MRI Quality Assurance and Improvement Project in a Radiology Department: Experience in a Large Academic Medical Center.

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Quality Story Board
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Introduction

- Our radiology department is a part of large academic center with multiple hospitals and multiple MRI scanners.
  - 40 radiologists, 22 residents, 2 MR physicists, and 12 MRI technologists.
- We established a MRI Quality Assurance (QA) team comprised of radiologists, physicists, technologists and administrators to identify and initiate a MRI quality improvement process

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Purpose

- Identify and initiate MRI quality processes to improve issues related to:

  ❖ Scanner → Is it functioning properly?

  ❖ Technologist → Are they educated to troubleshoot issues? Could they have done something to improve an exam? Is there a specific tech who is repeating the same mistakes?

  ❖ Patient → Is this patient fit to undergo an MRI? Did they cooperate with breath holds, etc.?

  ❖ Protocol → Is the protocol answering the clinical concern?

  ❖ IV contrast → Timing of bolus, proper contrast selection

  ❖ Image quality → Are the technical parameters within acceptable range, or can our physicist can optimize them better?

  ❖ Artifacts → Are there any artifacts?

  ❖ Scanning time → Is timing efficient to answer the clinical question and not be excessively long?

  ❖ Workflow → Are there issues involved in getting the patient to the scanner, on the scanner, off the scanner, and out of the room?

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Methods

- Radiologist identified the QA cases in real time and dropped the index cases into a QA folder in PACS interface software
- MR physicist reviewed all cases with an experienced MR technologist and prepared the cases for discussion at MRI Quality meeting
- All QA cases underwent a case-based root cause analysis to identify the cause of the degraded images quality and to implement a tailored plan to resolve the issues. "Good job" cases were also identified to encourage technologists

- Pilot QA project introduced to monitor the efficiency of our monthly QA efforts using focus groups on a single scanner using body cases
  - Focus group 1 (pre-intervention): 10 months after initiating our monthly QA meetings, 37 body MRI cases (49 studies) were selected over 1 month from our 3T scanner.
    - Our 3T MRI is located in the hospital and receives a high volume of inpatient scans.
  - Intervention: We identified a pattern of QA issues and implemented interventions to improve patient awareness and technologist education
  - Focus group 2 (post-intervention): 1 month after these interventions were implemented, we selected another 37 cases from our 3T MRI to assess for improvement

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Intervention 1:Patient education

- A straightforward educational poster was placed in the waiting room for our 3T and 1.5T MRI scanners.
- This was also converted to an educational handout for patients to review.

Intervention 2: Technologist Education-Quality Assurance

- We implemented a hard stop for which the technologist must acknowledge that they have reviewed the images before completing the exam.
- A box is also available for comments on the quality of the exam, which are reviewed at monthly QA meetings
- Lack of comments on an exam flagged for quality issues is also addressed at QA meetings

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Results

- **Monthly QA meetings** prior to focus group 1**(pre-intervention)**

- Top QA issues were attributed to
  - Technologist (26%),
  - Patient (18%),
  - Protocol (18%),
  - Scanner (12%)
  - Image quality (10%)
  - Others (16%)
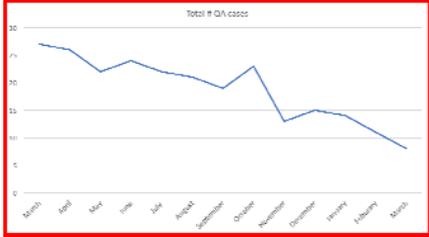
- Since the implementation of these monthly QA meetings, number of cases and issues related to technologist issues have decreased.

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Results

Focus group 1 (pre-intervention)

- 35 % studies were without any quality issues
- 65 % studies had quality issues.
  - 20 % single issues
  - 45 % multiple issues
- MRIs performed during the night/evening shifts received the worst subjective scores
- Key quality issues
  - image quality (37%)
  - technologist (28%)
  - patient (28%)
    - 18% inpatient
   - 10% outpatient
  - artifacts (20%)

Focus group 2 (post-intervention)

- 63 % studies were without any quality issues → 28% improvement
- 37 % studies had quality issues.
  - 27 % single issues
  - 10 % multiple issues (Improved significantly)
- MRIs performed during the evening shifts received the worst subjective scores.
- MRIs performed during the night shift had only minor quality issues.
- Key quality issues
  - image quality (0%)
  - technologist (12%)
  - patient (22%)
    - 17% inpatient
    - 5% outpatient
  - artifacts (8%)

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Conclusions: Where we are succeeding

- Monthly QA meetings have lead to significant decrease in issues related to MRI quality.
- Focus groups lead to a more detailed analysis of MRI quality problems and helped in systematic resolution of key issues.

Comparison of pre- and post-intervention focus groups
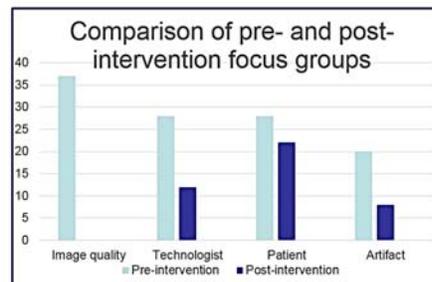
- Technologist-related issues have greatly improved
  - Monthly QA meetings are educational for technologists and allow for constructive feedback and problem solving
  - Focus groups identify and eliminate more specific issues
  - Tech self-assessment and review of images at the end of the study is a great quality initiative, serving as a consistent reminder to the busy technologist.

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Conclusions: Where we are succeeding

- Quality issues related to MRI sequence optimization from physics standpoint and artifacts have significantly improved
- Obesity is not a significant contributing factor to the quality of our MRIs
  - Most of our patient are overweight or obese
  - Our technologists and physicists have gained experience in dealing with obesity-related technical issues
- Issues during the night shift have greatly improved with our new quality measures
  - Many of the night shift technologists only work at night and therefore may not be exposed to monthly QA meetings
  - Quality checklist is an efficient measure for the busy night shift

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Conclusions: Where continued improvement is needed

- Patient related issues showed only a small improvement pre- and post-intervention
  - This is attributable entirely to inpatients, who are not exposed to the educational poster in the waiting room or at the front desk
    - Outpatients however showed a 50% decrease in patient-centered issues.
  - Educational material that can be distributed to alert inpatients is needed
    - Inpatient issues in patients who are not well enough to cooperate are likely only solved by delaying MRI or rerouting to CT instead.

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