

# Improving Body MRI Patient Throughput

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## The Team

- Team Members
  - Eric Tamm, MD, radiologist, team leader
  - Janio Szklaruk, MD, PhD, radiologist
  - Sam Jacob, MBA, administrator
  - Leejo Puthooran, RTR, supervisor
  - Danna Stone, RN, nursing supervisor
  - Brian Stevens, Information Services
  - Cathy Modaro, Facilitator
- Sponsors
  - Dr. Marshall Hicks (Division Chief)/Dr. Joey Steele (Quality Office, Diagnostic Imaging)/Dr. Vikas Kundra (Body Imaging Section Chief)

## Aim Statement

- Increase the number of body MRI cases per day by 20% from 21 to 25 cases by September 1, 2010.

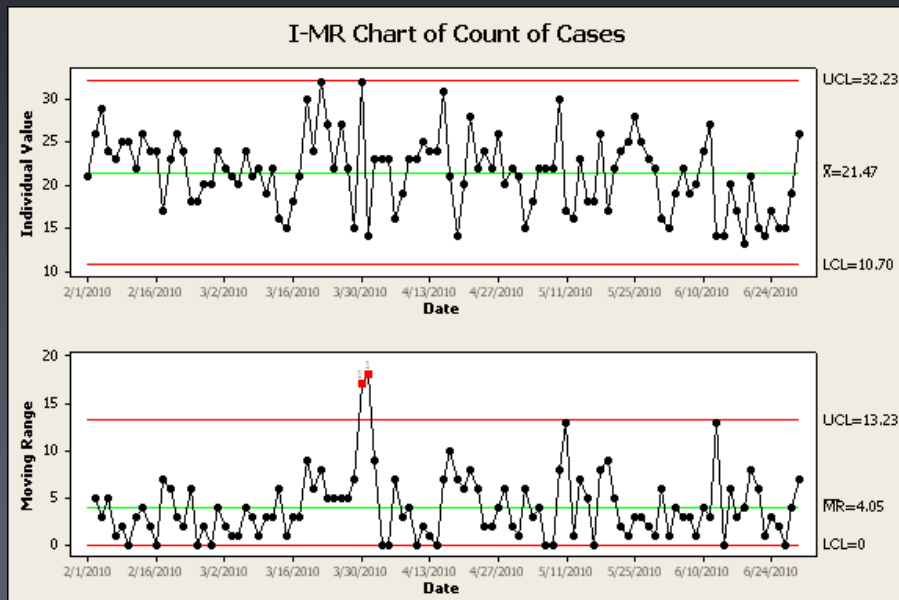
## Background

- Current Problem
  - Time Required to Schedule an MRI of the body (abdomen and/or pelvis)
    - Need to schedule sometimes up to 2 weeks in advance to find a time available to image a given patient for a body MRI study
    - Secondary to limited availability of time “slots” for scheduling cases
- History
  - 160 MRIs per day
    - Neuro, Body, MSK, Chest, Breast
  - 15% are Body MR
  - Multiple factors influence availability, particularly exam time (*to be detailed in Fishbone Diagram*)

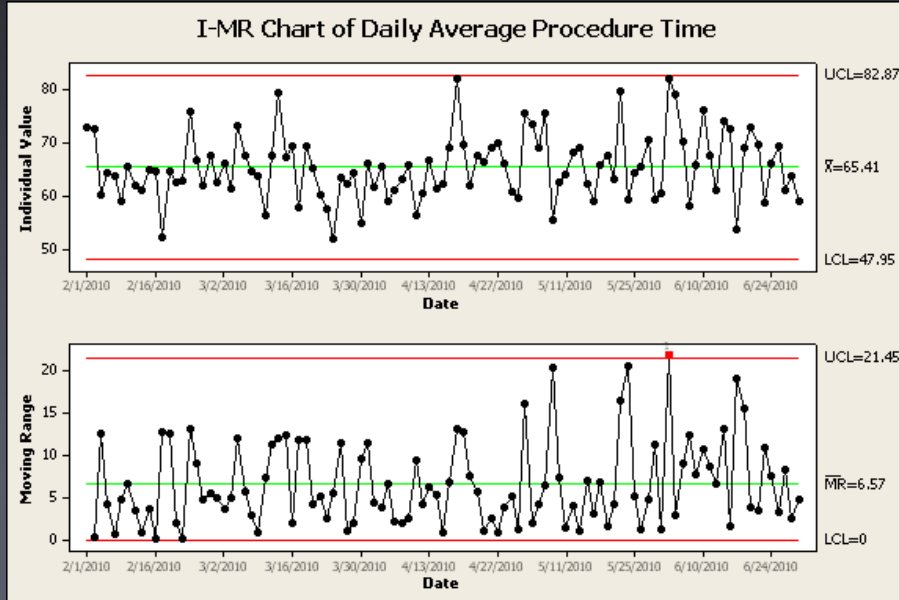
# How to Identify Change is Resulting in Improvement?

