Improve Reject Rates for Portable Chest Imaging Exams

Problem Statement

Approximately 11.40% of portable chest x-rays per month at URMC are rejected & repeated to ensure diagnostic imaging quality. An average of 4500 bedside portable chest x-rays are performed per month, resulting in an average of 513 additional radiation exposures to patients each month to obtain a diagnostic quality image.

Background Statement

Portable chest imaging (PCXR) is one of the most commonly performed exams in most hospitals. Over the past several years, the use of Digital Radiography (DR) has flourished amongst imaging departments and has several advantages for the Radiologic Technologist (RT), including an immediate availability for quality assessment. This increased efficiency has led to the unintended consequence of decreased awareness of the fundamental principles of ALARA by RTs. Repeating PCXR leads to increases in unnecessary radiation, patient repositioning, decreased technologist efficiency and delays in radiologist interpretation. Timely interpretation is essential for the patient's care team to determine prognosis and treatment. The purpose of this project was to define a diagnostic PCXR, develop process standardization, and decrease our portable chest imaging reject rate to that achieved by other large academic centers.

SMART Goal

Reduce the monthly reject rate for portable chest imaging exams from 11.40% to 8% by March 2022.

Root Causes

Using standardized performance improvement methodology the current state was evaluated by performing gemba walks, and staff surveys. Contributing root causes were determined:

- Variability of staff understanding of which key components lead to quality image.
- Staff were unaware of reject rates because data was not routinely shared with frontline staff.
- Key performance metrics did not include individual reject rate.
- The ease of obtaining repeat DR images promotes improper patient positioning and carelessness.
- Imaging volumes and staffing shortages led to increased distractions and rushing.
- Reject reasons were not accurately documented.

