Improving Patient Follow-Up Imaging Using Artificial Intelligence

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REDEFINING RADIOLOGY

Einstein
HEALTHCARE NETWORK
More than Medicine

Financial Disclosures

None.

Background

Why recommend follow-up imaging?
- Monitor interval change versus stability
- Characterize abnormalities
- Ensure resolution of disease
- Improve outcomes with earlier diagnosis

Adverse risks of failing to comply:
- Delayed treatment
- Poor patient outcomes
- Additional unnecessary testing
- Lost revenue
- Legal liability

Previously existing compliance analysis of **Einstein** radiology reports with *pulmonary nodule* follow-up recommendations

24% adherence rate ☹

…and beyond Einstein?

12% of potential malignancies not followed up appropriately[7]

> 35% non-adherence rate of follow-up imaging recommendations[4]

Objective

To improve patient compliance rates for follow-up imaging recommendations by implementing a natural language processing (NLP) algorithm and a tracking and reminder system that:

- identifies patients who require follow-up imaging based on radiology reports
- organizes follow-up recommendations by due date
- reminds patients of due or overdue recommendations
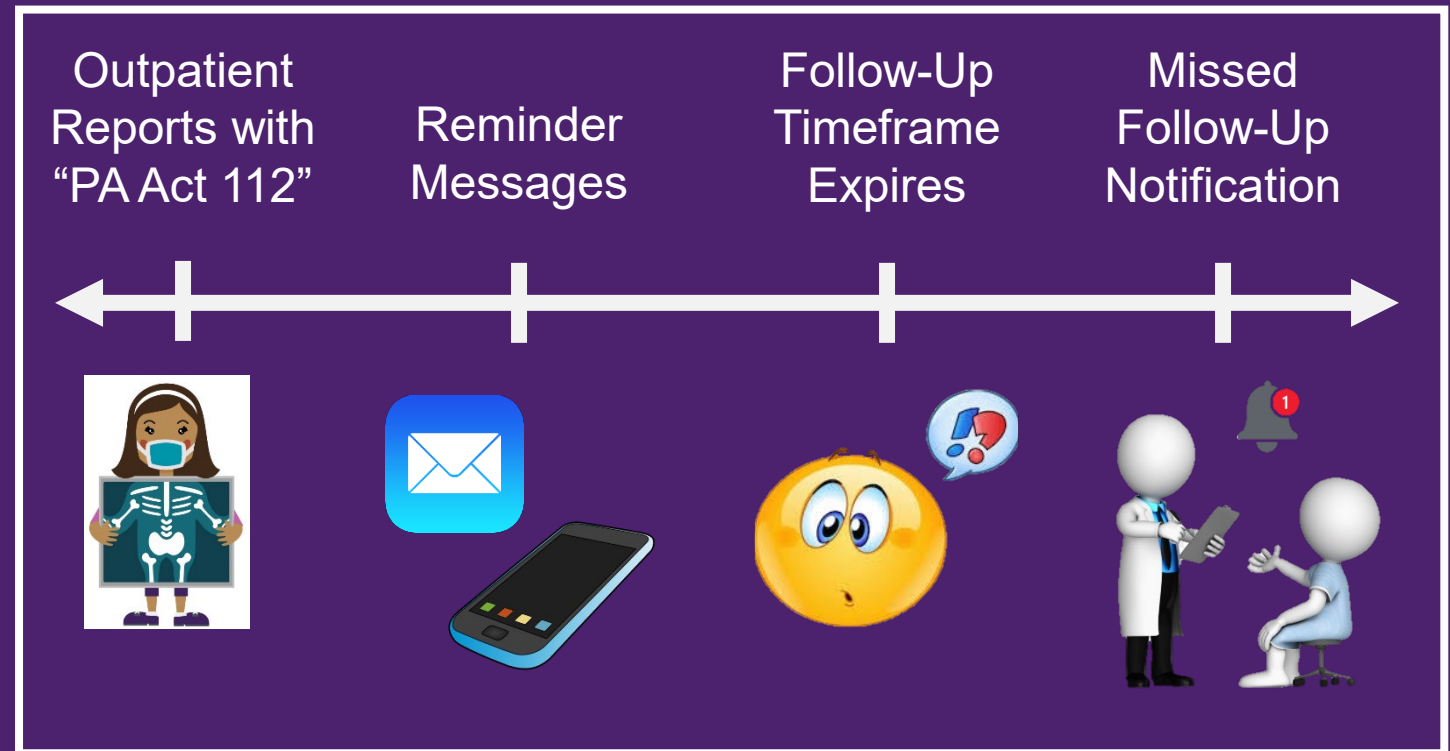
OUR GOAL