- Measurements – Sources of Data/Methodology
  - Radiology Information System (Computer-based)
    - Measure of number of patients per day
    - Measures of beginning and end of exam times (exam duration)
  - Data form/questionnaire filled out by technologists
    - Measures of room time utilization detail
    - Central tool for measuring impact of PDSA projects meant to reduce exam time, especially if cannot implement globally
  - Quality Assurance
    - Evaluation of secondary measure of scan quality by radiologists before and after change implementations

## Baseline Daily Case Volume (RIS)



## Baseline Daily Average Procedure Time (RIS)

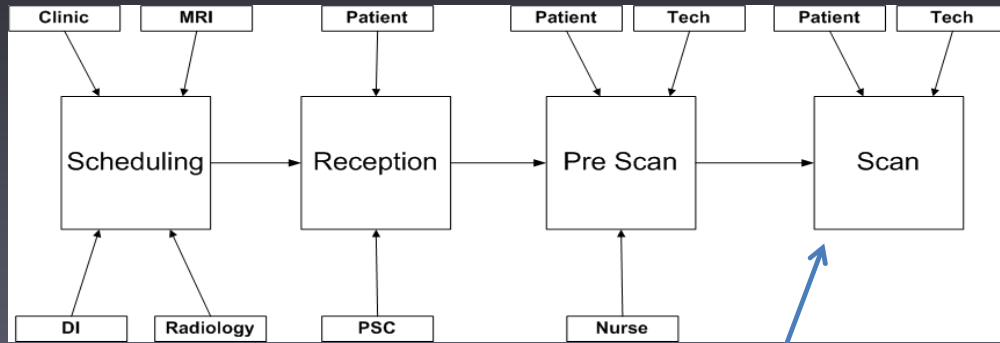


## Breakdown of Room Time From Technologists' Questionnaire

Baseline from June 22 – July 1

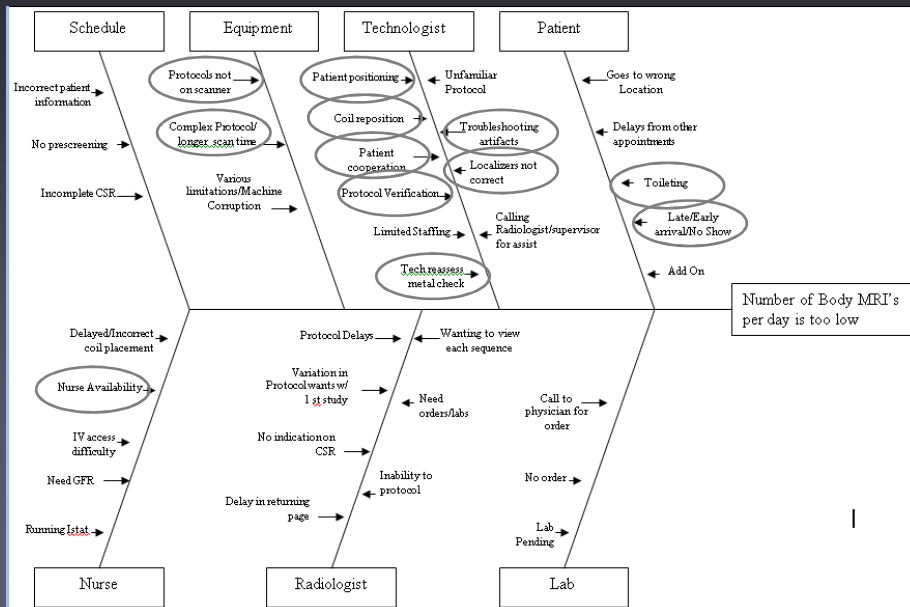
	Average	Variance	% of Total
Total Room Time	75 minutes	+/- 18 minutes	
Scan Time	48 minutes	+/- 15 minutes	64 %
Non-scan Time	26 minutes	+/- 9 minutes	36 %