Analysis

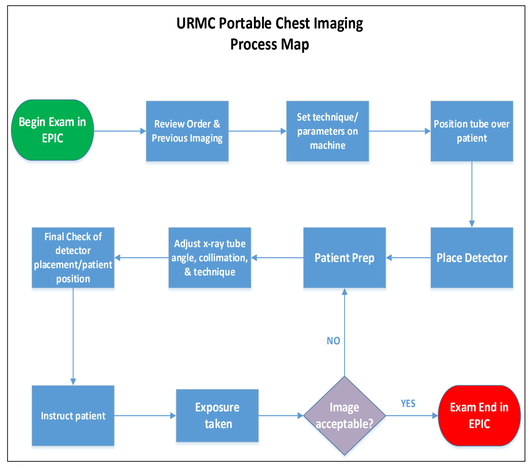


Figure 1

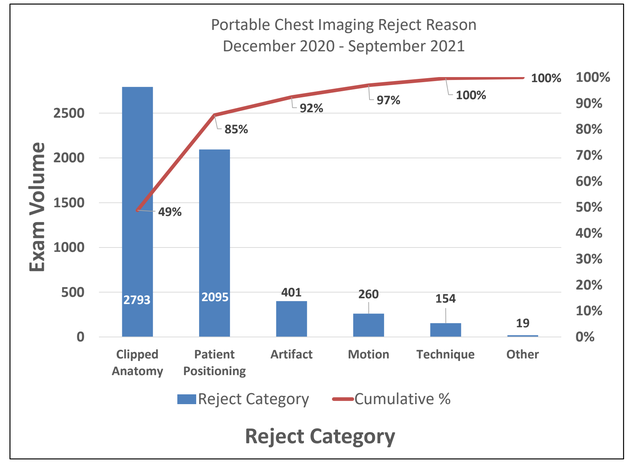


Figure 2

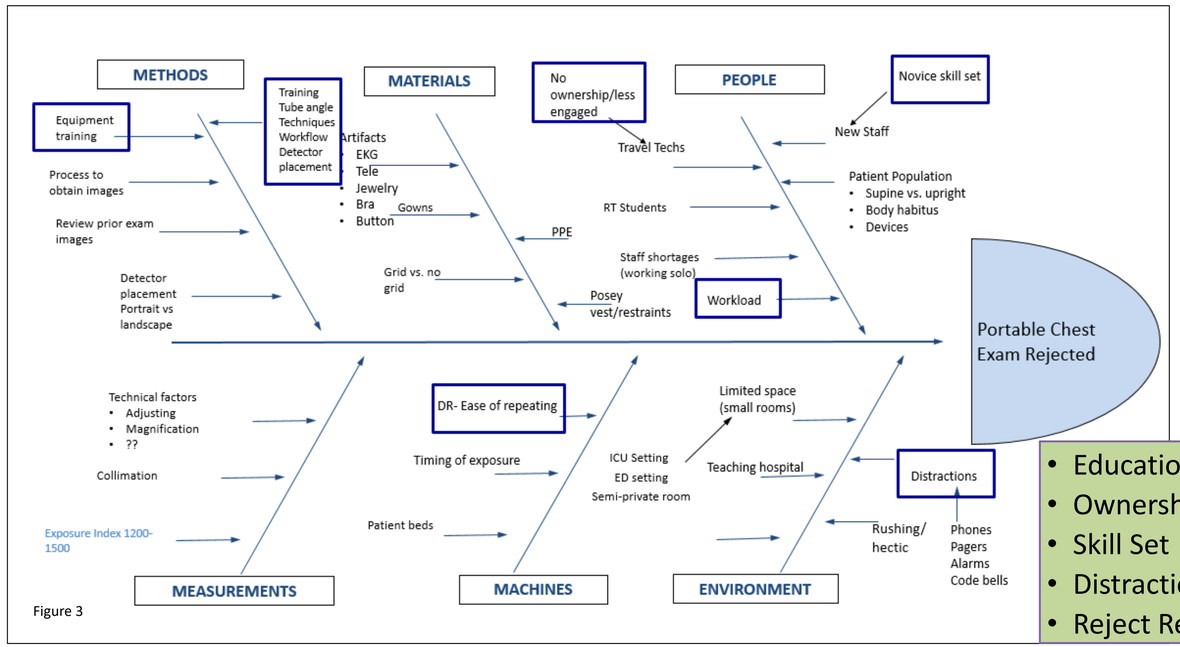
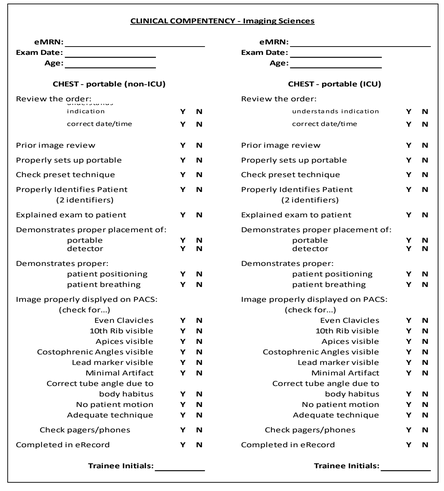


Figure 3

- Education
- Ownership of reject rates
- Skill Set
- Distractions
- Reject Reasons

Key Drivers	Interventions / Countermeasures
Clear and consistent way to assign exams to staff	Ambulatory technologist assists RT with portable rounds
	Enhanced communication with operating room imaging requests, which results in more efficiency for staffing
	Batch assigning portable exams based upon unit location and time of day
Clear and concise education, training ,orientation process for support staff and technologist	Develop a specific portable imaging orientation document (checklist), including review of reject data
Standardize key components of quality PCXR and how obtain	Education of what an acceptable PCXR is at the college level, entry level and advanced level. Model best practices and Radiologist feedback
	Develop a reference table / diagram for staff specific to implantable equipment / lines / feeding tube placement
Review/presentation of reject data not communicated at the individual level or department level	Discuss with all staff departmental reject rate, post reject rate in a common area.
Too many variables and options for reject reasons	Consolidate reject reasons and define when to use them

Figure 4



CLINICAL COMPENTENCY - Imaging Sciences

eMRN: _____ Exam Date: _____ Age: _____

CHEST - portable (non-ICU)

Review the order:	
indication	Y N
correct date/time	Y N
Prior image review	Y N
Properly sets up portable	Y N
Check preset technique	Y N
Properly Identifies Patient (2 identifiers)	Y N
Explained exam to patient	Y N
Demonstrates proper placement of: portable	Y N
detector	Y N
Demonstrates proper: patient positioning	Y N
patient breathing	Y N
Image properly displyed on PACS: (check for...)	
Even Clavicles	Y N
10th Rib visible	Y N
Apices visible	Y N
Costophrenic Angles visible	Y N
Lead marker visible	Y N
Minimal Artifact	Y N
Correct tube angle due to body habitus	Y N
No patient motion	Y N
Adequate technique	Y N
Check pagers/phones	Y N
Completed in eRecord	Y N

Trainee Initials: _____

eMRN: _____ Exam Date: _____ Age: _____

CHEST - portable (ICU)

