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**The American College of Radiology**

# **Dose Index Registry**

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## **ABR PQI Project Description**

October 12, 2017



American College of Radiology  
1891 Preston White Drive  
Reston, VA 20191-4397

## DIR ABR PQI Project Description

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<b>Date</b>	<b>Description of Revisions</b>
June 18, 2012	Original issue
July 3, 2012	<u>Appendix A</u> Step 3 revised to allow for a change in optimization target
November 28, 2012	<u>Section 1</u> Clarification that board-certified physicists can participate <u>Section 2</u> The project may be repeated if a different performance measure is used.
February 22, 2013	<u>Section 2</u> Participants must provide the measurement on which the project was based, and the beginning and end dates of the baseline and post-improvement plan cycles, to the ACR at the completion of the project.
June 8, 2016	<u>Appendix B</u> Example 2 added. <u>Appendix C</u> List of abbreviations; previously Appendix B.
March 6, 2017	<u>Section 2</u> Revised. <u>Appendix B</u> Example 2 revised.
May 1, 2017	<u>Section 2</u> Revised.
October 12, 2017	<u>Section 2</u> Administrative procedures revised. <u>Section 3.1</u> Baseline data must be collected during NRDR participation.

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## 1. Introduction

This document describes how diplomates of the American Board of Radiology (ABR) can use the Dose Index Registry (DIR) as a Practice Quality Improvement (PQI) Improvement Activity towards the fulfillment of their Part IV Maintenance of Certification (MOC) requirements. Board-certified physicists and radiologists can use DIR for this purpose.

DIR is a data registry that allows facilities to compare their CT dose indices to regional and national values. Information related to dose indices for all CT exams is collected, anonymized, transmitted to the American College of Radiology (ACR), and stored in a database. Participating facilities are then provided with periodic feedback reports comparing their results by body part and exam type to aggregate results. Data collected from the registry will be used to establish national benchmarks for CT dose indices.

Participating facilities choose an exam type on which to base a PQI plan. The impact of the plan is measured by comparing the facility's target measure calculated during the baseline period to the same measure calculated during the post-improvement plan period.

## 2. Administrative

At the conclusion of the project, the facility may request documentation from the ACR attesting to the fact that the participant contributed data to the registry during the project. The request should specify the participant's NPI, NRDR Facility ID and the period of time for which attestation is requested. It should be sent to [rbkefer@acr.org](mailto:rbkefer@acr.org).

Information about the ABR's administrative requirements can be found at <https://www.theabr.org/moc-part4-activities>.

Diplomates must sign on to their ABR Personal Database in order to officially attest to their participation in the project.

## 3. Data Collection and Analysis

### 3.1 Baseline Cycle

The following steps describe the process for beginning the first (baseline) cycle:

- Register for DIR participation online, on the National Radiology Data Registry website.<sup>1</sup> This step includes entering the names and birth dates of all participating diplomates.
- Install software provided by the ACR on a facility workstation. The facility's CT scanners must be configured to send dose index data to the workstation, which in turn transmits the data to DIR.
- Define a measure to be obtained.
- Establish a desired measurement target/goal.
- Estimate the predicted baseline measurement result.
- Transmit data on all CT examinations performed at the facility for a period of six months. This period spans January 1 to June 30, or July 1 to December 31, of a specific year.

The following steps are performed at the end of the first six-month period:

- Collect baseline measurement summary data. This information is available in the semi-annual feedback report loaded to the DIR website every six months.
- Perform baseline data analysis.

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<sup>1</sup> [nrdr.acr.org](http://nrdr.acr.org)

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- Develop and implement an improvement plan during the following six months.

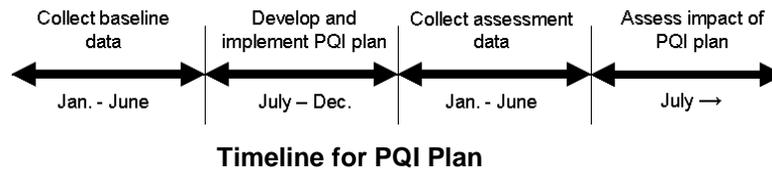
### 3.2 Post-Improvement Plan Cycle

The following steps are performed before collecting data for the second (post-improvement plan) cycle:

- Determine that the improvement plan has been successfully implemented.
- Reaffirm the measure to be obtained.
- Reaffirm the desired measurement target/goal.
- Estimate the predicted measurement result after implementation of the improvement plan.

