Increasing utilization of a rapid osteomyelitis MRI protocol to improve patient throughput

Christabell Ndibe MD*, Nadja Kadom MD, Geetika Khanna MD, Olivia Ries MS, Kiery Braithwaite MD and Ashishkumar K. Parikh, MD

*Presenter and primary author.

Email: Christabell.Chinonso.Ndibe@emory.edu

INTRODUCTION

The clinical standard for imaging evaluation of possible osteomyelitis requires MRI with and without intravenous (IV) contrast.

We developed an institutional rapid osteomyelitis (rOM) MRI protocol without the use of IV contrast or need for sedation thereby increasing throughput and decreasing scheduling delays.

The **rOM scan time is less than 15 minutes** compared to a **scan time of approximately 30-45 minutes for an osteomyelitis MRI with IV contrast**.

PURPOSE

To increase use of the rOM MRI protocol to greater than 50% in children with suspected acute musculoskeletal infection.

11-year-old with fever, left knee pain and elevated inflammatory markers

T2 STIR Coronal

T1 coronal

★ Bone marrow edema in the left distal femur metaphysis consistent with acute osteomyelitis.

- Imaging was performed using a rOM MRI protocol (utilizes **T2 STIR, T1 coronal, T2 HASTE, DWI and ADC sequences**).

METHODS

General : We used the Scientific Method for Improvement and Model for Improvement Methodologies and tested our theory with PDSA cycles. Control chart was used to monitor improvement.

Exclusion criteria: **Patients < 2 years of age, outpatients, patients with history of malignancy, sickle cell patients and history of prior surgery in the extremity.**

Context and Intervention:
Initial state analysis showed about 9% usage of the rOM MRI protocol.

Team members were a group dedicated to musculoskeletal imaging which comprised of MRI technologists, physicists, and pediatric subspecialist physicians.

Our root cause analysis showed lack of physician awareness of the availability of the rOM protocol and lack of an order set in the electronic health record (EHR) as barriers preventing its use.

Interventions: Presentations about the rOM protocol was given to our consulting colleagues in various time points between 2022-2024. A new order set for rOM was also developed and implemented in September 2023.

METHODS

Study of the Intervention: The number of MRI exams performed using the rapid osteomyelitis protocol vs. standard protocol for suspected osteomyelitis in all eligible inpatients between August 2022 and September 2024 was recorded.

Measures/Metrics:

- Rate of utilization pre and post education for awareness.
- Rate of utilization pre and post implementation of the electronic order set.

Analysis: Data analysis performed using a statistical process p chart with 3-sigma control limits.

PDSA Worksheet Project Name: Rapid Osteomyelitis

Ramp #: 1	Test #: 1	Test Start Date: Aug 22, 2022.	Test Complete Date: Oct 23, 2023.

Project SMART Aim: Increase utilization of rapid osteomyelitis MRI protocol from 9% to greater than 50% by Sept 30, 2024

What key driver does this test impact? **Clinical provider awareness.**

PLAN:

A. Briefly describe the test:

Increased education amongst clinical providers that primarily order imaging studies or consult on patients with suspected osteomyelitis. Education in form of direct presentations with relevant parties.

B: How will you measure the success of this test?

Increased awareness of the exam as seen from increased ordering of rapid/fast osteomyelitis MRI's.

C. What do you predict will happen?

There will be transient increase in orders for a rapid osteomyelitis MRI, but then will slowly taper to baseline levels

D. Plan for collection of data:

Assessing incidence of rapid MRI exams using Montage, our institutional radiology database.

E. Tasks:

List the tasks necessary to complete this test (what)	Person responsible (who)	When	Where
Education Orthopedics	Ashish	Aug 2022	Virtual
Education Hospitalists	Ashish	Apr 2023	Virtual
Education Infectious disease	Ashish	Oct 2023	Virtual

DO:

Was the Cycle Carried out as planned? ☒ Yes or ☐ No

Record Data and Observations.

Presentation to orthopedic faculty, hospitalists and infectious disease faculty at various time points on the availability and benefits of a rapid osteomyelitis MRI.

STUDY:

Did the results match your predictions? ☒ Yes or ☐ No

What did you learn? Compare the result of your test to your

There was a transient increase in the rapid osteomyelitis MRI orders after each educational intervention. This highlights the need for continued education/awareness for a sustained outcome.

Act: Decide to Adapt, Adopt or Abandon (shade one box)

☐ **Adapt.** Improve the change and continue testing the plan.

☒ **Adopt.** Select changes to implement on a larger scale and develop an implementation plan and plan for sustainability.

☐ **Abandon.** Discard this change idea and try a different one.

PDSA Worksheet Project Name: Rapid Osteomyelitis

Ramp #: 2	Test #: 2	Test Start Date: Nov 22, 2022.	Test Complete Date: Sept 1, 2023.

Project SMART Aim: Project SMART Aim: Increase utilization of rapid osteomyelitis MRI protocol from 9% to greater than 50% by Sept 23, 2024

What key driver does this test impact? **Ordering process/EPIC**

PLAN:

A. Briefly describe the test:

Implementing new order in EPIC specifically for a rapid/fast osteomyelitis MRI protocol.

B: How will you measure the success of this test?

Increased ordering of rapid/fast osteomyelitis MRI's.

C. What do you predict will happen?

Increased ordering of rapid osteomyelitis in eligible patients.

D. Plan for collection of data:

Assessing incidence of rapid MRI exams using Montage, our institutional radiology database.