# Process Analysis Flowchart (Overview)



Rate Limiting Step

# Process Analysis: Fishbone



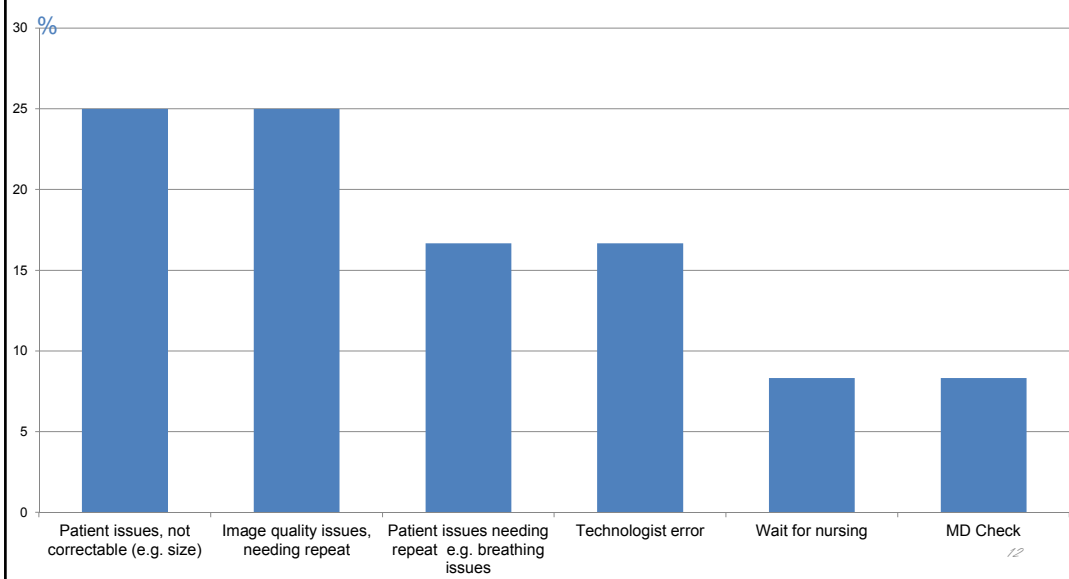
## Decision Making

Tools used to make decisions about changes to address in the project

- Flow chart analysis for rate-limiting step (scanner time)
- Group discussions/survey and email discussions /survey with technologists, radiologists, nurses
- Fishbone diagram
- Tally sheet for very long exams (+ 2 standard deviations)

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## Pareto Chart Causes of Prolonged Studies (> 115 min.)



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## Changes Made to Reduce Room Time: Non-Scan Time

- Technologists informed nurses:
  - About next patient to be imaged so that particular patient is ready for when the scanner is available, (i.e. reminding patient about rest room usage).
  - About upcoming endorectal pelvis studies to minimize time waiting for nurses to place endorectal coil.
- Endorectal cart prepared in advance to minimize prep time for endorectal pelvis studies.
- Syringes filled with contrast prior to studies.
- Patient demographics downloaded in advance to scanners.
- Floater technologist made available to assist in preparing room, cleaning room, assisting during scan to minimize non-scan time.

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## Changes Made to Reduce Room Time: Changes to Scan Time

- Scout views performed with arms down to eliminate need to reposition patient.
- Scout view changed from respiratory triggered or multiple breath holds technique to free breathing (shortening scan time).
- Fast spin echo T1 used to replace spin echo T1 in limited pelvis, with plans for subsequent more wide spread use in pelvis studies (savings of 10 minutes per pelvis study).
- Choice made in one of two diffusion techniques for endorectal coil studies of the prostate.

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## Project Plan

- Collect data from RIS for baseline
  - Limitation: RIS Only provides “begin scan time” and “end scan time” data
  - Purpose: to assess overall impact of project on all body cases.
- Analyze flowchart for rate limiting steps
- Survey technologists/radiologists/nurses for how to improve throughput
- Compare results against Fishbone and Tally Sheet to identify projects of potentially greatest benefit
- Create Radiologist Quality Questionnaire
  - To measure impact on secondary measure of study quality