The post-improvement plan cycle is completed as follows:

- Transmit data on all CT examinations performed at the participating facility for a period of six months. This period spans January 1 to June 30, or July 1 to December 31, of a specific year.
- Collect post-improvement measurement summary data. This information is available in the semi-annual feedback report loaded to the DIR website every six months.
- Perform post-improvement data analysis.
- Determine whether the group project has met its performance goal.
- Write a participant self-reflection statement.
- Attest to project completion in the ABR PQI Personal Data Base of each participant.



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**Appendix A**      **Example 1**

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**MOC Part 4: Practice Quality Improvement (PQI)**

**Group Participant PDSA (Plan-Do-Study-ACT) Checklist & Summary Record<sup>2</sup>**

**BASELINE PDSA CYCLE (Cycle #1)**

*(In Cycle #1, a topic is selected and baseline data gathered to compare with post-improvement plan data in Cycle #2.)*

**Step 1: PLAN. Identify and Describe the Project (Group-Designed)**

**[GROUP MEETING #1]**

- Select a Topic:
  - On August 24, 2011 the Joint Commission issued a Sentinel Event Alert concerning the radiation risks of diagnostic imaging. To address this concern, our facility plans to monitor radiation dose indices for diagnostic exam procedures.
- Define a Measure to be obtained:
  - Mean CTDIvol for a CT Head Without IV Contrast
  - While we intend to monitor dose indices for all exams, for the purpose of this PQI project we are focusing on CT Head Without IV Contrast
- Establish a desired measurement target/goal (What does the group want it to be to achieve an appropriate standard of performance and/or patient care?):
  - Our target/goal is to be at or below the national average CTDIvol for a CT Head Without IV Contrast. The national average is the average CTDIvol of all facilities participating in the Dose Index Registry (DIR)
- Estimate the predicted baseline measurement result (What does the group think it *will* be?):
  - We estimate that our mean CTDIvol for this exam will be 75mGy

