Improving Prostate MR Image Quality Collaboratively

RSNA 2024
Building Intelligent Connections

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UR MEDICINE | Imaging

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ACR LEARNING NETWORK

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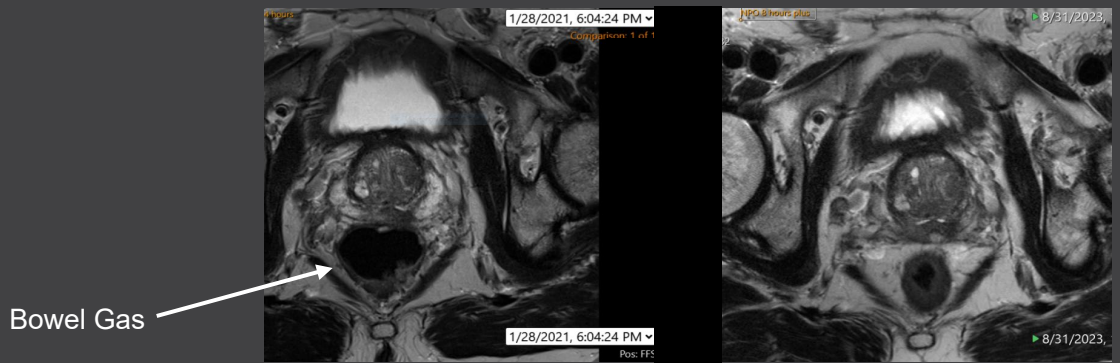
Background

- Approximately 13% of men are diagnosed with prostate cancer during their lifetime.(1)
- High quality magnetic resonance imaging (MRI) serves a valuable role in the detection of prostate cancer, yet *image quality is not routinely audited*.
- Poor image quality limits diagnostic confidence and the accuracy of image guided biopsies.
- The Prostate Image Quality (PI-QUAL) scoring system was utilized to evaluate diagnostic quality of multiparametric prostate MRI exams
- At our institution, prostate MRI exams *do not require* enema prep and/or an endorectal coil



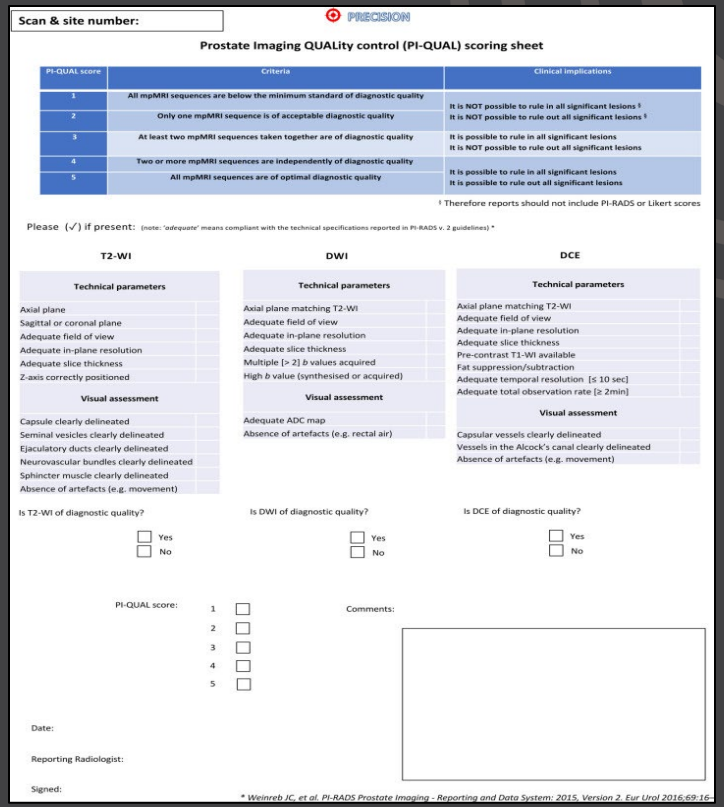
(1) "Cancer of the Prostate - Cancer Stat Facts." *National Cancer Institute*, seer.cancer.gov/statfacts/html/prost.html. Accessed 11 Mar. 2024.

