Diagnostic Errors in Neuroradiology, Physician Experience Level and Tumor Board Participation at a Single Tertiary Academic Center

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Introduction

- Error rates for diagnostic radiology range between 1.7-9%.\textsuperscript{1,2,11,3–10}

- When there is high prevalence of abnormalities on the radiology studies, error rates range from 12.4-50%.\textsuperscript{12–19}

- **Purpose**: explore the correlations of tumor board (TB) attendance and years of post-fellowship practice (CPY) with error rates at a single tertiary academic medical center (UC Davis).
Methods

- Retrospective study with Institutional Review Board approval.
- Searched internal Neuroradiology Quality Assurance (QA) database for errors made by attending neuroradiologists (n=11) at UC Davis from 2014 – 2020.
- All misses confirmed by two neuroradiologists and assigned a RadPeer score.
- Calculated post-fellowship years of clinical practice (CPY) and frequency of TB attendance for each radiologist.
- Specific tumor boards included: Head and Neck (H&N), Skull Base (SKB), Brain, and Pediatric Neuroradiology (PN).
Methods

- Classified errors as H&N, SKB, Brain, or PN misses.
- Correlated CPY and specific TB attendance rates with H&N, SKB, Brain, and PN misses using Spearman’s rank correlation coefficients.
- A scatter plot matrix was generated using the rank values of these variables.
## Results

Table 1. Summary Statistics of the Metrics of the Clinical Experience of Attending Neuroradiologists and Error Rate Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Median</th>
<th>Quartile Range</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain TB</td>
<td>12.27</td>
<td>11.43</td>
<td>15.00</td>
<td>18.00</td>
<td>35.00</td>
<td>0.00</td>
<td>35.00</td>
</tr>
<tr>
<td>Brain errors</td>
<td>1.28</td>
<td>0.73</td>
<td>1.27</td>
<td>1.15</td>
<td>2.42</td>
<td>0.59</td>
<td>3.02</td>
</tr>
<tr>
<td>CPY</td>
<td>13.30</td>
<td>15.91</td>
<td>6.10</td>
<td>25.40</td>
<td>43.70</td>
<td>0.30</td>
<td>44.00</td>
</tr>
<tr>
<td>H&amp;N TB attendance</td>
<td>20.82</td>
<td>23.58</td>
<td>13.00</td>
<td>35.00</td>
<td>68.00</td>
<td>0.00</td>
<td>68.00</td>
</tr>
<tr>
<td>H&amp;N errors</td>
<td>0.46</td>
<td>0.31</td>
<td>0.40</td>
<td>0.58</td>
<td>0.93</td>
<td>0.00</td>
<td>0.93</td>
</tr>
<tr>
<td>PN TB attendance</td>
<td>9.18</td>
<td>16.23</td>
<td>5.00</td>
<td>15.00</td>
<td>55.00</td>
<td>0.00</td>
<td>55.00</td>
</tr>
<tr>
<td>PN errors</td>
<td>0.52</td>
<td>0.37</td>
<td>0.50</td>
<td>0.47</td>
<td>1.37</td>
<td>0.00</td>
<td>1.37</td>
</tr>
<tr>
<td>SKB errors</td>
<td>0.43</td>
<td>0.57</td>
<td>0.24</td>
<td>0.41</td>
<td>1.92</td>
<td>0.00</td>
<td>1.92</td>
</tr>
<tr>
<td>Total errors</td>
<td>3.55</td>
<td>2.29</td>
<td>2.95</td>
<td>2.12</td>
<td>8.73</td>
<td>0.59</td>
<td>9.32</td>
</tr>
<tr>
<td>Volume Read Exams</td>
<td>16668.00</td>
<td>11892.97</td>
<td>16617.00</td>
<td>24207.00</td>
<td>32906.00</td>
<td>1078.00</td>
<td>33984.00</td>
</tr>
<tr>
<td>Total TB attendance</td>
<td>40.18</td>
<td>36.99</td>
<td>36.00</td>
<td>85.00</td>
<td>95.00</td>
<td>0.00</td>
<td>95.00</td>
</tr>
</tbody>
</table>

TB = Tumor Board; CPY = Post-fellowship years of clinical practice; H&N = Head and Neck; PN = Pediatric Neuroradiology; SKB = Skull Base; Volume Read Exams = total volume of read studies during the study period. Total, Brain, H&N, SKB, PN errors expressed as errors per 1,000 interpreted exams.
## Results