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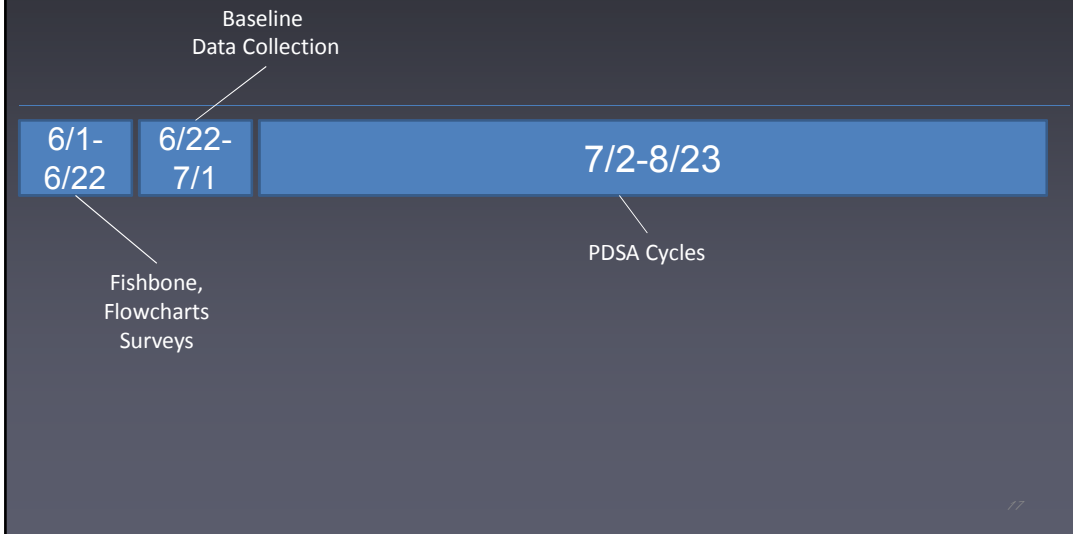
## Project Plan (Continued)

- Create Technologist Questionnaire
  - To analyze in detail time room utilization (e.g. room prep time, time to prepare patient, scan time, time to clean up room).
  - To track effects of PDSA cycles/projects: questionnaire also records medical record numbers, dates, types of study performed, and PDSA project to be tested.
- Brainstorm for projects based on above (Fishbone, Surveys, etc.)
- Carry out PDSA projects:
  - Monitor effects via Technologist Questionnaire
  - Note: Extent of implementation limited by available manpower
- Institute successful projects broadly.
- Monitor effect on control chart for number of studies/exam time (RIS data).

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## Timeline



## Testing Changes

- Instructed the technologists to document in Technologist Questionnaire time points for scanner time.
- As developed new PDSA projects, they were implemented using the Technologist Questionnaire to measure impact.
- Informed all technologist s/ supervisor about the changes we made for improvement and instructed them to implement with one-to-one training on changes.
- During implementation, analyzed on weekly basis effect of PDSA changes primarily through Technologist Questionnaire.

## Unexpected Issues/Barriers

- Short staffed areas due to medical leave issues:
  - Reduced manpower, affected severely all PDSA cycles especially “floater” worker to help prepare rooms
  - Affected both nursing and technologists
- Unanticipated use/testing of new sequences
  - Visit by GE application specialist during study
  - Dual diffusion sequences (body vs endorectal coil) as part of implementation of new sequence
  - Startup of MRI protocol committee

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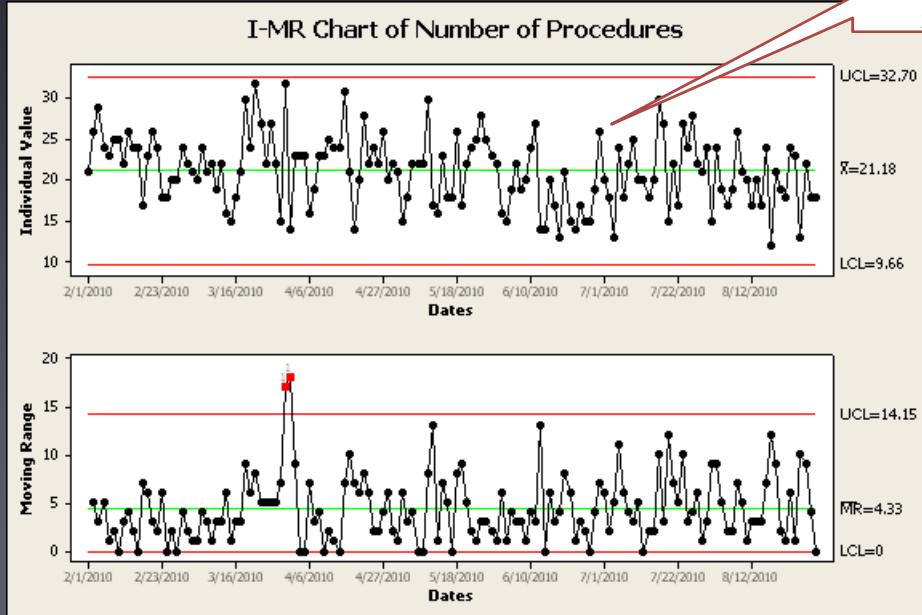
## Unexpected Issues/Barriers (Continued)