In partnership with the ACR Learning Network®, goal of this project was to improve prostate MRI image quality through use of the Prostate Imaging Quality (PI-QUAL) scoring metric, improving detection of prostate cancer.

ACR LEARNING NETWORK

PI-QUAL

- 5-point Likert scale was used to determine if exam had sufficient quality to "*rule-in*" or "*rule-out*" clinically significant prostate cancers (2,3)
- The project team and radiologists were trained to use the audit tool
- 1206 MRI prostate exams were manually audited and scored by radiologists and MR technologists



Scan & site number:

PRECISION

Prostate Imaging QUALity control (PI-QUAL) scoring sheet

PI-QUAL score	Criteria	Clinical implications
1	All mpMRI sequences are below the minimum standard of diagnostic quality	It is NOT possible to rule in all significant lesions ‡ It is NOT possible to rule out all significant lesions ‡
2	Only one mpMRI sequence is of acceptable diagnostic quality	
3	At least two mpMRI sequences taken together are of diagnostic quality	It is possible to rule in all significant lesions It is NOT possible to rule out all significant lesions
4	Two or more mpMRI sequences are independently of diagnostic quality	It is possible to rule in all significant lesions It is possible to rule out all significant lesions
5	All mpMRI sequences are of optimal diagnostic quality	

‡ Therefore reports should not include PI-RADS or Likert scores

Please (✓) if present: (note: '*adequate*' means compliant with the technical specifications reported in PI-RADS v. 2 guidelines) *

T2-WI	DWI	DCE
Technical parameters	**Technical parameters**	**Technical parameters**
Axial plane	Axial plane matching T2-WI	Axial plane matching T2-WI
Sagittal or coronal plane	Adequate field of view	Adequate field of view
Adequate field of view	Adequate in-plane resolution	Adequate in-plane resolution
Adequate in-plane resolution	Adequate slice thickness	Adequate slice thickness
Adequate slice thickness	Multiple [> 2] *b* values acquired	Pre-contrast T1-WI available
Z-axis correctly positioned	High *b* value (synthesised or acquired)	Fat suppression/subtraction
Visual assessment	**Visual assessment**	Adequate temporal resolution [≤ 10 sec]
Capsule clearly delineated	Adequate ADC map	Adequate total observation rate [≥ 2min]
Seminal vesicles clearly delineated	Absence of artefacts (e.g. rectal air)	**Visual assessment**
Ejaculatory ducts clearly delineated		Capsular vessels clearly delineated
Neurovascular bundles clearly delineated		Vessels in the Alcock's canal clearly delineated
Sphincter muscle clearly delineated		Absence of artefacts (e.g. movement)
Absence of artefacts (e.g. movement)		

Is T2-WI of diagnostic quality? ☐ Yes ☐ No

Is DWI of diagnostic quality? ☐ Yes ☐ No

Is DCE of diagnostic quality? ☐ Yes ☐ No

PI-QUAL score: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Comments:

Date:

Reporting Radiologist:

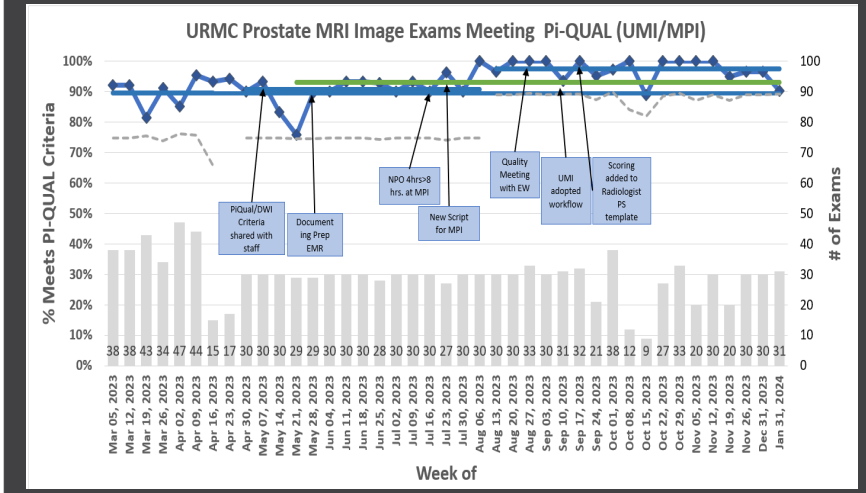
Signed:

* Weinreb JC, et al. PI-RADS Prostate Imaging - Reporting and Data System: 2015, Version 2. Eur Urol 2016;69:16-

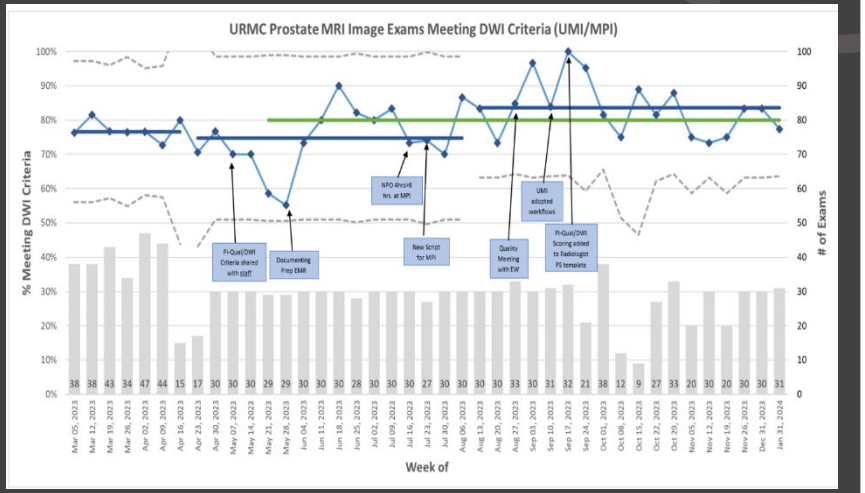
(2) "Collaborative measure_Prostate MRI Image Quality Final_08142023"(2023). American College of Radiology.
(3) Giganti F, Kirkham A, Kasivisvanathan V, Papoutsaki MV, Punwani S, Emberton M, Moore CM, Allen C. Understanding PI-QUAL for prostate MRI quality: a practical primer for radiologists. Insights Imaging. 2021 May 1;12(1):59. doi: 10.1186/s13244-021-00996-6. PMID: 33932167; PMCID: PMC8088425.