Review the order:	
understands indication	Y N
correct date/time	Y N
Prior image review	Y N
Properly sets up portable	Y N
Check preset technique	Y N
Properly Identifies Patient (2 identifiers)	Y N
Explained exam to patient	Y N
Demonstrates proper placement of: portable	Y N
detector	Y N
Demonstrates proper: patient positioning	Y N
patient breathing	Y N
Image properly displayed on PACS: (check for...)	
Even Clavicles	Y N
10th Rib visible	Y N
Apices visible	Y N
Costophrenic Angles visible	Y N
Lead marker visible	Y N
Minimal Artifact	Y N
Correct tube angle due to body habitus	Y N
No patient motion	Y N
Adequate technique	Y N
Check pagers/phones	Y N
Completed in eRecord	Y N

Trainee Initials: _____

Figure 5

Ashley Conley RT • Kristin Kozak RT • Brian Travis RT • Stephanie Donlon RT • Kuirland Lopez RT • Taylor Lyda RT •
Karen Fenicchia, BSN, RN • Erin Panter, BSRT, • Sean Cleary, M.D. • Ben Wandtke, M.D., MS.
Department of Imaging Sciences, University of Rochester Medical Center, Rochester, New York

Results

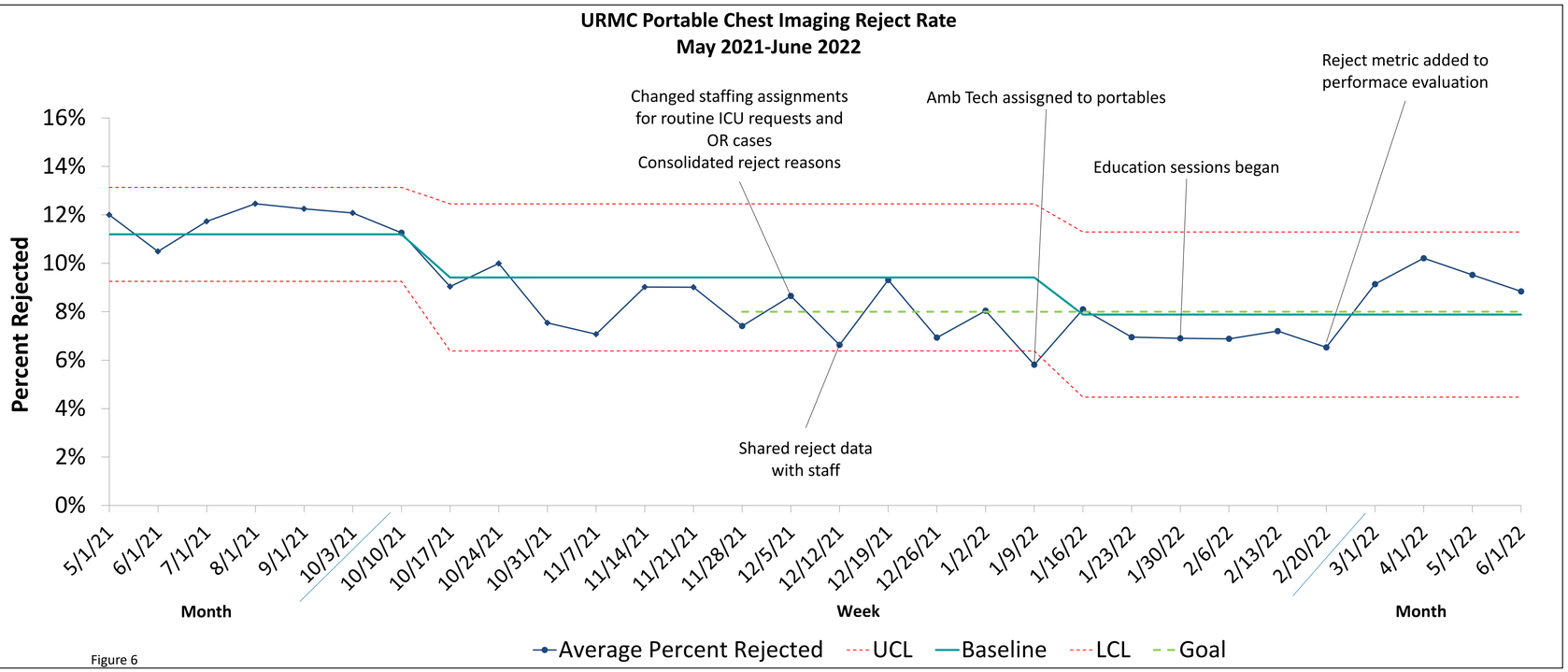


Figure 6

- Portable Chest Imaging Overview
- Infection Prevention and Radiation Safety Techniques
- The Role of the Radiologic Technologist
- Patient Identification Steps
- Communication
- Order Review and History
- Common Abbreviations and Invasive Devices
- Positioning, Preparing Patient and Portable Machine
- The Final Check
- How to Determine Quality
- When is a Repeat Required
- Reject Analysis (NYS Guidelines)
- Reject Reasoning
- Film Critique