- Unexpected scope of patient conditions.
- Multiple scanner types.
- Radiology department move disrupted getting data from RIS.
- Difficulty in collecting data from technologists and from radiologists via questionnaire.
- Unexpected drop in overall MRI volume (decreased demand) during the time of the project decreased impact of saving time per scan on increasing volume.

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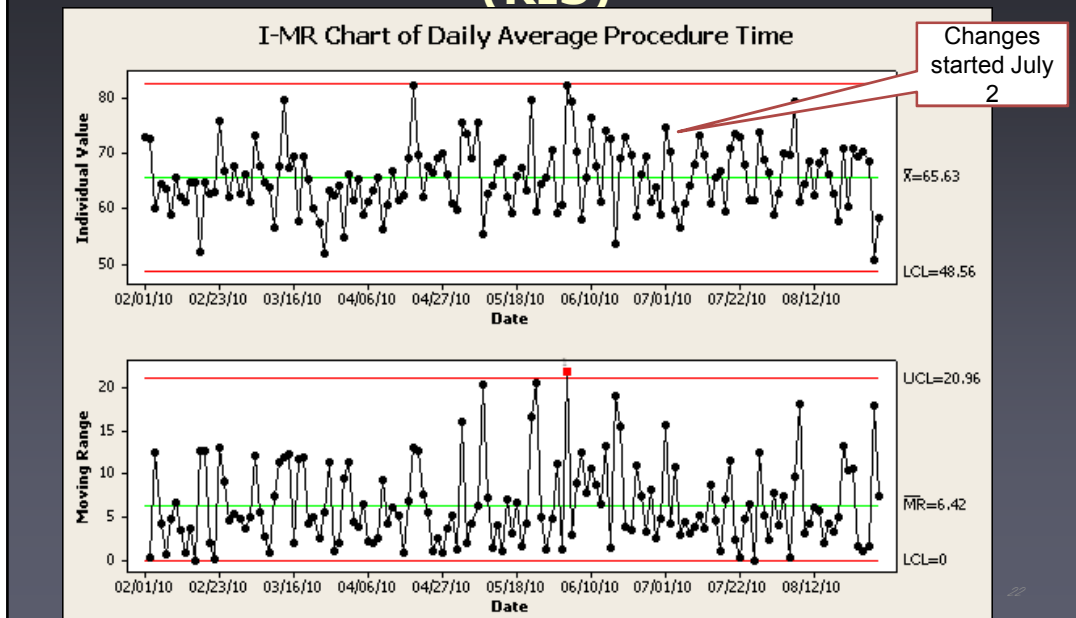
## Results Daily Case Volume (RIS)