Data

Baseline average PI-QUAL ≥ 4 = 91%



Baseline average DWI rated optimal = 71%



Post intervention PI-QUAL ≥ 4 = 99%

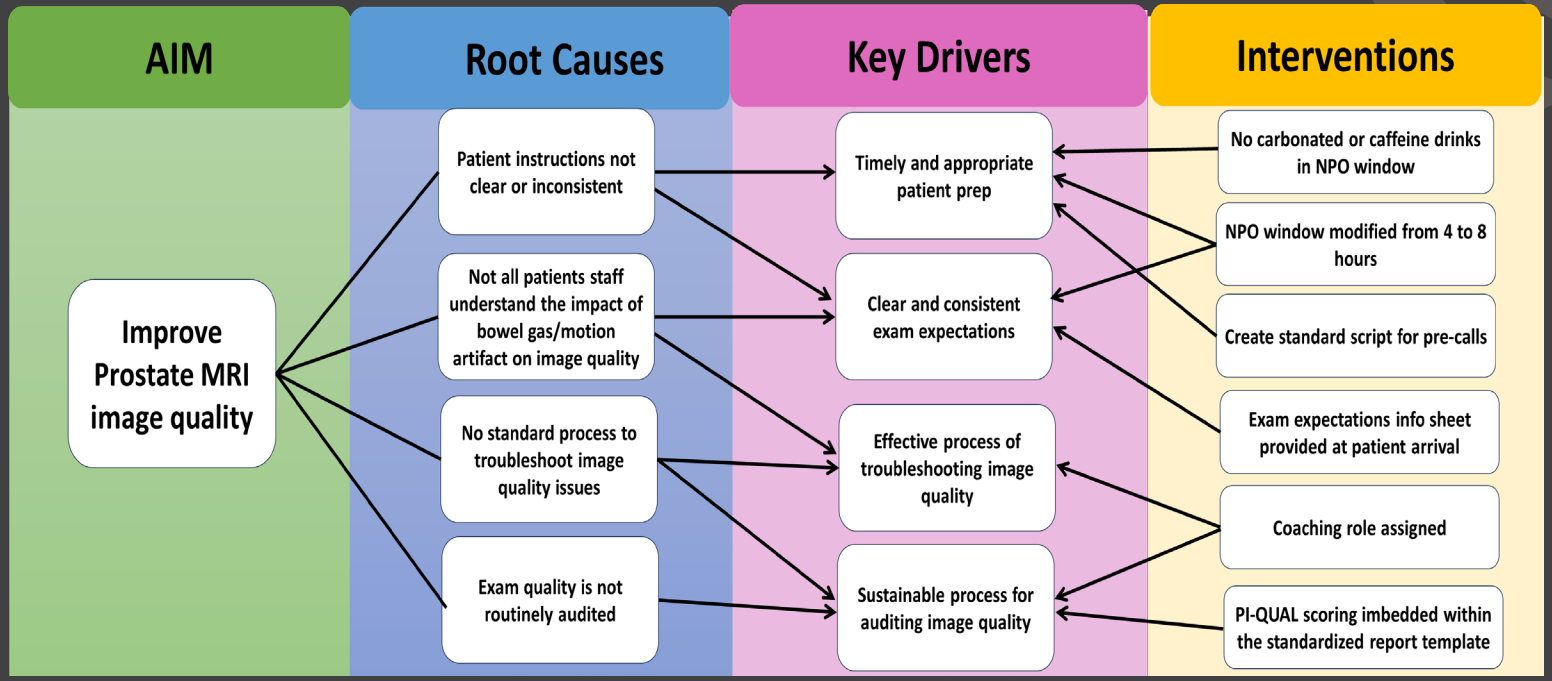
Post intervention DWI rated optimal = 88%

SMART Goals

Increase the percentage of prostate MRI exams that receive a *PI-QUAL score of ≥ 4 from 91% to 93%* from April 2023 to September 2023

Increase the percentage of prostate MRI exams with at least one Diffusion-Weighted Imaging (DWI) sequence(s) *rated optimal from 71% to 80%* from April 2023 to September 2023

Analysis


AIM
Root Causes
Key Drivers
Interventions
Improve Prostate MRI image quality
Patient instructions not clear or inconsistent
Not all patients staff understand the impact of bowel gas/motion artifact on image quality
No standard process to troubleshoot image quality issues
Exam quality is not routinely audited
Timely and appropriate patient prep
Clear and consistent exam expectations
Effective process of troubleshooting image quality
Sustainable process for auditing image quality
No carbonated or caffeine drinks in NPO window
NPO window modified from 4 to 8 hours
Create standard script for pre-calls
Exam expectations info sheet provided at patient arrival
Coaching role assigned
PI-QUAL scoring imbedded within the standardized report template

Bowel Gas Reduction Techniques

- Nothing to eat or drink for 8 hrs.
- Refraining from caffeine or carbonated beverages
- Scripted pre-exam instructions and expectations for patients

Pre-MRI Exam Script

Hello, this is _____ calling from Marketplace Imaging. I am calling in regards to your prostate MRI which is scheduled for date___ Do you have time for some instructions and questions?

Your prostate MRI is scheduled on date_____ with an arrival time of _____.

Your Mychart instructions may state not to eat or drink anything 4 hours before the exam, but we recommend that you do not eat or drink anything 8 hours before the exam, no carbonation, and no caffeine.

