Reduction in Turnaround Times for STAT Exams in Body Imaging

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Overview

- The Department of Diagnostic and Interventional Imaging at Memorial Hermann-TMC provides 24 hour coverage by staff and residents.

- Overnight efforts are concentrated on Emergency Department patients, but preliminary reports may be posted on any exam as soon as it becomes available on PACS.

- Transcribed reports, i.e. those that have been reviewed or dictated by the attending radiologists, may be available subsequently.

- Similar to other institutions, the current standard for STAT radiology exams is the availability of a finalized report within four hours of the order.
Problem Statement

- At the time of our project, turnaround times (TAT) significantly exceeded that standard.

- Exam report TAT were also highly variable, which added to the perception of exam delays.

- Extended wait times for exam results frustrate ordering physicians and prolong decisions regarding treatment plans.

- Reasons for delay and variability in finalized report availability include variable coverage during the day, exam interpretation by resident and significant overutilization of the STAT priority (~40-50% of exams), among others.
Goals

- Decrease the “order to transcribed” TAT of body imaging STAT exams (CR, CT, US) to a median of 4 hrs. and significantly decrease process variation within six months.

- Improve customer satisfaction
  - Primary customer: Ordering provider
  - Secondary customer: Patient

- Use effort as model and expand scope from body imaging CR, CT and US TAT to TAT across the entire Department.

- Institute of Medicine Aims: Timely and Efficient
Institutional goal: providing better care for the community.

- Operational Excellence
  - Provide extended coverage
  - Prioritize STAT exams
- Customer Safety
  - Rapid report time improves patient care

Business goals
- Decrease TAT to provide for more expedient, efficient and efficacious treatment, improving patient flow.
- Decrease indiscriminate STAT orders to decrease overutilization and waste.
Team Members

- Eduardo Matta, MD
- Logan Boatman, MD
- Bill Shepherd, MS
- Kathy Masters, MS, RD – Six Sigma Black Belt
- Staff and Residents in Body Imaging at Memorial Hermann-TMC
Measurements

- Baseline data was acquired for the 3-5/2010 period (Phase 1).
- Mean, median, and standard deviation of our TAT were calculated.
- Observations were plotted on control charts.
- After implementation of two interventions (Phases 2 and 3), data was also acquired and analyzed with similar metrics.
- Statistical analyses were performed to demonstrate a statistically significant improvement.
- Data was similarly acquired for a period after the withdrawal of one of the interventions (Phase 4).
Staff, technologists and residents were surveyed regarding current delays & ways to improve workflow.

*Fishbone (Ishikawa)* diagrams illustrate steps between order entry (O) and finalized report (F) & reasons for potential delays.
Among many areas of potential delays, the most straightforward area to effect change was on the reading of exams (C>T).

The steps to follow from exam completion to finalized report were traced on a process map.

*Due to the volume of STAT orders (~40-50%), reports were not routinely transcribed STAT unless the provider specifically called to request this.
Interventions

- Phase 1 (3 - 5/2010) - Baseline

- Phase 2 (6 - 8/2010) - Department-wide implementation of an evening/night shift for radiology attending physicians
  - Redistribution of Staff to cover 6PM – midnight
  - (This is in addition to 24h coverage by the ED radiologists.)

- Phase 3 (9 - 10/2010) - Prioritization of STAT Exams:
  - Resident checkout immediately following exam review
  - Sign-out Reminders
  - Redistribution of STAT exam work

- Phase 4 (10/2010 - 2/2011) - Relaxation of prioritization
Results

- At the baseline (Phase 1), < 25% of the exams were meeting the goal of having a report in the system within 4 hours of order.
  - Mean “exam complete to transcribed” TAT was 9.0 hrs (median 8.1 hrs).
  - The process was highly variable (S.D. 7.3 hrs).

- The evening shift (Phase 2) and the targeted STAT exam prioritization interventions (Phase 3), significantly decreased TAT mean, median (3.0 hrs.) and variability.

- By the end of both interventions, the percentage of STAT exams transcribed within 4 hrs of order almost doubled (~45%).

- Withdrawal of Phase 3 reminders returned the Phase 4 TAT to what had been achieved in Phase 2.
Baseline C>T TAT mean and variability was analyzed using a control chart, later expanded as new data was acquired.
## Results

**Exam “Ordered to Transcribed” Turnaround Time by Project Phase**

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Mean (hrs)</th>
<th>Median (hrs)</th>
<th>S.D. (hrs)</th>
<th>Yield*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>11.2</td>
<td>10.4</td>
<td>7.8</td>
<td>24.9%</td>
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<tr>
<td>Phase 2</td>
<td>8.1</td>
<td>5.9</td>
<td>7.0</td>
<td>39.9%</td>
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<tr>
<td>Phase 3</td>
<td>7.3</td>
<td>4.7</td>
<td>6.3</td>
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<tr>
<td>Phase 4</td>
<td>8.0</td>
<td>5.6</td>
<td>6.7</td>
<td>40.0%</td>
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</tbody>
</table>

*Percentage of STAT exams transcribed within 4 hrs of the order.

