Optimization of a Prostate MRI Value Chain to Increase Patient Access and Improve Prostate Cancer Care

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Purpose

MRI is a critical tool in the diagnosis and staging of prostate cancer, but its availability can be limited by resource and workflow constraints.

We assessed the impact of a multi-faceted Continuous Quality Improvement (CQI) initiative designed to improve patient access to, and availability of, multiparametric prostate MRI (mpMRI).
Methods

The CQI initiative was implemented at a tertiary-care academic medical center which performs 70,000 MRI exams annually.

The CQI program involved:

• re-design of the prostate 3T MRI value chain;
• transition of the PI-RADS v2 compliant mpMRI protocol from scanning with an endorectal coil to scanning without;
• and re-structuring of exam/resource scheduling.

New process metrics were developed and implemented to inform and support the CQI program.

Methods

The CQI period, from April 2016 - March 2018, was divided into four consecutive 6-month intervals:

1. Observation period: baseline 3 mpMRI slots per day (endorectal technique);
2. Phase 1: 5 mpMRI slots per day; a metric for MRI exam access, the number of days to the 3rd - next available exam, was measured starting at the end of Phase 1;
3. Phase 2: 7 mpMRI slots per day; purchase of a commercially available MR software package for small field-of-view diffusion weighted imaging; introduction of a new MRI scanning protocol without an endorectal coil (maintaining PI-RADS v2 compliance);
4. Phase 3: 10 mpMRI slots per day (without endorectal coil); expanded access to three 3T MRI scanners on weekdays and weekends, including evenings.
Methods – Outcomes

Primary outcome measures:
  a. access to mpMRI (defined as 3rd‐next available appointment, measured beginning March 2017);
  b. availability of mpMRI (defined as percentage of weekly outpatient MRI operating hours from 0800‐2000 hours during which mpMRI was offered).

Secondary outcome measures:
  c. mpMRI exam volume;
  d. mean mpMRI in‐room exam time;
  e. mean time spent per day by a radiologist for endorectal coil placement;
  f. number of mpMRI exams flagged for CQI review.

Statistical process control (SPC) analysis was used for a. and chi‐squared test of proportions for f. outcome measures.

Results – Primary Outcomes

During the CQI period:
  a. mpMRI access improved significantly
     – days to the 3rd‐next available appointment decreased from 21 days in March 2017 to <1 day (same day availability) in March 2018 (p<0.0001, SPC);

  b. weekly mpMRI availability improved in each CQI phase
     – 14% (12/84 hrs) in the Observation period,
     – 24% (20/84 hrs) in Phase 1,
     – 33% (28/84 hrs) in Phase 2,
     – and 100% (84/84 hours) in Phase 3.
Results – Primary Outcomes

Figure. Monthly prostate MRI exam volume and wait time at a tertiary-care academic medical center in the northeastern United States, April 2016 – March 2018. Monthly prostate MRI exam volume (blue) is plotted on the left hand axis; wait time (orange) is plotted on the right hand axis. Dashed lines represent rolling 3-month averages. 6-month exam volume increased consecutively (blue boxes). Wait time decreased from 20 days at the start of measurement in March 2017 to <1 day in March 2018.

Results – Secondary Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Patient access to mpMRI (median, 3rd available exam)</th>
<th>mpMRI Exam availability (% of weekly hours of operation)</th>
<th>mpMRI exam volume</th>
<th>Mean monthly mpMRI volume</th>
<th>Mean mpMRI in-room time</th>
<th>Mean time for coil placement</th>
<th>mpMRI for CQI review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>n/a</td>
<td>14</td>
<td>357</td>
<td>60</td>
<td>75</td>
<td>41</td>
<td>n/a</td>
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<tr>
<td>Phase 1</td>
<td>21</td>
<td>24</td>
<td>504</td>
<td>84</td>
<td>83</td>
<td>68</td>
<td>12</td>
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<tr>
<td>Phase 2</td>
<td>2</td>
<td>28</td>
<td>634</td>
<td>106</td>
<td>64</td>
<td>61</td>
<td>15</td>
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<td>Phase 3</td>
<td>0.5</td>
<td>100</td>
<td>653</td>
<td>109</td>
<td>41</td>
<td>0</td>
<td>23</td>
</tr>
</tbody>
</table>
Results – Secondary Outcomes

Phase 2

8 AM
Prostate MRI #1
Prostate MRI #2
Prostate MRI #3
Prostate MRI #4
Prostate MRI #5

9 AM
Prostate MRI #6
Prostate MRI #7

10 AM
Prostate MRI #8

11 AM
Prostate MRI #9

12 PM
Phase 3

Radiologist time gained
+ 1 hour/day

8 AM
Prostate MRI #1
Prostate MRI #2
Prostate MRI #3
Prostate MRI #4

9 AM
Prostate MRI #5

10 AM
Prostate MRI #6

11 AM
Prostate MRI #7

12 PM

Physician Interpretation and Consultation time gained

The transition from an endorectal coil prostate MRI protocol to a non-endorectal coil prostate MRI protocol:

- reduced in-room exam time,
- reduced daily physician time for endorectal coil placement,
- and allowed mpMRI exam availability to extend beyond typical weekday/daytime hours to include night/weekend availability.

Conclusions

• A comprehensive CQI initiative resulted in improved access to and availability of mpMRI for patients.

• Optimizing the mpMRI value chain achieved:
  – same day availability,
  – nearly doubled mpMRI volume,
  – and maintained exam quality.

• Patient access to a critical resource in prostate cancer care was expanded, an important development given increasing demand for this exam.