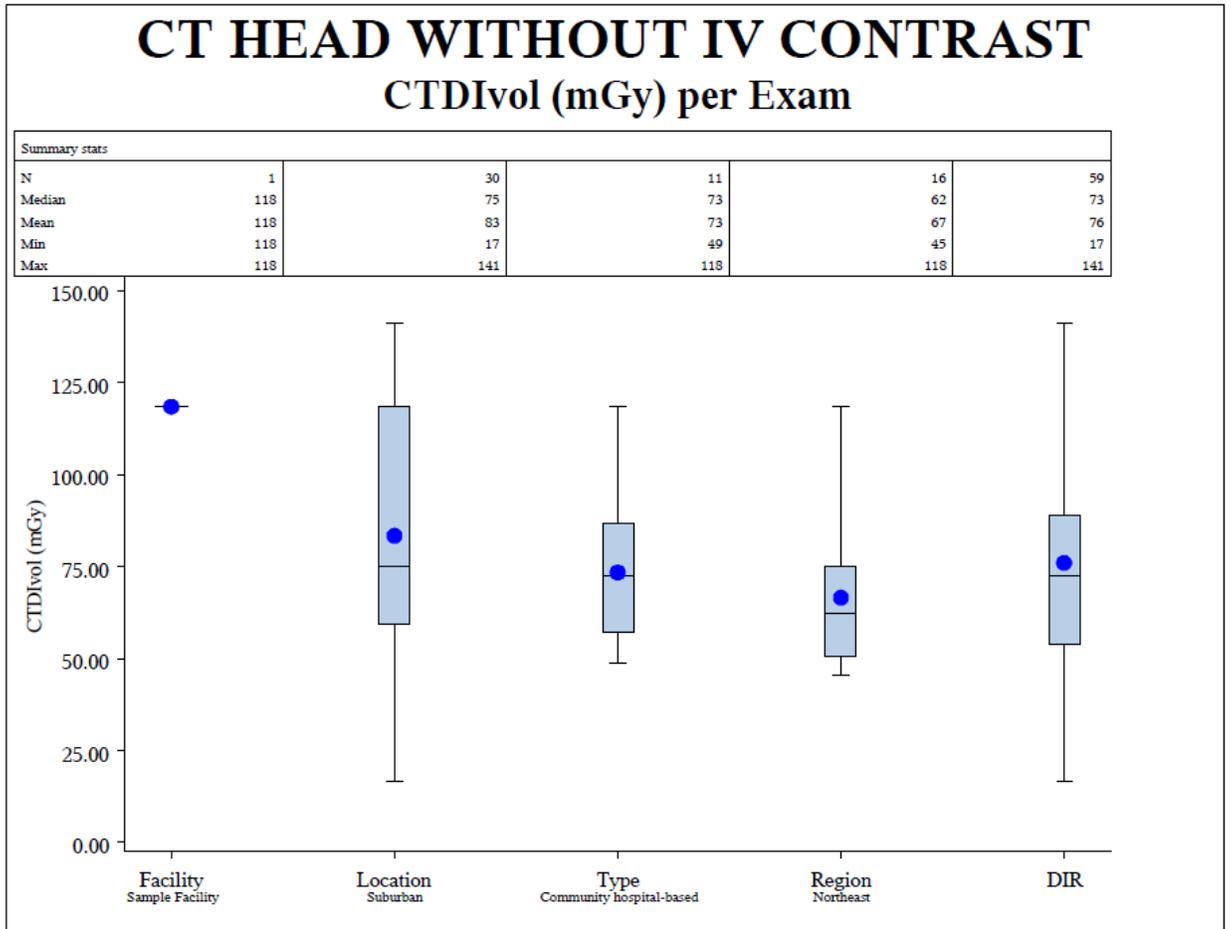
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<sup>2</sup> This optional form contains the structural elements for GROUP PQI Project process record keeping. Separate recording of data elements of a project should be attached to this form. DO NOT SEND this form to the ABR, unless requested to do so during an audit. This form is appropriate for GROUP PQI efforts.

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## □ Step 2: DO. Baseline Measurement Summary

- Number of Data Points collected :
  - 157 CT Head Without IV Contrast
- Baseline Measurement Value calculated:
  - Mean CTDIvol =118 mGy (see plot)



## □ Step 3: STUDY. Baseline Data Analysis

### [GROUP MEETING #2]

- How did the baseline results compare to the predicted results?
  - The baseline results were much higher than predicted
- How did the results compare the desired target goal?
  - The baseline results were much higher than the DIR average of 76 mGy
    - If baseline results *did not* meet the target:
    - Cite Potential Contributing Factors and Root Causes:

1. We found that in a small number of cases, exams that were labeled as CT Head Without IV Contrast were in fact CT Perfusion studies.
2. We also found that some patients were being given the wrong protocol for a CT Head Without IV Contrast resulting in a higher than expected CTDIvol.
3. We found that the late-night technologist was sometimes adjusting the protocol incorrectly at the scanner
  - Proceed to Step 4.

If the baseline results unexpectedly *did* meet or exceed the desired goal, return to Step 1 to select a new project and begin a new PDSA process. Complete Steps 9 and 10 as appropriate. Alternatively, review the baseline results for other exam types whose dose indices are not optimized. Continue the project with Step 4, using one of these exam types as a target for optimization.

#### □ **Step 4: ACT. Improvement Plan Development**

- Discuss and adopt actions to address Contributing Factors and Root Causes
  - Review and adjust processes for assigning exam descriptions
  - Review and edit all of our protocols for CT Head Without IV Contrast
  - Develop and implement training courses for our CT technologists regarding our protocols and the effect of changes to the protocol on radiation exposure
- *Construct* an Improvement Plan based on these findings and a process by which to implement the plan. Determine an appropriate time interval after plan implementation to allow for the plan to have its desired effect. Then proceed with re-measurement to assess improvement in Cycle #2.

