? (appendicitis..)
  - Others..
    - US more efficient!

*Broder JS. CT utilization: the emergency department perspective. Pediatr Radiol. 2008 Nov;38 Suppl 4:S664*
Head traumas:

- “Findings suggest that CT may be over utilized among pediatric fall patients”.
- “Evidence-based guideline as well as individual provider feedback was associated with a reduction in cranial CT rates without an increase in missed significant head injuries.”
- “Future work to optimize CT utilization should focus on additional factors contributing to imaging practices and interventions”


Nigrovic LE. Quality Improvement Effort to Reduce Cranial CTs for Children With Minor Blunt Head Trauma. Pediatrics. 2015;136:e227

Appendicitis:

- “Children with inconclusive focused appendicitis ultrasound findings and a low Alvarado score are extremely unlikely to have appendicitis (NPV, 99.6%). Avoiding unnecessary CT of these patients is a safe approach to diagnosis.”
- “Among children with suspected appendicitis, the use of US imaging has increased substantially as the use of CT has declined.”
- “Higher-radiation diagnostic imaging accounts for an increasing proportion of imaging procedures among children with gastrointestinal symptoms, even though these often are not recommended for evaluation of gastrointestinal disorders.”

Blitman NM. Value of Focused Appendicitis Ultrasound and Alvarado Score in Predicting Appendicitis in Children: Can We Reduce the Use of CT? AJR. 2015;204:W707

Bachur RG. Effect of Reduction in the Use of Computed Tomography on Clinical Outcomes of Appendicitis. JAMA pediatrics. 2015;169:755

Challenge - Who should be reading plains X-rays in real time in the paediatric emergency department?

• Chest radiographs:
  - “Although the clinically significant discordant rate was relatively low, daily chest radiograph reassessment by pediatric radiologists in a joint meeting with pediatricians has an added value for patient safety, quality assurance, and mutual training.”
  - “Overall agreement for identification of consolidation on chest radiographs was good”


Williams GJ. Variability and accuracy in interpretation of consolidation on chest radiography for diagnosing pneumonia in children under 5 years of age. Pediatric pulmonology. 2013;48:1195
Challenge - Who should be reading plains X-rays in real time in the paediatric emergency department?

- Bones traumas:
  - “Interpretive errors by pediatric radiologists reviewing certain musculoskeletal radiographs are relatively infrequent. Diagnostic errors in the form of a miss or overcall occurred in 2.7% of the radiographs.”

Propositions: is there a need for paediatric radiologist on duty 24/7?

- Depending on:
  - Size of the hospital
  - Number and distribution of patients in the ER
  - Number of radiologists within the staff, to avoid
    - Deficit of radiologists during working hours
    - Leak to other practices
    - Elevated cost
    - … Inflation of “urgent requests”
Propositions: what do we need for X-rays

- Dialog between ER physicians and radiologists
- Respect of protocols: evidence-based medicine
  Justification of imaging procedures
- Radiographers able to perform common valuable paediatric imaging examinations
  Optimisation of imaging procedures
- If necessary: help with tele-radiology
- Systematic reassessment by paediatric radiologists for out of hours examinations
  - (Rate of reports in my unit: 98.9%)
Propositions: what do we need for sonography

- Real-time dialog between ER physicians and radiologists
- Respect of protocols: evidence-based medicine
  Justification of imaging procedures
- Who is able to perform the US study?
  - Only radiologist
  - Only paediatric radiologist
  - Use of US by ER physicians
  - Delegation to radiographer under radiologist responsibility
  - Remote and tele-sonography
Propositions: what do we need for sonography

• “A diagnostic strategy using clinical evaluations, routine US performed by emergency physicians, and clinical re-evaluation of patients with acute abdominal pain is appropriate to provide positive results for the diagnosis and treatment of appendicitis in remote locations”

Topin F. Diagnostic Accuracy of Emergency Physician-Performed Ultrasound for Acute Appendicitis in a Remote Location. The Journal of emergency medicine. 2016 In press
Kim C. Clinical application of real-time tele-ultrasonography in diagnosing pediatric acute appendicitis in the ED. The American journal of emergency medicine. 2015;33:1354
• “The long-term goal of this work is to enable remote ultrasound scanning through teleoperation. This parallel mechanism allows for both translation and rotation of an ultrasound probe mounted on the top plate along with force control”

Propositions: what do we need for CT and MR

• Real-time dialog between ER physicians and radiologists
• Respect of protocols: evidence-based medicine
  Justification of imaging procedures
• Radiographers able to perform common valuable paediatric imaging examinations
  Optimisation of imaging procedures
• If on-call radiologist:
  ▪ real-time acceptance of dedicated protocol
  ▪ Report with tele-radiology
  ▪ Possibility for cooperation between several centres
Interventional procedures

- Few centres are able to maintain a real effective team of interventional paediatric radiologists
- In most of cases, cooperation with adults interventional radiologists in mandatory
- Expertise in diagnosis and treatment needs dialog between ER physicians, paediatric and interventional radiologists
Discussion and conclusion

- **Observations:**
  - Increase activity for paediatric radiologists in relation with emergencies, 24/7
  - Population of paediatric radiologists remain stable
  - => need for new organization
- **Respect of justification : First rule**
- **Radiation burning has to be controlled, mainly with CT**
- **Use of sonography may be enlarged with new technologies/ procedures**
- **MR need to be available 24/7**
- **Tele-radiology is a valuable tool, permitting tele diagnosis and inter-site cooperation**