Changes started July 2

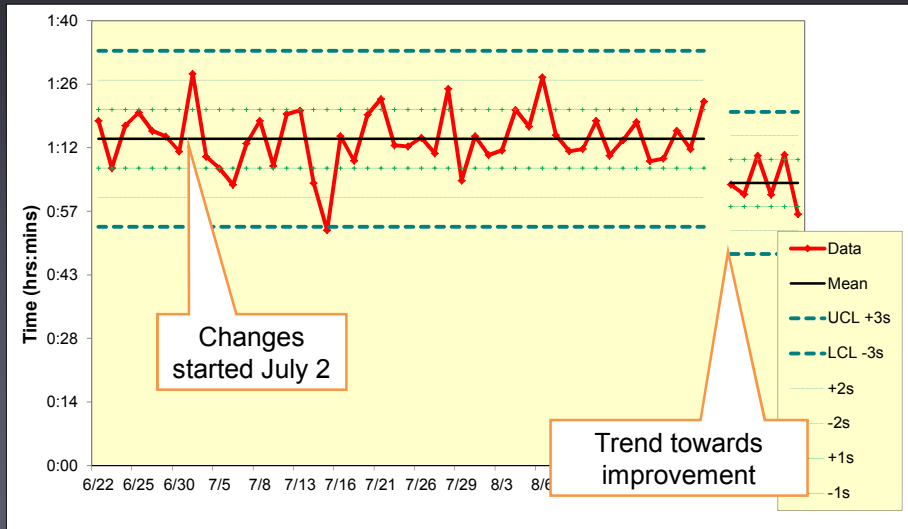


## Results Daily Avg. Procedure Time (RIS)

Changes started July 2

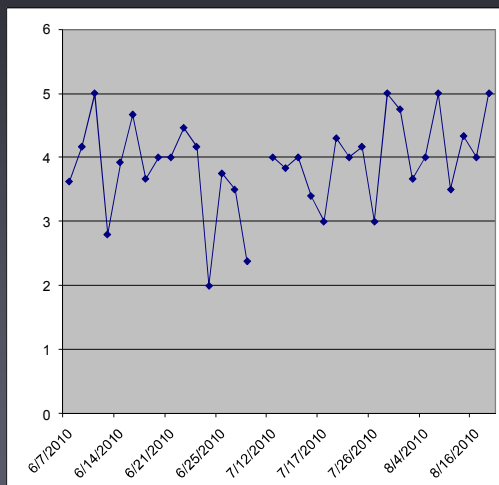


## Total Exam Time (Normalized to One Anatomic Region)



## Radiologists' Assessment of Image Quality

- QA
  - Score by Radiologists
  - Scale
    - 5 = Excellent
    - 1 = Poor
- Prior - July 1, 2010
  - 3.87 +/- 0.89 (1SD)
- After – July 1, 2010
  - 4.05 +/- 0.94 (1SD)
- No significant change



## Floater Results: 15% Reduction in NS Time

	Scan Time	Non-Scan Time	Total Time
Baseline (no floater)	0:48	0:26	1:15
Floater	0:49	0:22	1:11
Endorectal pelvis			
Non FI	0:51	0:29	1:21
FL	0:52	0:25	1:17
Abdomen (only)			
Non FI	0:47	0:25	1:12
FL	0:47	0:20	1:08
Abd/Pelvis			
Non FI	0:45	0:24	1:10
FL	0:45	0:23	1:08
Pelvis (non Prostate)			
Non FI	0:58	0:21	1:19
FL	0:56	0:21	1:18

## Actions Based on Results

- Will recommend to department investigating hiring radiology support for a “floater” to minimize non-scan time
  - Can be utilized for non-body areas as well (neuroradiology, musculoskeletal)
  - May enhance benefit of interventions not otherwise successful (e.g. prep time outside of room, “handoffs”, etc.) given limited personnel
- Will recommend additional training for technologists to limit the need to repeat sequences
- Will recommend that questionnaires for technologists and radiologists be incorporated into radiology information system upgrade to better capture data (scan vs non-scan)

## Floater Expenses and Margin

	1 Additional Procedure/Day	2 Additional Procedures/Day
Current Margin/Procedure	\$1945	\$1945
Annual Revenue Increase	\$486,250	\$972,500
Additional Floaters (MRI Technologists)	1.5 FTE	3 FTE
Additional Floater Salary & Benefit Expense	\$138,540	\$277,380
Net Margin	\$347,710	\$695,120

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## Conclusion: Lessons Learned

- Much promise in reducing non-scan time which consumes 1/3 of room time.
- Need sophisticated data collection tools for efficient collection of sufficient data.
  - Building these into Radiology Information System would be beneficial.
- Lack of manpower/shortage of personnel reduced benefits of interventions (could only implement on a limited basis).
  - Questionnaires were crucial for assessing benefits of projects that could only be implemented on a small scale.
- Multiple simultaneously occurring other changes outside of this project made it difficult to assess impact of changes.

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## Conclusion: What's Next

- Try to implement “floater” and learn how to use efficiently.
- Explore other avenues to reduce scan time, non-scan time.
- Pursue ways to prevent excessively long scans with long term projects.
  - Identify most common correctable imaging problems, and develop comprehensive training program for technologists.
  - Develop mechanisms to determine in advance, and compensate for, patient factors detrimental to imaging.
    - » Ex: claustrophobia, patient size, hearing loss, breathing abnormalities, etc.

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