#### Improvement Plan:

- Review and adjust processes for assigning exam descriptions
  - Select a committee to review process
  - Committee meets and provides recommendations
  - Recommendations are implemented
- Review and edit all of our protocols for CT Head Without IV Contrast
  - Select a committee to review protocols

- Committee meets and revises protocols
- Recommendations are implemented
  
- Develop and implement training course for our CT technologists regarding our protocols and the effect of changes to the protocol on radiation exposure

### POST-IMPROVEMENT PLAN PDSA CYCLE (Cycle #2)

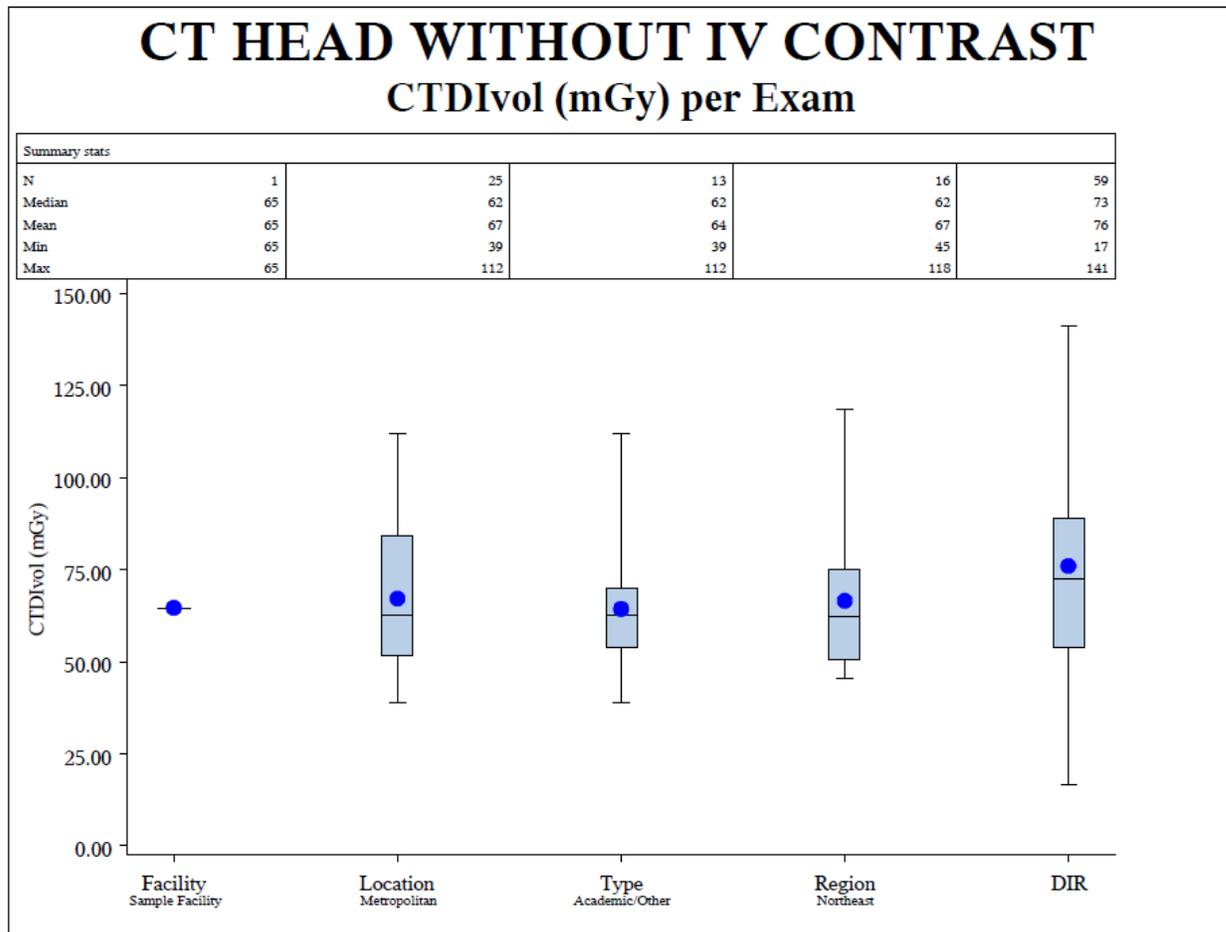
(In Cycle #2, re-measurement is performed after implementation of the Improvement Plan developed in Cycle #1.)

