Data driven optimization and monitoring of MR scheduling

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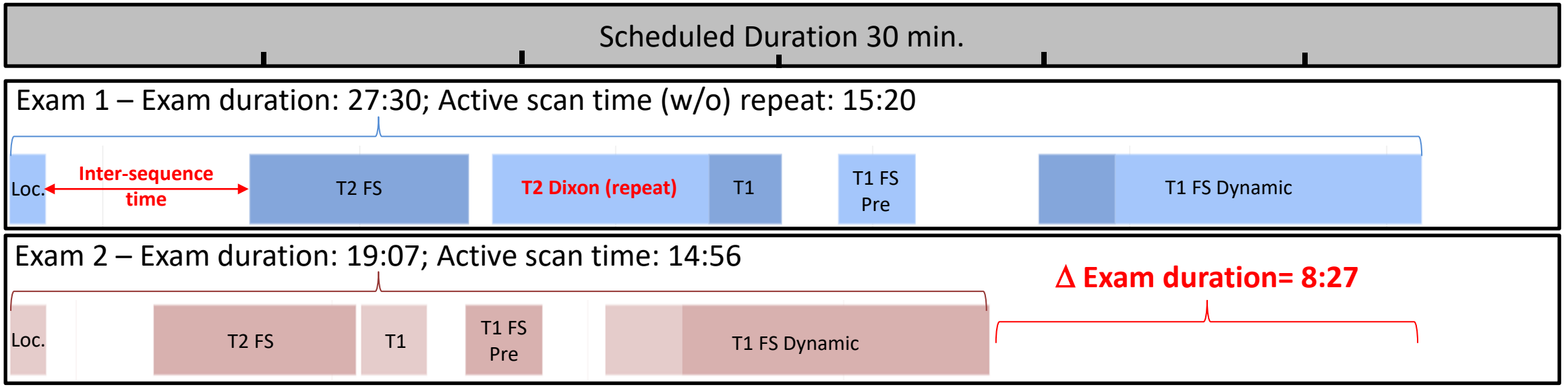
Background and Motivation

- MR exams must be scheduled in appropriate time slots to maintain operational efficiency
- Traditional methods of estimating exam durations such as scanner estimates of active scan time fail to account for the inherent variability in the process
- Comprehensive and robust quantitative information on MR exam durations would aid in optimizing MR scheduling