E. Tasks:

List the tasks necessary to complete this test (what)	Person responsible (who)	When	Where
Develop order	Ashish/IS&T	Nov 22	CHOA
Implement Order	IS&T/EPIC	Oct 23	CHOA

DO:

Was the Cycle Carried out as planned? ☒ Yes or ☐ No

Record Data and Observations.

Order in Epic for the rapid osteomyelitis MRI rolled out Oct 2023. Soon after, significant increase in utilization of the rapid osteomyelitis MRI.

STUDY:

Did the results match your predictions? ☒ Yes or ☐ No

What did you learn? Compare the result of your test to your previous performance:

Having a rapid osteomyelitis order set on EPIC streamlined and created visibility for its availability which led to a significant increase in the number of orders placed.

There was increased rOM orders placed after an order set became available on EPIC which was higher compared to the numbers of studies completed following clinician education.

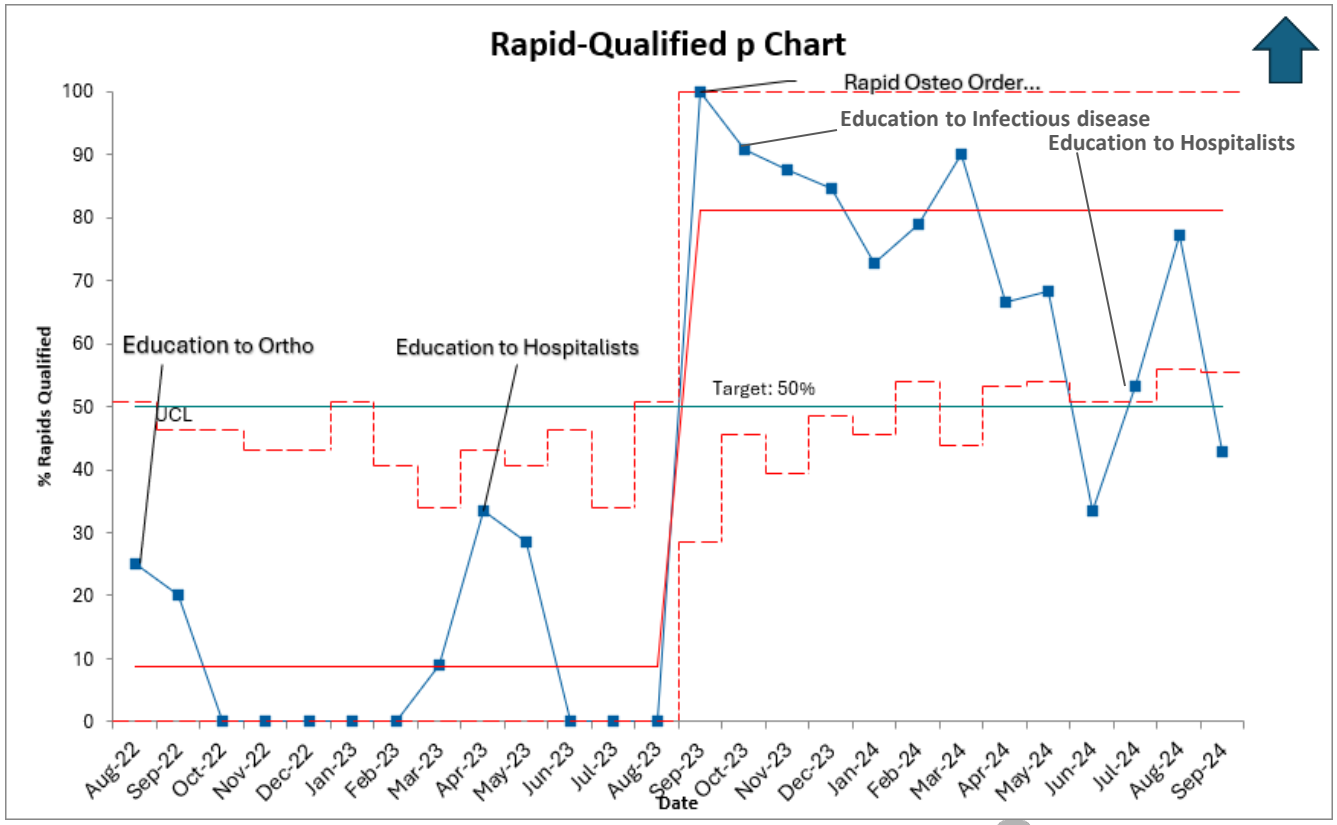
Act: Decide to Adapt, Adopt or Abandon (shade one box)

☐ **Adapt.** Improve the change and continue testing the plan.

☒ **Adopt.** Select changes to implement on a larger scale and develop an implementation plan and plan for sustainability.

☐ **Abandon.** Discard this change idea and try a different one.

Monthly Percentage of Rapid Osteo Protocol Utilization



- No sustained change with educational interventions.
- Sustained positive change with implementation of a rOM osteomyelitis order on EPIC.

Target: 50%

RESULTS

- Out of a total of 250 osteomyelitis MRIs from Aug 2022 to September 2024, 124 were performed with the rOM MRI protocol.

- This equates to an average of 50% utilization of the rOM MRI protocol which is an increase compared to the 9% usage at the inception of this quality improvement project.

DISCUSSION

- Use of our rOM MRI protocol increased transiently after educating our clinical partners.
- Creation of an order set in the EHR led to a sustained increase in the utilization of rOM MRI.
- Consistent use of this protocol in the long term will require continuous education on its availability and regular quality assurance as evidenced by the constant fluctuations in the number of studies ordered.
- A limitation of our study is the need for frequent educational presentations to our clinical colleagues as well as radiologists who might be accustomed to reading these studies with the use of intravenous contrast.