Workflow Analysis and Redesign for Outpatient MRI Scans Performed at an Academic Medical Center

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• There are no disclosures to report.
Purpose

- A Business Process Improvement (BPI) initiative that applied the principles of operations management to workflow analysis of outpatient MRI scans.
Steps in a BPI Initiative

- Identify the process to be improved.
- Develop the objective for the project based on the requirements of the process.
- Select the members of a cross-functional team.
- Document the current process by creating a flowchart.
- Identify disconnects in the process.
- Recommend changes.
- Establish process and sub-process measures.
- Implement the improvements.
Materials/Methods

- **Process for Improvement:** Scanner turnover time
- **Objectives:**
  - Reduce turnover time
  - Reduce patient wait times
  - Improve scanner utilization.
- **Stakeholders:**
  - Radiologic technologists
  - QI chief
  - MR physicist
  - Department chairman
- **Current Process:** Defined by breaking MRI acquisition into steps and timing them across a sample of 16 patients.
- **Disconnects:** Bottlenecks were identified.
- **Recommend Changes:** A new process workflow was defined.
- **Define Process Measures:** Resources necessary to implement the new workflow were defined, with the process measured in terms of cycle times, capacity, and economic benefit, or net present value (NPV).
Workflow Analysis and Redesign

**Existing Workflow:** Flow Time = 68 minutes

1. Patient is transported to changing Room 30:33
2. IV Placed in Holding Area for contrast patients 10:40
3. Consent Obtained in Holding Area 11:48
4. Situate Patient in MRI Scanner 11:10
5. Start MRI 1:40
6. Scan Time 44:00
7. Patient Leaves MRI Suite 2:54
8. Prep Room 3:02
9. Send Images 2:42

**Redesigned Workflow:** Flow Time = 60 minutes

1. Patient is transported to changing Room 30:33
2. Consent Obtained in Holding Area 11:48
3. Patient Music Preference 5:00
4. Situate Patient in MRI Scanner 6:10
5. Start MRI 1:40
6. Scan Time 44:00
7. Patient Leaves MRI Suite 2:54
8. Prep Room 3:02
9. Send Images 2:42

Note that the process of placing an IV has been moved out of the holding area, utilizing unused buffer time previously present in the time spent in the changing room. An additional employee (phlebotomist) is utilized to place the IV. The new buffer time is sufficient to absorb time spent on difficult IV placements. Introductions and patient music preference selection have been moved out of the main process flow into the buffer taking place in the holding area.
• IV Placement and situating the patient in the MRI scanner were identified as significant bottlenecks in the process.
  – IV placements resulted in 44 minutes of delays across 16 patients.
  – Situating the patient in the scanner involved steps that when moved outside of the main process, resulted in time savings of 5 minutes/patient.
## Effects of redesigned workflow on process measures.

<table>
<thead>
<tr>
<th>Process Measures</th>
<th>Outpatient Scans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Time</td>
<td>68:00 minutes/scan</td>
</tr>
<tr>
<td>Capacity</td>
<td>0.88 scans/hour</td>
</tr>
<tr>
<td></td>
<td>21 scans/day</td>
</tr>
<tr>
<td>Revenue/Scan (Blended Average technical + professional)</td>
<td>$750/scan</td>
</tr>
<tr>
<td>Revenue/day</td>
<td>$15,750/day</td>
</tr>
<tr>
<td>New Flow Time</td>
<td>60:00 minutes/scan</td>
</tr>
<tr>
<td>New Capacity</td>
<td>1.00/hour</td>
</tr>
<tr>
<td></td>
<td>24/day</td>
</tr>
<tr>
<td>New Revenue/day</td>
<td>$18,000/day</td>
</tr>
<tr>
<td>Additional Revenue/year</td>
<td>$821,250/year</td>
</tr>
<tr>
<td>Fixed Cost (Hire phlebotomist x 3)</td>
<td>$60,000/year</td>
</tr>
<tr>
<td>Net Revenue/Year/scanner</td>
<td>$760,250/year</td>
</tr>
<tr>
<td>NPV (5% discount value, 10 year life of project)</td>
<td>$5,870,448.98</td>
</tr>
</tbody>
</table>

*Note that calculations assume 365 operational days per year, operating 24 hours/day, and 100% capacity utilization.*
Conclusion

• The lean radiology organization should search for positive NPV projects that improve efficiency and enhance patient care. Departments seeking to increase their competitiveness in a challenging healthcare business environment should adopt an analytical approach to workflow improvement. In this case, a simple workflow analysis identified significant improvements generating additional revenue of $800,000/year per scanner, requiring minimal resources to implement.

• In the implementation phase, the process measures created within the BPI initiative will be used to monitor the success of the redefined workflow.
Questions?

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