Improving Curriculum and Patient Care:

Areas of Weakness Identified through the “Emergent/Critical Care Imaging Simulation”

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What are we trying to Simulate?

ALL of the skills necessary for service as a radiologist performing Emergent and Critical Care Imaging

Skills Needed in Emergent and Critical Care Imaging

- Observational skills
- Confident Determination of Normal
- Identification of Key Findings
- Recognition of Acuity
- Communication of Results
- Initiation of Appropriate Action
- Stamina
The “Front End”

1. Create the Case Curriculum:
   - Collect Cases for Case Library
   - HIPAA Compliant case data
   - Full DICOM Image set
   - Normal and Abnormal Cases

2. Create the Simulation:
   - Balance across Body System
   - Balance across Modality
   - Publish (Web-based Delivery) to participating training programs
3. Administer the Simulation:

- PACS Workstation
- Typical Work Flow Style
- 65 Cases (all systems, all modalities)
- Normal and Abnormal Cases
- Variation in ACUITY
- 8 Hour Shift
  (Mimics true ED experience ... minus the phone calls, interruptions .....)

The “User Experience”
LEFT SCREEN: User picks a case from the workflow...

RIGHT SCREEN: View full DICOM set with image manipulation tools
LEFT SCREEN: User enters free text response ....
(no cuing)

...and selects acuity level ....
... and submits case....

Oooops ... need addendum? User can re-access case and enter an addendum
Continue through exercise by selecting a new case from workflow list.....

Varied Case content
The “Back End”

Grading
1. Score against Key
2. Indicate Error Type

Results and Analysis sent to Program Director:

1. Group Results
The “Back End”

Results and Analysis to Program Director:

2. Individual Resident Results

3. Topic areas for additional study
**Video Review of Cases**
*Feedback/education for Residents*

Emergent/Critical Care Imaging Simulation
*2011-2016*

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SIMULATION</th>
<th>PARTICIPATING INSTITUTIONS</th>
<th>TOTAL RESIDENTS</th>
<th>R LEVELS</th>
<th>AVERAGE</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>SIM 1</td>
<td>1</td>
<td>22</td>
<td>R1-12</td>
<td>62%</td>
<td>48-72%</td>
</tr>
<tr>
<td>2012</td>
<td>SIM 1</td>
<td>3</td>
<td>36</td>
<td>R1-20</td>
<td>60%</td>
<td>42-74%</td>
</tr>
<tr>
<td>2013</td>
<td>SIM 1</td>
<td>4</td>
<td>66</td>
<td>R1-25</td>
<td>60%</td>
<td>49-74%</td>
</tr>
<tr>
<td>2014</td>
<td>SIM 2</td>
<td>9</td>
<td>103</td>
<td>R1-63</td>
<td>59%</td>
<td>39-78%</td>
</tr>
<tr>
<td>2015</td>
<td>SIM 3</td>
<td>17</td>
<td>129</td>
<td>R1-95</td>
<td>59%</td>
<td>47-68%</td>
</tr>
<tr>
<td>2016</td>
<td>SIM 4</td>
<td>26</td>
<td>201</td>
<td>R1-126</td>
<td>56%</td>
<td>22-86%</td>
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</tbody>
</table>

*Note: R1-12 indicates residents in their 1st through 12th years.*
Simulation – A Self Discovery Process

- Identifies the Educational Tasks
- Identifies the Knowledge Gaps
  - Individuals
  - Programs
  - Across institutions
- Identifies Areas of Uncertainty
- Curriculum - Trains Toward Competency

Areas of Weakness Identified
Method

- **212 Residents / 16 Institutions**
  - 148/R1
  - 64/R2
- **129 Cases**
  - Normal and Abnormal
  - All Modalities
  - All Systems
  - All ages
- **Categories**
  - Body, Neuro, MSK
- **Grading**
  - Score of 0-10
  - Faculty Graders (4)
  - Predetermined key(s)

**Method**

- **Fixed Effects**
  - Modality, Category, Pt. Age, Pt. Gender, Normal/Abnormal, Acuity, Resident Training Level
- **Random Effects**
  - Grader, Resident Program, Residents ID (blinded), Case ID
- **Specific Analysis**
  - Average score
  - Score distribution (specifically score of < 3)
  - Category
  - Performance regarding Modality
  - Performance regarding Resident Training Level
Results - Summary

• 97% Grader reliability
• Lower performance on CR
  – Mean score 6.29/10, p=0.0642
• Lower category performance in Neuro
  – Mean score 5.71/10, p=0.0001
• Higher scores corresponded to increased training levels
• Specific topics identified with low scores across all institutions and training levels (Table 1)

Table 1: Eight “Gaps” Across Institutions and Training Levels

<table>
<thead>
<tr>
<th>Category</th>
<th>Topic</th>
<th>Modality</th>
<th>% scoring 0-3 pts</th>
<th>AVG SCORE</th>
<th>AVG SCORE</th>
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<tbody>
<tr>
<td>Neuro</td>
<td>Suppurative Adenitis</td>
<td>CT w</td>
<td>100%</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Hyperdense Basilar Artery</td>
<td>CT w/o</td>
<td>90%</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Otitis/Osteomyelitis</td>
<td>CR</td>
<td>90%</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Cerebellar Edema</td>
<td>CT w/o</td>
<td>85%</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Lemierre’s</td>
<td>CT w</td>
<td>71%</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Currant</td>
<td>CT w</td>
<td>71%</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>MSK</td>
<td>Lytic Lesion-pelvis (Osteoma)</td>
<td>CR</td>
<td>72%</td>
<td>18</td>
<td>40</td>
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<tr>
<td>Ped.</td>
<td>Non Accidental Trauma</td>
<td>CR</td>
<td>75%</td>
<td>17</td>
<td>25</td>
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