#### □ Step 5: PLAN

- Determine that the Improvement Plan constructed in Cycle #1 has been successfully implemented.
  - All steps of the Improvement Plan has been successfully implemented
- Reaffirm the Measure to be obtained.
  - Mean CT DIvol for a CT Head Without IV Contrast
- Reaffirm the desired measurement target/goal (What does the group *want* it to be?):
  - Our target/goal is to be at or below the national average CT DIvol for a CT Head Without IV Contrast. The national average is the average CT DIvol of all facilities participating in the Dose Index Registry (DIR).
- Estimate predicted measurement result *AFTER* implementation of the Improvement Plan (What does the group think it *will* be?):
  - We think that it will be 76mGy which was the DIR average on the last report.

#### □ Step 6: DO. Repeat Measurement Summary

- Number of Data Points Collected:
  - 157 CT Head Without IV Contrast
- Re-measurement Value obtained:
  - Mean CT DIvol =65 mGy (see plot)



□ **Step 7: STUDY. Re-measurement Data Analysis**

**[GROUP MEETING #3]**

- How did the measurement results compare to the predicted results?
  - Our results were better than predicted (predicted=76 mGy; actual=65 mGy)
- How did the results compare the desired target goal?
  - Our results were better than the target goal (target=DIR average of 76 mGy; actual=65 mGy)
- If results **did not** meet the target:
  - Re-evaluate the Improvement Plan by determining any problems with the plan design or its implementation, including issues preventing root causes from being addressed effectively.

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- Has the target/goal been set too high? Is an adjustment in order?
  - Is the measure the correct one?
  - Are modifications to the improvement plan warranted?
  - Proceed to Step 8.
  - If results **did** meet or exceed the target: Proceed to Step 8
- **Step 8: ACT. PROJECT DECISION POINT**  
**[GROUP MEETING #4]**
- Determine whether the group project has met its performance goal.
    - **Yes, we have met the target goal**
    - **If “yes,”** adopt the improved practice process as a standard and proceed to a new PQI Project.
    - **If “no,”** proceed with additional PDSA cycle(s) as needed to adjust the improvement plan or the measure target/goal. Continue the existing project either until the goal is met or an end-point is otherwise determined. *(Any improvement identified through this process is an indication of success and in some cases, the magnitude of improvement in the project measure achieved may be all that can be reasonably expected.)*
- **Step 9: Participant Self-Reflection Statement:**  
*(This brief narrative completes the quality improvement process. The PQI participant records his/her reflections on the project, improvements in quality/safety to which it has led, and its overall value to the practice or patient care.)*
- We feel that this exercise has led to an improvement in both our ability to monitor dose indices as well as in the level of radiation exposure that our patients are receiving. We will continue to monitor our dose indices through the DIR and will expand the review of our protocols to include all exams.
- **Step 10: Each Group PQI Participant Must Attest to Project Completion his/her ABR Personal Data Base.**

**Appendix B**      **Example 2**

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**MOC Part 4: Practice Quality Improvement (PQI)**

**Group Participant PDSA (Plan-Do-Study-ACT) Checklist & Summary Record<sup>3</sup>**

**Step 1: PLAN. Identify and Describe the Project  
(Group-Designed) [GROUP MEETING #1]**

- Select a Topic:
  - Patients with suspected kidney stones can be successfully evaluated with low radiation dose CT protocols; however, literature indicates these CT protocols are underutilized.
- Define a Measure to be obtained:
  - Median DLP for CT scans protocols aimed at assessing for kidney stone.
- Establish a desired measurement target/goal (What does the group want it to be to achieve an appropriate standard of performance and/or patient care?):

It has been shown that patients can be effectively evaluated for kidney stone with CTs at a lower radiation dose than currently used. We intend to incorporate low dose CT exams for kidney stone/flank pain in a more frequent and consistent basis; providing minimal risk to the patient while balancing the radiologist's diagnostic confidence. Our goal is to reduce non-contrast kidney stone CT's mean DLP to below the national average of 690 mGy-cm. Specifically, our goal is to achieve a DLP X% below the reported national average (i.e. median <XXX mGy-cm).