**Exam “Complete to Transcribed” Turnaround Time by Project Phase**

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Mean (hrs)</th>
<th>Median (hrs)</th>
<th>S.D. (hrs)</th>
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<tbody>
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<td>Baseline</td>
<td>9.0</td>
<td>8.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Phase 2</td>
<td>6.1</td>
<td>3.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Phase 3</td>
<td>5.3</td>
<td>2.3</td>
<td>5.8</td>
</tr>
<tr>
<td>Phase 4</td>
<td>5.9</td>
<td>3.0</td>
<td>6.2</td>
</tr>
</tbody>
</table>
Results

Initial interventions targeted night exams, but daytime TAT and variation during the day improved as well.
Bi-modal distribution present during baseline much less pronounced by Phase 3.
Conclusions: Lessons Learned

- The evening shift significantly improves STAT TAT.
  - Major undertaking: a full radiologist is removed from dayshift.
  - Does not adversely affect daytime exams at this point.

- Prioritizing STAT exam readout and checkout improves TAT.
  - More targeted approach.
  - More of a “zero-sum” process in regards to routine exams.

- The impact of this change on routine exams during the day will continue to be evaluated.
Conclusions: What Worked Well

- **Evening Shift**
  - Decreased our TAT
  - Staff radiologists more available for consultation,
  - Decreased the time to call-back for actionable findings
  - Improved clinician satisfaction.

- **Reminders:** Use of reminders in the form of text pagers twice a day had a measurable impact that, when withdrawn, reverted to its expected level.
Next Steps

- Streamlining the many steps leading to exam completion (O>C). This will require engagement of technologists, nurses, transport personnel, clerks, etc.

- New measures, such as flags, alarms or reminders on ‘overdue’ exams may help address this issue.

- Decrease STAT priority overutilization. Hopefully, the prospect of obtaining a timely STAT report may be incentive for more appropriate ordering.

- Expansion of the project to the entire Department.
New Effort

- Department-wide expansion has already started.

- Data is being analyzed in rule-based format.
  - More closely matches customer perception during working hours.
  - Which percent of exams meet our TAT criteria.
    - Routine exams ordered before noon are to be read same day.
    - Routine exams ordered after noon are to be read by noon next day.

- Radiologists not meeting goals are paged with reminders.

- Section delays are posted outside reading room areas.
## New Effort

### AUGUST 2011

<table>
<thead>
<tr>
<th>Orders</th>
<th>Column Labels</th>
<th></th>
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<th></th>
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<th>%</th>
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<tbody>
<tr>
<td>Row Labels</td>
<td></td>
<td>Delay Day</td>
<td>Delay Eve</td>
<td>Delay Night</td>
<td>OnTime</td>
<td>Grand Total</td>
<td>Ontime</td>
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<tr>
<td>EMERGENCY RADIOLOGY</td>
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<td>237</td>
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<td>5,247</td>
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<td>CHEST RADIOLOGY</td>
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<td>441</td>
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<td>3,668</td>
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<td>229</td>
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<td>2,773</td>
<td>65.42%</td>
<td>34.58%</td>
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<td>PEDI RADIOLOGY</td>
<td>68</td>
<td>101</td>
<td>157</td>
<td>2,171</td>
<td>2,497</td>
<td>86.94%</td>
<td>13.06%</td>
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<tr>
<td>BODY IMAGING</td>
<td>273</td>
<td>164</td>
<td>135</td>
<td>1,802</td>
<td>2,374</td>
<td>75.91%</td>
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<tr>
<td>VASCULAR INTERVENTION</td>
<td>38</td>
<td>11</td>
<td>8</td>
<td>303</td>
<td>360</td>
<td>84.17%</td>
<td>15.83%</td>
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<tr>
<td>NUCLEAR MEDICINE</td>
<td>56</td>
<td>25</td>
<td>1</td>
<td>91</td>
<td>173</td>
<td>52.60%</td>
<td>47.40%</td>
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<td>Grand Total</td>
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<td>1,097</td>
<td>1,243</td>
<td>13,733</td>
<td>17,092</td>
<td>80.35%</td>
<td>19.65%</td>
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### SEPTEMBER 1-15 2011

<table>
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<th>Orders</th>
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<td>OnTime</td>
<td>Grand Total</td>
<td>Ontime</td>
</tr>
<tr>
<td>EMERGENCY RADIOLOGY</td>
<td>77</td>
<td>131</td>
<td>166</td>
<td>2,331</td>
<td>2,705</td>
<td>86.17%</td>
<td>13.83%</td>
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<tr>
<td>PEDI RADIOLOGY</td>
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<td>70</td>
<td>104</td>
<td>1,167</td>
<td>1,394</td>
<td>83.72%</td>
<td>16.28%</td>
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<td>CHEST RADIOLOGY</td>
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<td>42</td>
<td>134</td>
<td>1,031</td>
<td>1,279</td>
<td>80.61%</td>
<td>19.39%</td>
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<tr>
<td>NEURORADIOLOGY</td>
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<td>180</td>
<td>150</td>
<td>754</td>
<td>1,194</td>
<td>63.15%</td>
<td>36.85%</td>
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<tr>
<td>BODY IMAGING</td>
<td>137</td>
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<td>18</td>
<td>874</td>
<td>1,057</td>
<td>82.69%</td>
<td>17.31%</td>
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<tr>
<td>VASCULAR INTERVENTION</td>
<td>20</td>
<td>13</td>
<td>5</td>
<td>120</td>
<td>158</td>
<td>75.95%</td>
<td>24.05%</td>
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<tr>
<td>NUCLEAR MEDICINE</td>
<td>25</td>
<td>10</td>
<td>38</td>
<td>73</td>
<td>52.05%</td>
<td>47.95%</td>
<td></td>
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<tr>
<td>Grand Total</td>
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<td>474</td>
<td>577</td>
<td>6,315</td>
<td>7,860</td>
<td>80.34%</td>
<td>19.66%</td>
</tr>
</tbody>
</table>

Source: RADNET
Thank you.