is to incorporate as much automation as possible, particularly due to the lack of a nurse navigator.

Outpatient Reports with "PA Act 112" → Reminder Messages → Follow-Up Timeframe Expires → Missed Follow-Up Notification

Methods

- All outpatient diagnostic radiology reports at our institution from January 1, 2020 through April 30, 2021 that generated an Act 112 notification

- Reports processed through a NLP algorithm (Within Health, Brooklyn, NY) to determine the following:
  - Recommended radiologic examination (modality & anatomy)
  - Recommendation due date
    - Specified in the report
    - Assumed to be 3 months from the date of the examination if no time interval was provided

- Compliance Range: defined in accordance with the American College of Radiology (ACR) as the period that begins 30 days before and ends 60 days after the due date

- Expiration Date: defined as 60 days after the due date

- Deemed compliant if recommendations with completed follow-up examinations fell within the compliance range

- Automated tracking and reminder system (Within Health, Brooklyn, NY) to determine if follow-up imaging was scheduled or completed
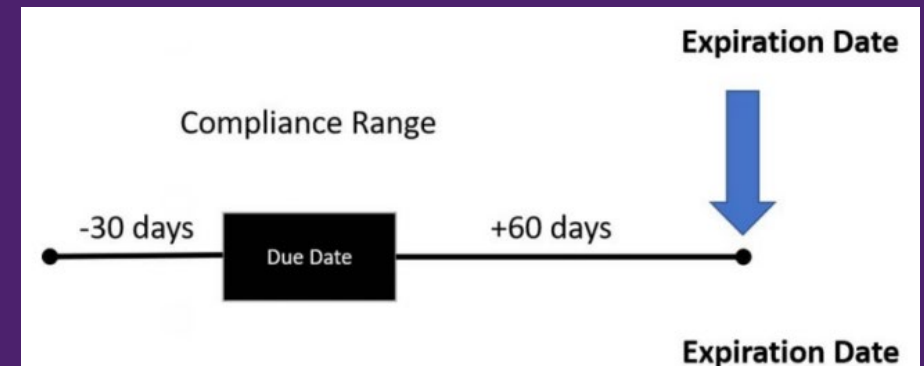
	Control Group	Intervention Group
Received initial Act 112 letter?	Yes	Yes
Received reminder messages?	No	Yes
Intervention Time Frame (includes all recommendations with expiration dates in this period)	January 1-February 28, 2021	March 1-April 30, 2021
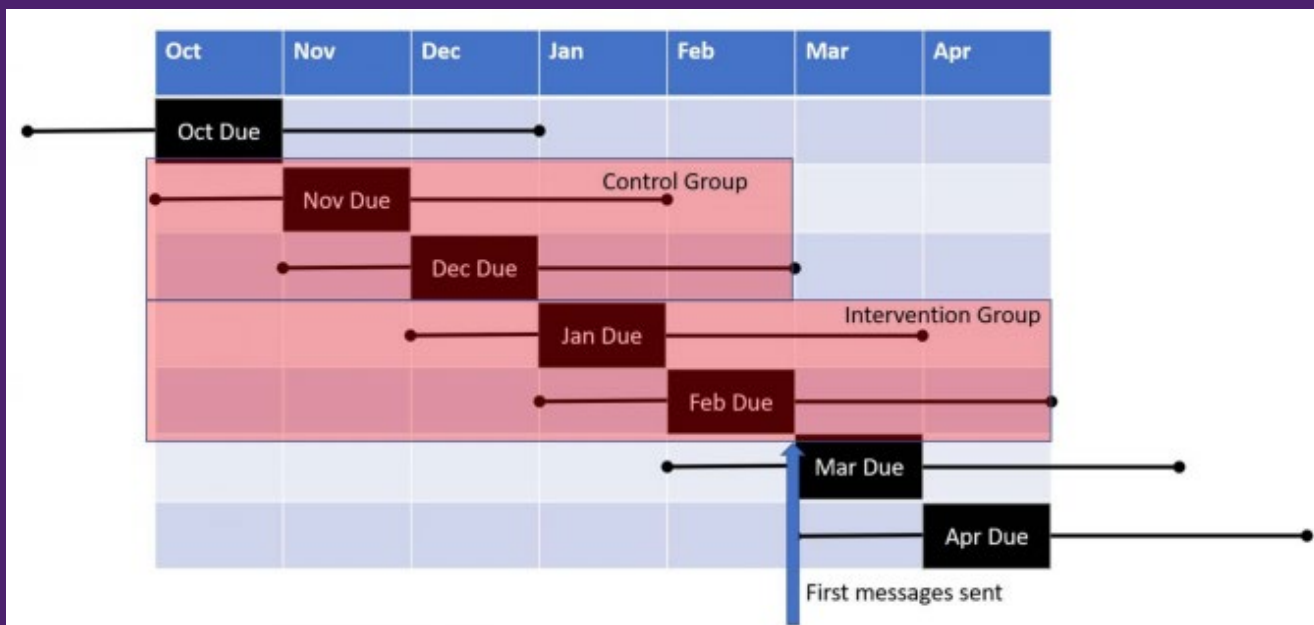
- Outcome measures:
  - Baseline compliance rate
  - At-risk population
  - Compliance rate in the at-risk population
  - Differences in the compliance rates and percentages of compliance rate change