Variability in exam duration for consecutive screening breast exams

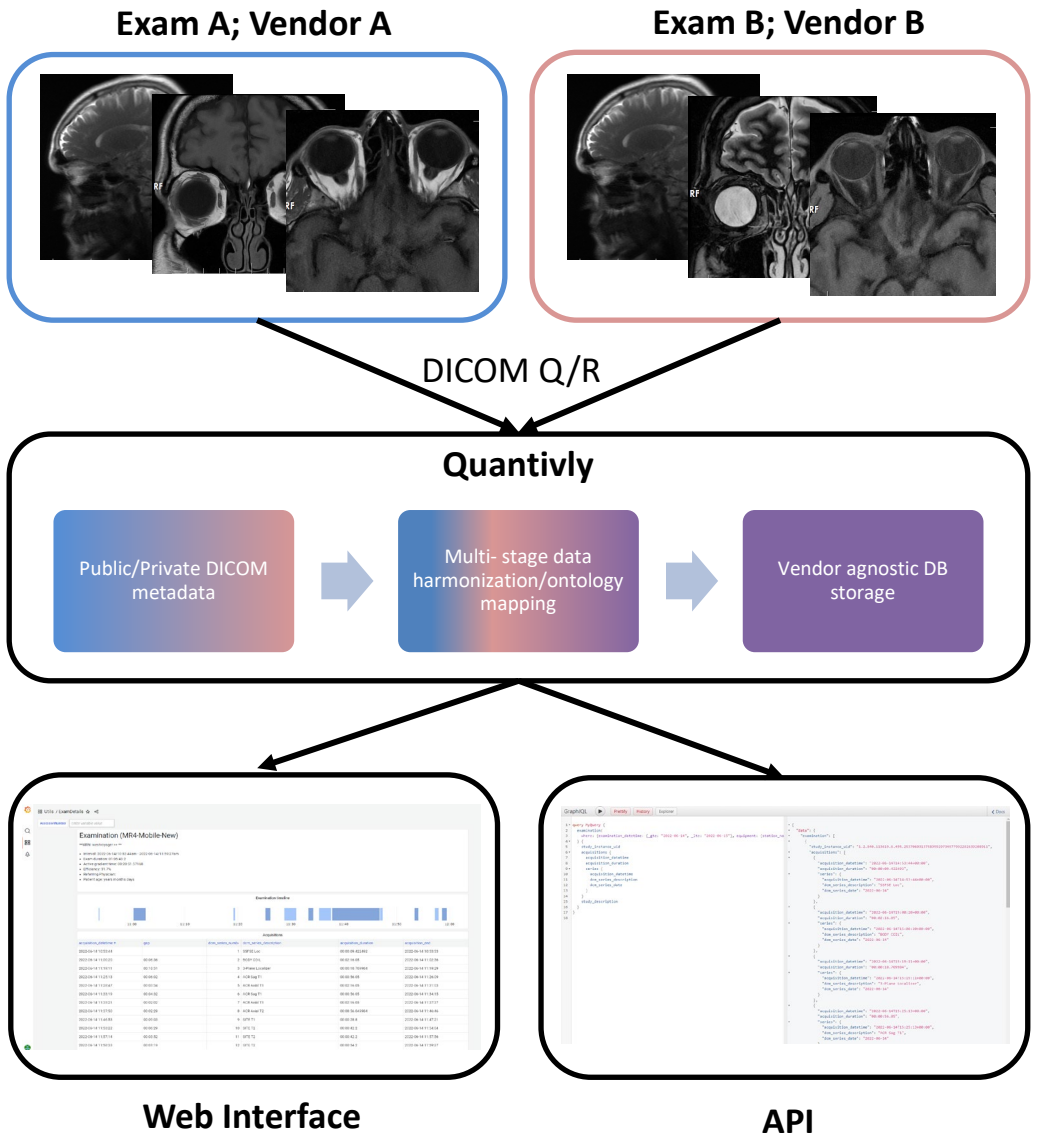


Objective

- Use historical performed exam duration data to:
  1. Identify schedule inefficiencies
  2. Design appropriate scheduling interventions
  3. Assess the impact of interventions on operational efficiency

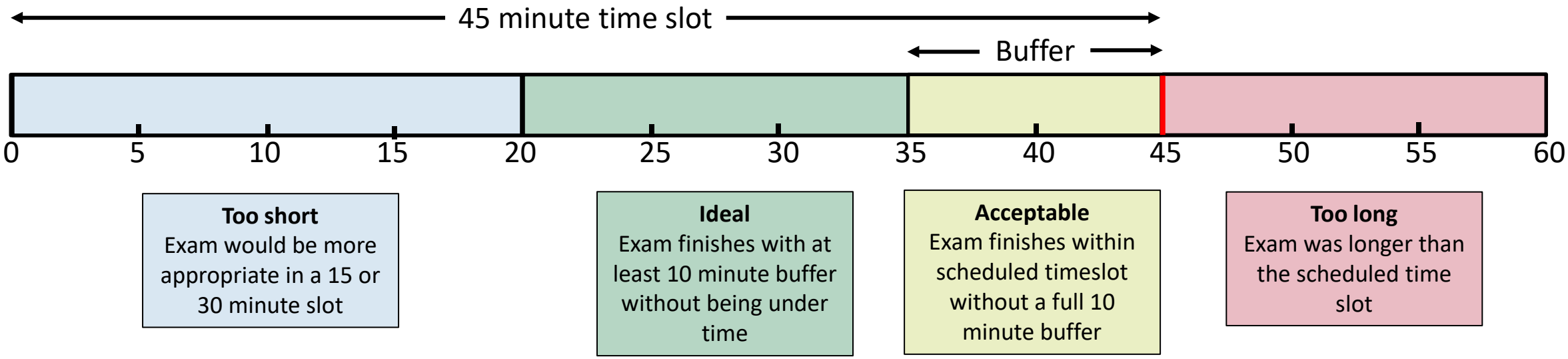
Methods: Exam Duration Data

- Exam durations were extracted from Quantivly, a software platform that harmonizes DICOM metadata in an easily retrievable and vendor agnostic format
- Exam duration data was merged with RIS data to select outpatient exams only
- High volume outpatient exams were reviewed for inefficiencies



Methods: Exam Duration Fit

- Available time slots: 15, 30, 45, 60 minutes
- A 10 minute buffer is desired to turn the room around between patients
- Each exam is considered too short, ideal, acceptable, or too long based on the assigned time slot and buffer time