Please note: As the ability to implement low dose exams is limited on factors specific to the facility, radiologists, scanner technology available, and patient to be scanned (body habitus, presence of baseline scan, etc.), facilities should strive

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<sup>3</sup> This optional form contains the structural elements for GROUP PQI Project process record keeping. Separate recording of data elements of a project should be attached to this form. DO NOT SEND this form to the ABR, unless requested to do so during an audit. This form is appropriate for GROUP PQI efforts.

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for a reduction percentage achievable to their facility. Reduction rates and the corresponding DLP are as follows:

Reduction % from National Average							
DLP (mGy*cm)	0%	10%	20%	30%	40%	50%	60%
	690	620	550	480	410	340	270

- Estimate the predicted baseline measurement result (What does the group think it *will* be?):
  - We estimate median DLP of kidney stone CT protocols will be consistent with national average of participating facilities within the DIR: 690 mGy-cm.

## Step 2: DO. Baseline Measurement Summary

- Number of Data Points collected :

A total of 250 kidney stone CT protocols

- Baseline Measurement Value calculated:

Median DLP = XXX mGy-cm (as determined by facility's own reduction goal)

## Step 3: STUDY. Baseline

### Data Analysis [GROUP

### MEETING #2]

- How did the baseline results compare to the predicted results?

The baseline results were higher/lower than predicted.

- How did the results compare the desired target goal?

When compared to the desired target goal, the baseline results were significantly higher/lower than the DLP goal of <XXX mGy-cm.

- If baseline results *did not* meet the target:
- Cite Potential Contributing Factors and Root Causes:
  1. A dedicated low dose kidney stone CT protocol versus CT for undifferentiated abdominal symptoms is either not performed or randomly used.

2. Low dose protocol was not ordered because the radiologists were either not comfortable with the image quality of low dose or iterative reconstruction algorithm.
3. Patients with previously diagnosed kidney stone sometimes have follow up scans that do not utilize reduced dose CT.
4. Patient with suspected kidney stone has BMI >30 kg/m<sup>2</sup>.

- Proceed to Step 4.

If the baseline results unexpectedly *did* meet or exceed the desired goal, return to Step 1 to select a new project and begin a new PDSA process. Complete Steps 9 and 10 as appropriate. Alternatively, review the baseline results for other exam types whose dose indices are not optimized. Continue the project with Step 4, using one of these exam types as a target for optimization.

### **Step 4: ACT. Improvement Plan Development**

- Discuss and adopt actions to address Contributing Factors and Root Causes
  - Create, or review/edit any existing, kidney stone protocols for dose optimization as well as clearly identify scan's clinical indication. Radiologist, technicians, and medical staff ordering CTs will complete RadIQ's Kidney Stone Module, <http://www.radiq.org/>.
    - This education module will train users how different scan parameters affect radiation dose as well as how/when to use for kidney stone evaluation.
  - RadIQ's Kidney Stone Module is designed to familiarize the user with CT low dose images as well as images that utilize filtered back projection (FBP) and iterative reconstruction algorithms.
  - Review and implement new procedures to ensure a more comprehensive medical history is given with each CT.
- *Construct* an Improvement Plan based on these findings and a process by which to implement the plan. Determine an appropriate time interval after plan implementation to allow for the plan to have its desired effect. Then proceed with re-measurement to assess improvement in Cycle #2.