Medications can be taken with a sip of water. It is important that you follow these instructions to assure the best image quality for your MRI.

You will be asked to change into hospital scrubs for your exam and will get an IV placed. The technologist will explain all the steps while being imaged. You will be asked to hold very still for the exam and given breathing instructions. Please make sure you have all questions answered before the exam begins, we want you to be comfortable and ready.

Patient Script

UR MEDICINE

Welcome to UR Medicine Imaging at Marketplace!

Due to multiple factors, your particular exam for today is more sensitive than most and does require a bit more preparation than other MRIs to get the best images possible. Urine in the bladder, rectal gas, feces, and motion (voluntary or not) may all hinder our ability to perform certain imaging scans. By not eating or drinking and withholding caffeine and carbonated beverages, the goal is to limit urine, gas, feces, and involuntary bowel motion. Please use the restroom at your discretion while waiting for your MRI to begin. Do your best to stay relaxed and follow your technologist's instructions. Prior to and during your exam, feel free to expel gas/air as needed since it will lead to better images.

Thank you for choosing URMC Marketplace Advanced Imaging to perform your prostate MRI!

Patient Feedback

"Everyone was absolutely wonderful. Everything was patiently explained, and the staff was responsive to any question"

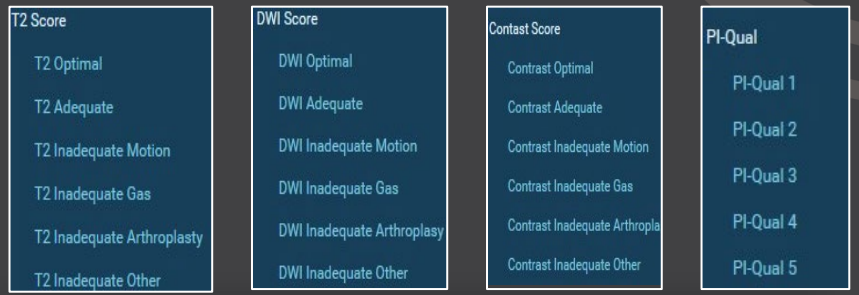
"Improve headphones for clearer voice instructions"

"Paper / written instructions would be more beneficial. Trouble hearing instructions on voicemail"

Quality Scoring at the time of interpretation

	Pick List Choice	Display in Report
T2 Score	Optimal	1
	Adequate	2
	Inadequate – Motion	3M
	Inadequate – Gas	3G
	Inadequate – Arthroplasty	3A
	Inadequate – Other	3O
DWI Score	Optimal	1
	Adequate	2
	Inadequate – Motion	3M
	Inadequate – Gas	3G
	Inadequate – Arthroplasty	3A
	Inadequate – Other	3O
Contrast Score	Optimal	1
	Adequate	2
	Inadequate – Motion	3M
	Inadequate – Gas	3G
	Inadequate – Arthroplasty	3A
	Inadequate – Other	3O
PI-QUAL Score	1	1
	2	2
	3	3
	4	4
	5	5

Report Template Pick List



PROCEDURE: Using a magnetic field strength of 3.0 Tesla, multiparametric MR imaging was performed of the prostate gland. Large field-of-view axial T1 weighted images of the pelvis were obtained. Subsequently, small field-of-view sagittal, axial, and
coronal T2 weighted images were obtained through the prostate gland; small field of view axial T1 weighted images and axial diffusion images were obtained through the prostate gland. 1 1 1 5

Results of the audit are discreetly displayed at the bottom of the report.

Key Learning Points

- ***Radiologist, Radiologic Technologist and patients*** play an important a role in image quality.
- The data collected and shared was ***eye opening*** on what we could accomplish without an enema or endorectal coil.
- Prior to project, image quality was ***not routinely*** audited.
- ***Manual*** retrospective PI-QUAL auditing was time consuming.
    - This process was improved by implementing an imbedded PI-QUAL assessment within the standardized reporting template.

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Thank You

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