Target Exams– Prostate and MRCP

	Prostate w/wo contrast (60 min.)	MRCP w/wo contrast (30 min.)
Inefficiency	• Substantial difference (~9 min) in median exam duration between 3T scanners due to scanner technology	• Majority of exams acceptable or over time • Substantial variability in exam duration likely due to variation in scanner platforms and respiratory motion management
Intervention	• Trial preferential scheduling to more efficient scanner (10/1/21-3/15/22) • Reduce scheduled time slot from 60. to 45 min. (effective 3/15/22)	• Extend scheduled time slot from 30min. to 45 min. (effective 3/15/22)
Assessment	• Percentage of exams on preferred scanner • Change in on time metrics	• Change in on-time metrics

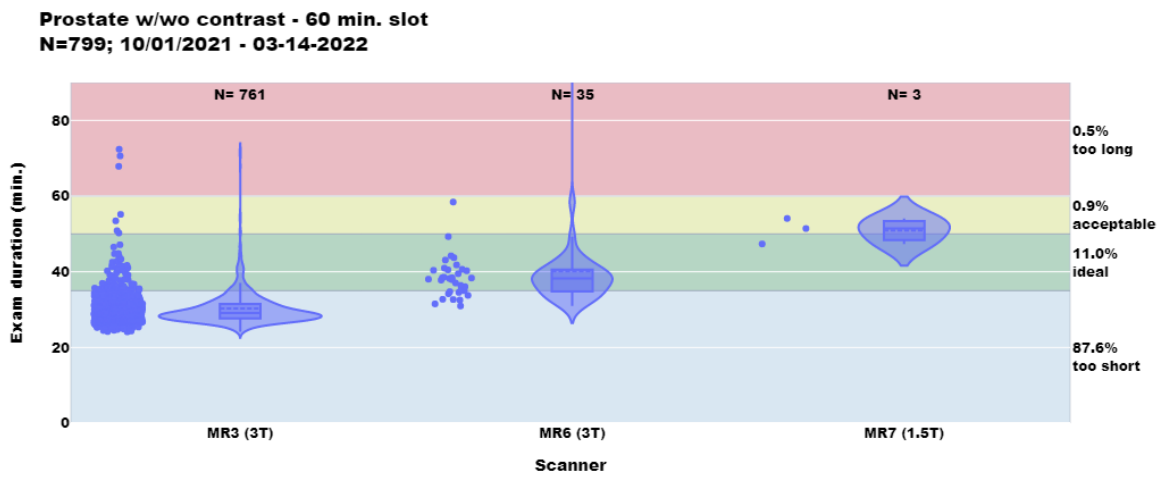
Net time made available on outpatient schedule