**Improvement Plan:**

- Encourage radiologists and CT technicians to participate in RadIQ to familiarize them with dose reduction techniques and increase confidence in utilizing low dose CT scans.
- Review existing kidney stone CT protocols for dose optimization through an improved comprehension of scan parameters modifications and their subsequent impact on image quality.
- Create new protocols and improve labeling for kidney stone CT if necessary.
- Consider creation of second kidney stone CT protocol at even lower radiation dose for repeat evaluations. Ensure all new study descriptors are accurately labeled in DIR database and matched to correct RPID.
- Committee meets to revise protocol descriptors.

### POST-IMPROVEMENT PLAN PDSA CYCLE (Cycle #2)

*(In Cycle #2, re-measurement is performed after implementation of the Improvement Plan developed in Cycle #1.)*

#### Step 5: PLAN

- **Determine that the Improvement Plan constructed in Cycle #1 has been successfully implemented.**
  - All steps of the Improvement Plan have been successfully implemented.
- Reaffirm the Measure to be obtained.
  - Median DLP for kidney stone CT exam.
- Reaffirm the desired measurement target/goal (What does the group *want* it to be?):
  - Our target/goal is achieve a XX% decrease than the reported national average kidney stone CT scan DLP (690 mGy-cm), or less than XXX mGy-cm.
- Estimate predicted measurement result *AFTER* implementation of the Improvement Plan (What does the group think it *will* be?):
  - We predict DLP will be lower than XXX mGy-cm.

#### Step 6: DO. Repeat Measurement Summary

- Number of Data Points Collected:
  - 250 Kidney Stone CT Protocols
- Re-measurement Value obtained:
  - Median DLP = XXX mGy-cm

### Step 7: STUDY. Re-measurement Data

#### Analysis [GROUP MEETING #3]

- How did the measurement results compare to the predicted results?
  - **The actual results match the predicted (i.e. 489 mGy-cm actual vs <500 mGy-cm predicted).**
- How did the results compare the desired target goal?
  - **Our goal was obtained (i.e. 489 mGy-cm actual vs <500 mGy-cm predicted).**
- If results **did not** meet the target:
  - **Re-evaluate the Improvement Plan by determining any problems with the plan design or its implementation, including issues preventing root causes from being addressed effectively.**
  - Has the target/goal been set too high? Is an adjustment in order?
  - Is the measure the correct one?
  - Are modifications to the improvement plan warranted?
  - Proceed to Step 8.
- If results **did** meet or exceed the target: Proceed to Step 8

### Step 8: ACT. PROJECT DECISION

#### POINT [GROUP MEETING #4]

- Determine whether the group project has met its performance goal.
  - **Yes, we have met, and exceeded the target goal**
  - **If “yes,” adopt the improved practice process as a standard and proceed to a new PQI Project.**
  - **If “no,”** proceed with additional PDSA cycle(s) as needed to adjust the improvement plan or the measure target/goal. Continue the existing project either until the goal is met or an end-point is otherwise determined. *(Any improvement identified through this process is an indication of success and in some cases, the magnitude of improvement in the project measure achieved may be all that can be reasonably expected.)*

#### Step 9: Participant Self-Reflection Statement:

*(This brief narrative completes the quality improvement process. The PQI participant records his/her reflections on the project, improvements in quality/safety to which it has led, and its overall value to the practice or patient care.)*

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The education provided by RadIQ's Kidney Stone Module facilitated the development and implementation of low radiation dose CT scans for suspected kidney stone. The education modules included both theory as well as actual reduced dose CT images, allowing us to identify dose optimization techniques, create protocols consistent with low dose, as well as improve diagnostic confidence in low dose CT images. Application of these improved kidney stone CT protocols have allowed for an increase in dose optimization than reported prior to completion of the educational module. Expanding this education to other clinical indications/exams will further allow our facility to achieve dose optimization for all CT exams.

**Step 10: Each Group PQI Participant Must Attest to Project Completion in his or her ABR Personal Data Base.**

**Appendix C**      **Abbreviations**

- ABR**    American Board of Radiology
- ACR**    American College of Radiology
- CT**     Computed tomography
- DIR**    Dose Index Registry
- MOC**    Maintenance of Certification
- NRDR**   National Radiology Data Registry
- PDSA**   Plan-Do-Study-Act
- PQI**    Practice Quality Improvement

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