- Fisher's exact test and chi-squared test

- Statistical significance was set at $P<0.05$

Term	Definition
Baseline Compliance Rate	Patients that already had follow-up at the beginning of the designated time period *Helps to determine patients at risk of falling out of compliance for follow-up*
At-Risk Population	Patients approaching the end of the adherence range, excluding those already at compliance *Intervention group received a short message service (SMS) communication and then up to 3 additional notifications unless/until the follow-up examination was completed or scheduled*
Compliance at End of Adherence Range	% of recommendations with completed or scheduled follow-ups at the end of the compliance period

Follow-Up Imaging Compliance Rates
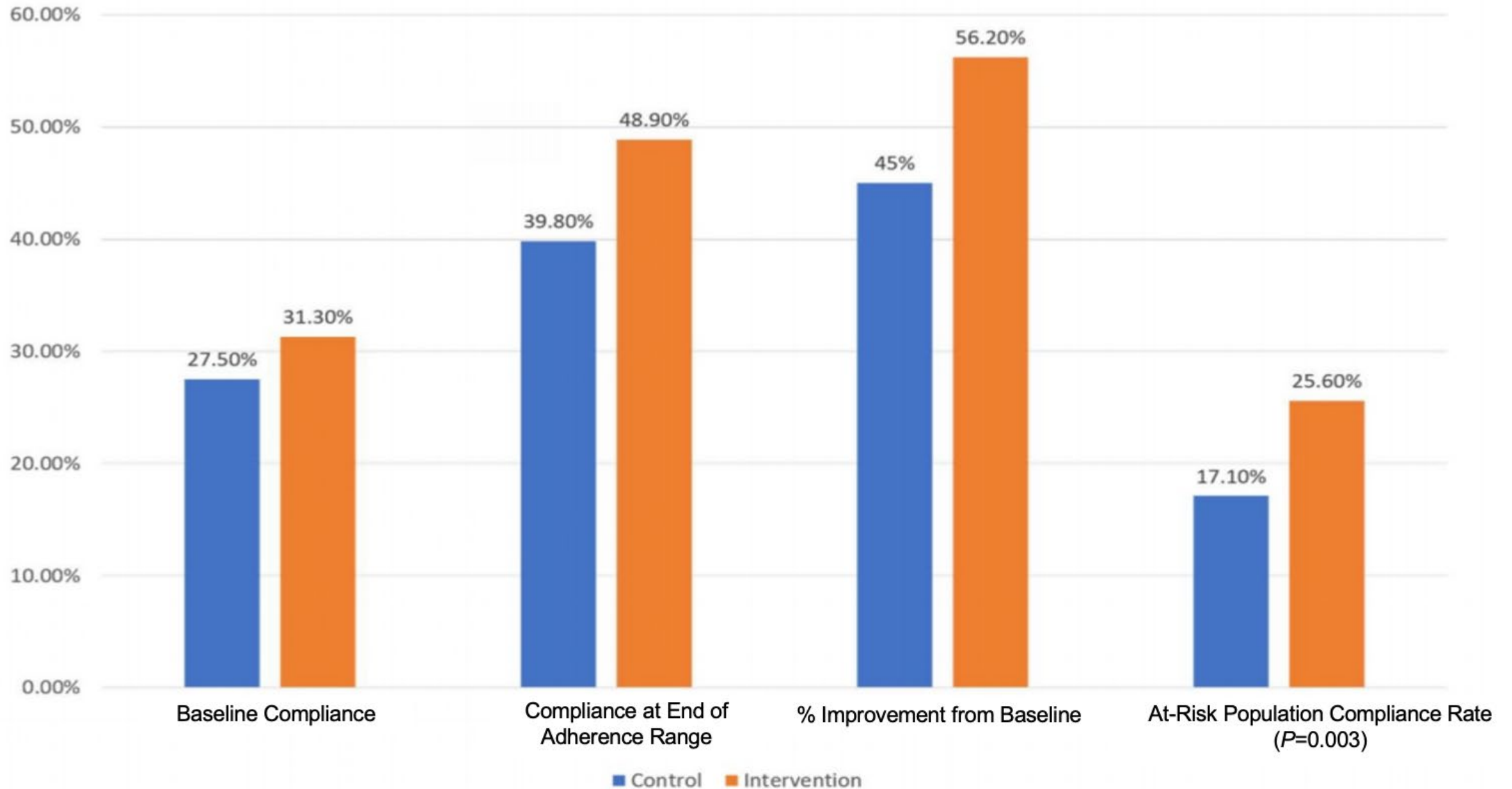
Limitations

- Only outpatients (PA Act 112)
- Heterogenous application of Act 112 amongst radiologists
  *i.e., s*ome recommended follow-up > 3 months
- Not all patients can receive SMS reminders
  - Phone number provided does not belong mobile phone
  - Phone number listed belongs to a family member or friend
- Follow-up data
  - No visibility on follow-up performed at another institution
  - No visibility on compliance if follow-up is not clinically needed per referring provider
- Prior compliance data analysis performed on lung nodule follow-up and pre-COVID using different methodology with mPower analytics
- COVID increased quarantine restrictions and decreased hospital visits

Conclusion

- Implementation of a NLP algorithm and tracking and reminder system provides automation in identifying patients with follow-up imaging recommendations and distributing reminder notifications to patients regarding due or overdue follow-up recommendations.

- Compared to patients who were only informed of follow-up recommendations by a letter at the time of the initial examination, patients receiving additional reminder notifications had significant improvement in compliance with recommended follow-up imaging.

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