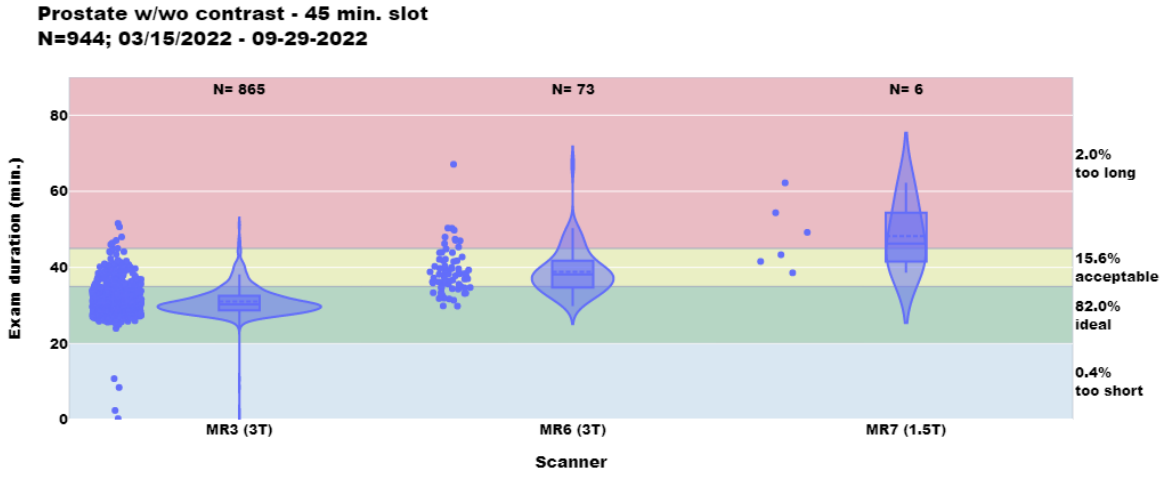
Results: Pre/Post Schedule Change

Pre-schedule change

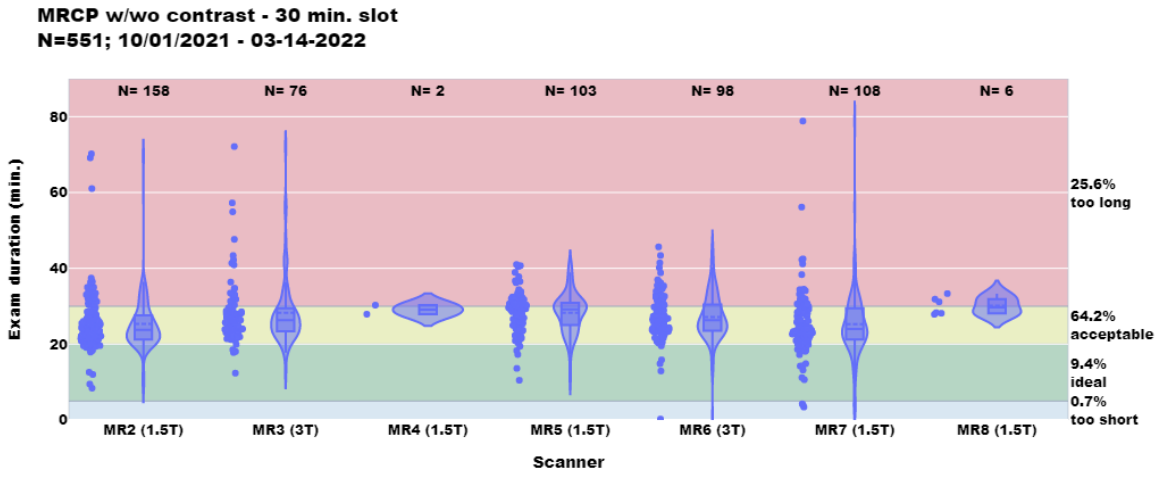
Post-schedule change

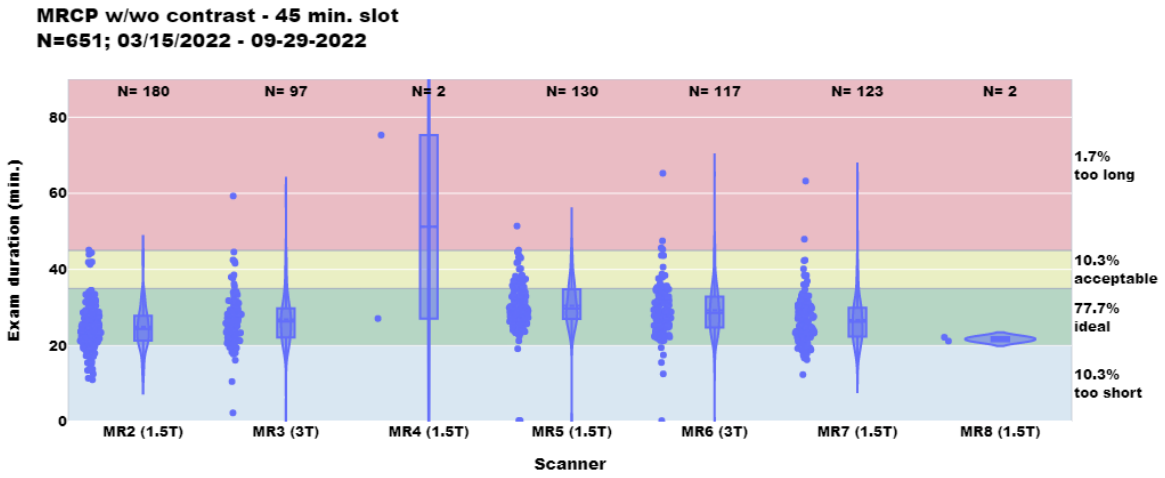
Prostate





MRCP





Results: Key Metrics

Prostate w/wo contrast

- 95% exams on preferred scanner before intervention; 92% after intervention
- Ideal exams: 11% → 82%
- Ideal or acceptable exams: 12% → 98%

MRCP w/wo contrast

- Ideal exams: 9% → 78%
- Ideal or acceptable exams: 74% → 88%

Net Impact

- 73 net hours made available on outpatient schedule after interventions
  - 2.6 hours/week
  - 133 hours/year (extrapolated)

Discussion

- Quantitative analysis of historical exam durations can be used to streamline MR operations
  - More exams finish on time → improved patient/staff satisfaction
  - Net scheduled duration decreased → potential increase in volume
- Automated analysis provides critical information on the variability in exam durations that cannot be practically obtained otherwise

Future Directions

- Repeat analysis with other exams
- Further analyze duration data to identify root causes of variability (scanner, technologist, patient etc.)
- Investigate other possible interventions beyond scheduling adjustments such as protocol changes and additional staff training