**NO MORE WAIT AND DELAYS:**

STREAMLINE WORKFLOW TO DECREASE PATIENT TIME OF STAY FOR IMAGE-GUIDED MUSCULOSKELETAL PROCEDURES

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Tomiwa O. Osunkoya, BEng, MEM
Yvonne Y. Cheung, MD, MS

**Problem**

Providing the right care for the right patient at the right time is a new system-wide goal for patients at Dartmouth-Hitchcock Medical Center.

Patients frequently wait for appointments and are delayed in obtaining image-guided musculoskeletal (MSK) procedures.
Assemble a team
• Secretaries, Technologists, Fluoroscopy team leaders, Radiology residents, MSK Attendings, and our departmental quality engineer

Use the data driven Lean Six-Sigma (LSS)
• Structured DMAIC methodology
  • Define, Measure, Analyze, Improve, Control

The project took 6 months from start to completion

Goal
- Decrease wait times, delays, and patient length of stay within the radiology department
VOC - Voice of Customer, a six sigma tool
SIPOC – Supply Process Input Output Customer, a six sigma tool

**Define Step**

- Developed a Project Charter
  - Identified Key Stakeholders
- Using an open-ended VOC tool sent to key stakeholders, we agreed on the global aim of decreasing patients' time of stay within the department
- Detailed Process Maps and SIPOC diagrams further categorized our needs
**Project Charter**

**Project Description / Opportunity Statement**
Decrease MSK procedure cycle time in order to decrease patient time in the department.

**Business Case**
Decrease cycle time will:
1. Increase number of procedures, thereby increasing revenue.
2. Improve same day access for add-on patients and therefore increase patient satisfaction.

**Project Scope**
All fluoroscopic guided MSK procedures performed in the core fluoroscopy suite; including injection, aspiration and arthrograms.

**Goal Statement**
1. Decrease current cycle time

**Measures**
1. Door to door time for patients
2. Technologists time spent on procedure
3. Radiology Resident time spent on procedure
4. Radiology Attending time spent on procedure

**Resource Plan**
- **Project Lead:** Eric Goodman
- **Project Sponsor(s):** Jason Spaulding

**Team Members**
- Tomi Osunkoya
- Yvonne Cheung
- Paula Hebert
- Nanci Adams
- Heather LaPorte

**Timeline**
- **Start Date:** 8/15/13
- **End Date:** 3/15/14

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**Assessing the VOC**

(Select Comments)

**Resident/Attending Comments**
- Patients often positioned sitting in chair rather than on table for consent
- Technologists disappear during the procedure to get a supply they should’ve had already
- Technologists set up trays differently
- Variability in technologist knowledge/ability
- Required to write out a consent form each time

**Technologist Comments**
- Attending preferences differ, making it difficult to set up a room correctly
- Supplies are not kept in a centralized location, or regularly restocked
- Infrequently assigned to MSK procedures
MSK Rapid Improvement Project
SIPOC

**Suppliers**
- Patient
- Secretary
- Schedulers
- Radiology Technologist
- Radiology Resident
- Radiology Attending
- Orthopedics

**Inputs**
- Order
- Demographic Info
- Medications
- Physician availability

**Process**
- Register at Front Desk
- Prepare Room for patient
- Patient Brought to Room
- Consent Patient
- Position Patient
- Perform Procedure
- Give After Care instructions

**Outputs**
- Treated Patient
- Fluid for lab study

**Customers**
- Patient
- Orthopedics

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**Measure Step**

- An observation tool was created
  - Time stamps were gathered for specified intervals, reflecting the work flow for 2 weeks

- Average time intervals were calculated
# Observation Sheet (Pre-Procedure)

**Observation Sheet (Pre-Procedure)**

<table>
<thead>
<tr>
<th>Patient Arrives at front desk</th>
<th>Check-In process</th>
<th>Patient filling out contrast sheet</th>
<th>Patient changing</th>
<th>Call to Core to announce Patient Arrival</th>
</tr>
</thead>
</table>

**Does the Patient need a Contrast Questionnaire?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Was the Patient given a Contrast Questionnaire?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Patient Demographics**

<table>
<thead>
<tr>
<th>Age</th>
<th>Procedure Information</th>
<th>Fluoroscopy</th>
<th>Ultrasound</th>
</tr>
</thead>
<tbody>
<tr>
<td>M F</td>
<td>Exam Type?</td>
<td>Arthrogram</td>
<td>Aspiration</td>
</tr>
<tr>
<td></td>
<td>Injection</td>
<td>Biopsy</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inpatient</th>
<th>Outpatient</th>
<th>1 side or both?</th>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Scheduled</th>
<th>Add-On</th>
<th>Joint of Interest?</th>
<th>Hip</th>
<th>Knee</th>
<th>Shoulder</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Ambulatory</th>
<th>Non-Ambulatory</th>
<th>Other:</th>
</tr>
</thead>
</table>

**Notes:**

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# Observation Sheet (Procedural)

**Observation Sheet (Procedural)**

<table>
<thead>
<tr>
<th>Patient positioning during consent process: On Exam Table</th>
<th>In Chair</th>
<th>Pre-Furosem Exam positioning</th>
<th>Who wrote out the consent?</th>
<th>Physician</th>
<th>Tech</th>
<th>Other</th>
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<tr>
<th>Patient consent</th>
<th>Procedure Time-Out</th>
<th>Physician initiating procedure</th>
<th>Attending</th>
<th>Resident</th>
<th>Tech</th>
</tr>
</thead>
</table>

| Next shoe prep | 1st 2nd 3rd 4th yr resident | Attending | | | |
|----------------|-------------------------------|----------|| | |

