

Background/Purpose

- Annually, the University of Kansas Medical Center (KUMC) performs over 40,000 portable chest radiographs (PCXRs).
- Radiologists have noticed an increase in image acquisition errors and technical defects that can often lead to misdiagnoses.
- Other researchers have attempted to individually address defects; however, improving only one variable at a time does little to guarantee high-quality images.¹⁻²
- Objectives of this quality improvement study were to:
 1. Identify frequencies of common PCXR technical defects;
 2. Devise strategies to reduce or eliminate them as a whole; and
 3. Reevaluate PCXR technical defects following strategy implementation to determine effectiveness.

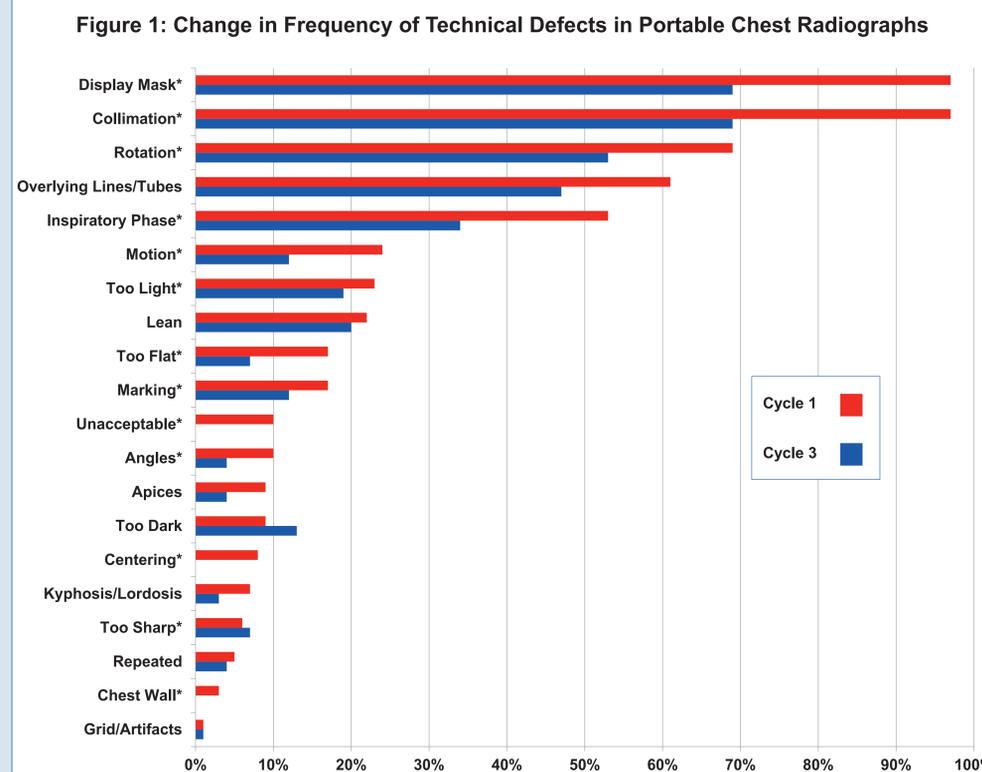
Methods

- We performed a three-cycle prospective quality improvement study comprised of three random samples 150 PCXRs from the KUMC Picture Archiving and Communication System (PACS).
- Each PCXR was evaluated by a cardiothoracic radiologist for the presence or absence of 20 technical defects (listed in Figure 1).



- Cycle 1 was analyzed to establish the baseline frequency of PCXR technical defects at KUMC.
- Results of the initial analysis were shared with radiologists, supervisors, and technologists. Strategies for improvement were implemented and two additional random samples of 150 PCXRs (Cycle 2 and Cycle 3) were assessed for defect reduction.
- Fisher exact tests were used to determine whether or not the implemented strategies significantly reduced the frequency of PCXR defects between each cycle.

Results



* Significant reduction in technical defects from Cycle 1 to Cycle 3 (all p-values < 0.05).
Note: sample 2 was not included, as it was not considered the primary endpoint of this study.

- Results of first sample (n=150) revealed technical defects ranged from 2 to 11, with an average of 5.33 technical defects per study (SD=1.64).
- Following strategy implementation, there was a significant 30% decrease in defects per study from 5.33 to 3.75 (SD=1.65) (p < 0.001).
- As shown in Figure 1, significant decreases in frequency were documented for the following 12 defects (all p-values < 0.05):
 - Marking
 - Too flat
 - Centering
 - Rotation
 - Inspiratory phase
 - Motion
 - Angles
 - Chest wall
 - Collimation
 - Overlying lines/tubes
 - Display mask
 - Unacceptable studies
- Examples of technical defects are shown in Figure 2.

Results

Figure 2: Small Right Apical Pneumothorax Revealed After Removal of Grid Technical Defect

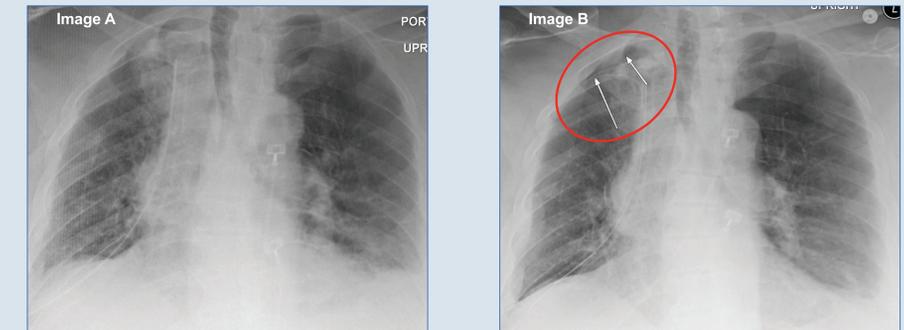


Image A: PCXR with significant grid artifact and overlying leads. Right thoracostomy tube in place. No definite pneumothorax identified.
Image B: Close interval follow-up without grid artifact demonstrating small right apical pneumothorax. Right thoracostomy tube remains in place. Overlying leads still noted.

Discussion

- Ensuring consistently high-quality PCXRs has become increasingly challenging as exam volume continues to rise.
- Given the inherent limitations of portable chest radiography, it is particularly important to minimize preventable technical defects to enable the highest possible diagnostic yield from images.
- Our study demonstrates that by implementing strategies collaboratively developed between radiologists and supervisory staff to educate and ensure accountability by radiologic technologists, technical defects in PCXRs can be significantly reduced.
- We plan to continue this process of education and quality improvement in PCXR and apply it to other types of radiologic exams to systematically improve image quality and resulting patient care.

References

1. McEntee MF, Houssein N & Al-azawi D. (2014). Use of incentive spirometry in portable chest radiography. *Radiologic Technology*, 85(3): 261-9.
2. Korhola O et al. (1994). Improvement of bedside chest radiograph quality using a high ratio grid and an electronic angle meter for alignment. *Acta Radiologica*, 35(3), 244-246.