Table 2. Spearman’s Rank Correlation Coefficients of Metrics of the Clinical Experience of Attending Neuroradiologists with Error Rate Measures (with p-values)

<table>
<thead>
<tr>
<th>Variable</th>
<th>T Errors</th>
<th>H&amp;N Errors</th>
<th>SKB Errors</th>
<th>Brain Errors</th>
<th>PN Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total TB</strong></td>
<td>-0.89</td>
<td>-0.81</td>
<td>-0.66</td>
<td>-0.82</td>
<td>-0.48</td>
</tr>
<tr>
<td></td>
<td>(p=0.0002)</td>
<td>(p=0.002)</td>
<td>(p=0.03)</td>
<td>(p=0.002)</td>
<td>(p=0.13)</td>
</tr>
<tr>
<td><strong>HN TB</strong></td>
<td>-0.90</td>
<td>-0.79</td>
<td>-0.65</td>
<td>-0.79</td>
<td>-0.42</td>
</tr>
<tr>
<td></td>
<td>(p=0.0002)</td>
<td>(p=0.004)</td>
<td>(p=0.03)</td>
<td>(p=0.004)</td>
<td>(p=0.19)</td>
</tr>
<tr>
<td><strong>Brain TB</strong></td>
<td>-0.81</td>
<td>-0.79</td>
<td>-0.54</td>
<td>-0.75</td>
<td>-0.48</td>
</tr>
<tr>
<td></td>
<td>(p=0.002)</td>
<td>(p=0.004)</td>
<td>(p=0.08)</td>
<td>(p=0.008)</td>
<td>(p=0.13)</td>
</tr>
<tr>
<td><strong>PN TB</strong></td>
<td>-0.40</td>
<td>-0.46</td>
<td>-0.10</td>
<td>-0.36</td>
<td>-0.34</td>
</tr>
<tr>
<td></td>
<td>(p=0.23)</td>
<td>(p=0.15)</td>
<td>(p=0.77)</td>
<td>(p=0.28)</td>
<td>(p=0.30)</td>
</tr>
<tr>
<td><strong>CPY</strong></td>
<td>0.05</td>
<td>0.08</td>
<td>0.28</td>
<td>-0.10</td>
<td>-0.16</td>
</tr>
<tr>
<td></td>
<td>(p=0.88)</td>
<td>(p=0.82)</td>
<td>(p=0.41)</td>
<td>(p=0.77)</td>
<td>(p=0.63)</td>
</tr>
</tbody>
</table>

TB = Tumor Board; CPY = Post-fellowship years of clinical practice; H&N = Head and Neck; PN = Pediatric Neuroradiology; SKB = Skull Base; T = Total. Total, H&N, SKB, Brain, PN errors expressed as errors per 1,000 interpreted exams.

**Statistically significant correlation coefficients bolded for clarity.**
Results

Figure 1. The Scatter Plot Matrix of the Ranks of Metrics of the Clinical Experience of Attending Neuroradiologists and the Ranks of Error Rate Measures.

Footnotes:

rTotalError, rH_NError, rSKBError, rBrainError, rPNErrror, rTotal_TB, rH_N_TB, rBrain_TB, rPN_TB, rCPYyrs: rank of Total Error, HN Error, SKB Error, Brain Error, PN Error, Total TB, HN TB, Brain TB, PN TB and CPY, respectively. TB = Tumor Board; CPY= Post-fellowship years of clinical practice; H&N = Head and Neck; PN = Pediatric Neuroradiology; SKB = Skull Base. Total, Brain, H&N, SKB, PN errors expressed as errors per 1,000 interpreted exams.
Discussion/Conclusion

- Strong correlation between high overall Tumor Board participation and low yearly error rates.
- Strong correlation between high Head and Neck, Brain, and Skull Base Tumor Board participation rates and low error rates in those areas.
- Correlation between Pediatric Neuroradiology Tumor Board and Pediatric Neuroradiology error rates was not statistically significant.
- H&N TB is held once per week, Brain TB every other week, and PN TB once per month: so, lower power for Pediatric Neuroradiology TB.
- No correlation between CPY and error rates.
- Recommend increased/continued tumor board participation throughout career.
References