<table>
<thead>
<tr>
<th>Skin prep</th>
<th>Did the physician need to request additional items for procedure?</th>
<th>Y / N</th>
<th>Racket entry site</th>
<th>If yes, what did they request?</th>
</tr>
</thead>
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<table>
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<tr>
<th>Page Attending (if applicable)</th>
<th>Did the technologist leave the room for any reason?</th>
<th>Y / N</th>
<th>Final entry site check or Attending</th>
<th>If yes, what was the reason?</th>
<th></th>
</tr>
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<table>
<thead>
<tr>
<th>Procedure</th>
<th>Procedure Attending Name</th>
<th>Goodwin</th>
<th>Graham</th>
<th>Cheung</th>
</tr>
</thead>
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**Tech sheets patient**

<table>
<thead>
<tr>
<th>Did the patient require additional imaging?</th>
<th>Y / N</th>
<th>Tech post-procedure instructions</th>
<th>If Y, where did they go next?</th>
<th>CT</th>
<th>MR</th>
<th>Angio</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Patient discharge</th>
<th>When there is delay in leaving the procedure room?</th>
<th>Y / N</th>
<th>Tech DGS works</th>
<th>If Y, why?</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Tech HIS works</th>
<th>Room cleanup</th>
<th>Who transferred the images?</th>
<th>Attending</th>
<th>Resident</th>
<th>Tech</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Notes/Debrief</th>
<th></th>
</tr>
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</table>

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From the collected data, a value-stream map was created that linked work and information flow, exposing waste and potential for improvement.

A root cause “fishbone” diagram allowed the team to pinpoint factors leading to delays and potential solutions.
**Value Stream Map**

<table>
<thead>
<tr>
<th>Cycle Time</th>
<th>Process Time</th>
</tr>
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<tbody>
<tr>
<td>Check In</td>
<td>0:03:18</td>
</tr>
<tr>
<td>Waiting Room</td>
<td>0:20:30</td>
</tr>
<tr>
<td>Tech Pre-Procedure Work</td>
<td>0:03:00</td>
</tr>
<tr>
<td>Rad Consent</td>
<td>0:04:18</td>
</tr>
<tr>
<td>Patient Positioning Procedure</td>
<td>0:04:36</td>
</tr>
<tr>
<td>Procedure</td>
<td>0:05:42</td>
</tr>
<tr>
<td>Tech Post-Procedure Work</td>
<td>0:04:36</td>
</tr>
</tbody>
</table>

**Analyze**

**PATIENT COMMUNICATION**
- Radiologist and Tech having duplicate conversations
- Incorrect forms given to patients by reception (e.g., contrast sheets)
- Lack of standardized consent

**PROCEDURAL ISSUES**
- Lacking commonly requested supplies in room
- Patient does not understand changing instructions, and is not properly undressed for the procedure
- Referring Provider orders incorrect examination or wrong side

**CLINIC COMMUNICATION**
- No standard positioning guide for techs
- Patient Mobility Issues
- Proper supplies not put on trays
- Various attending preferences

**SPACE**
- No dedicated MSK room/ no “overflow” space to accommodate add-on cases
- GI/GU Procedures run long
- Slow room turn-over

**Prolonged Patient Time in Fluoroscopy**
Using lean concepts, the team standardized workflow to decrease variation and eliminate duplicate work.

- Streamlined check-in
- Created Standardized trays
- Standardized consent forms
A “schedule board” was created

- This allowed all available technologists to see the progress of a procedure, and help in the throughput and room turnover process
- Secretaries could visualize and manage the work in multiple procedure rooms, helping to control work flow and quickly assign space for add-on requests
Technologists were rotated more frequent and regular basis through MSK procedures

- While this caused some difficulty at first, the large pool of available technologists are now comfortable assisting the radiologist in MSK procedures
- Radiologists got used to working with a wide variety of technologists
Control Step

- Continued documentation of standard practices
  - Training in new practices for secretaries, technologists, and radiologists to reduce variation
- Repeated the VOC tool and measure phase in August 2014 to document gains

Standardized Workflow
Total Patient time in System

- With standardized workflow and increased time I spend doing MSK procedures, the variation between radiologists is reduced, and I can be more confident that I am doing the right thing.
- Standardized trays make set up easy and reduces the amount of dead time between procedures.

VOC (Select Comments)

Technologists
- I can more easily assign patients to rooms and avoid delays caused by a procedure running long.
- My ability to accommodate add-ons has increased, I am turning fewer people away each day.

Secretaries
- With standardized workflow and increased time I spend doing MSK procedures, the variation between radiologists is reduced, and I can be more confident that I am doing the right thing.
- Standardized trays make set up easy and reduces the amount of dead time between procedures.
Control

- The process has been handed off to section leaders for:
  - ongoing tracking of key performance indicators
  - regular meetings with stakeholders

Conclusion

- Using a lean six-sigma methodology, we streamlined and stabilized our workflow in fluoroscopy guided MSK procedures
  - This has led to shorter time of stay and reduction of waits and delays for our patients