Figure 7

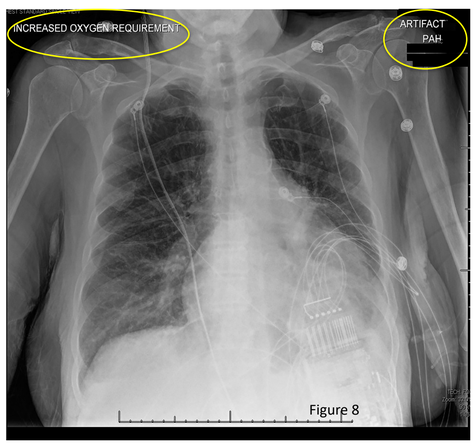


Figure 8

Radiologist Evaluation

	P31-10/10	P25-10/14	P25-10/15
Reject reason seem appropriate? (Y/N)			
Could clinical question be answered without repeating the image (Y/N)			
Any additional feedback (optional)			

Technologist Evaluation

	P31-10/10	P25-10/14	P25-10/15
Does the Reject reason seem appropriate? (Y/N)			
Per the indication, would this have been acceptable without repeating? (Y/N)			
What would have prevented this error from occuring? (free text)			

50 rejected portable chest x-ray images were anonymized, evaluated for quality and reject reasons based upon indication (Figure 8). 48% of rejected images needed repeating based upon clinical indications, 40% of rejected reasons were incorrectly selected by the performing RT, demonstrating a knowledge gap and lack of consensus between radiologists and RTs.

Interventions

The current state process was evaluated and several root causes were identified as contributing factors to high reject rates. Key drivers included making clear and consistent staffing assignments, standardizing RT portable workflows, defining reject reasons, standardizing and defining key components of quality imaging and sharing of reject rates (Figure 4).

- A through review of staffing assignments and portable volume provided an opportunity make meaningful adjustments to workflows to reduce the RT need to rush.
- Reinforced staff understanding of reject reasons, improved proper patient positioning, removed redundant reject reasons.
- Using feedback from our cardiothoracic radiologists, a comprehensive portable chest x-ray orientation checklist (Figure 6) was developed to standardize quality assessment and ensure all RT's understood the requirements of a diagnostic PCXR.
- All RT's and trainees were provided with comprehensive review/education on PCXR image quality including highlighting points on ALARA/radiation dose, common clinical indications, reject reasons and film critique. A comprehensive guide to portable chest imaging (figure 5) was developed based on best practices and radiologist feedback.
- A reference table/diagram shared with staff and posted on portable machines for staff specific to implantable equipment, lines, feeding tube placements. This provided the RT information that would ensure all necessary anatomy would be included to answer the clinical question.
- Reject rates were analyzed and routinely shared at staff meetings and posted in common areas.

Discussion

By implementing simple interventions, defining quality and sharing reject data**, the average monthly reject rate for PCXR decreased from 11.4% to 8.2% (28% reduction)**.
A limitation for this project was the inability to accurately measure technologist efficiency with workflow standardization by measuring the time it took to perform each PCXR exam due to lack of portable EMR access.
As a result of this project and increased engagement with frontline staff, we hypothesize that there was a Hawthorne effect that contributed to the pre-intervention reject rate reduction however, by standardizing our definition of diagnostic quality and training staff to better appreciate quality components and ordering indications of PCXR, we were able to sustain the mean reject rate below our goal of 8%.

Conclusion

Through the utilization of performance improvement methodologies, we were able to gain a better understanding of multiple factors that caused a higher reject rate. Image quality and reject rates are an important metric that will continue to be monitored and shared with staff on a monthly basis. Interventions and education that were developed during the course of the project continue to be a beneficial resource to orient new staff to portable chest imaging. Fall 2022, Imaging will begin exploring technology to better accurately record turn around times in order to gain a better understanding of technologist efficiency.