Artificial intelligence identifies high risk patients lost to colon cancer screening follow up during COVID-19 pandemic

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Abstract

Introduction
The COVID-19 pandemic resulted in the complete stoppage of many colon cancer screening programs. During this time, many patients were at risk of being lost to follow up for their colorectal cancer (CRC) screening and surveillance. Here, we describe use of an artificial intelligence driven recall system to surface high risk patients potentially overdue for repeat colonoscopy and interrogate the reasons for missed recall.

Methods
We conducted a retrospective study at a tertiary care academic medical center in continuous patients who underwent an initial colonoscopy between August to October 2019 and had a follow-up recommendation for a repeat colonoscopy within 2 years of the index procedure. A natural language understanding workflow was developed by Halo Solutions LLC in which: 1) procedure reports from gGastro (Modernizing Medicine, Florida) were converted to text files using OCR, and 2) these reports were evaluated alongside linked electronic healthcare record (EHR) data to determine the timing and indication of the recall procedure. Data was then manually reviewed to assess the reasons for missing the surveillance colonoscopy. Cases were randomly checked for accuracy, reaching an accuracy rate of 96%.

Results
4663 colonoscopies were performed, of which 14% (n=677) had a recall recommendation for surveillance colonoscopy within 2 years of the index colonoscopy. Of those cases, 24% (n=162/677) were flagged as potentially overdue. Of the 162 cases, 48 were found to have missing colonoscopy orders, 31 were not contacted by scheduling, and 32 were lost to follow up despite at least 1 attempted outreach. The remaining 51 were deemed not overdue following manual review of the full record (e.g., outside records documented colonoscopy, patient expired, etc.).

Discussion
Missed CRC surveillance for patients with higher risk findings or disease processes increases the risk of patient harm from missed polyps and cancers. Nearly one in six patients who were advised to have a colonoscopy within two years of their index procedure were lost to follow up. In most EHR systems, once these patients are lost to follow up, there is no safety net to identify who these patients are. Integrating artificial intelligence into the EHR and clinical practice enables rapid identification of patients at risk of loss to follow up and allows for optimizing patient care and safety.

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INTRODUCTION

- COVID-19 pandemic resulted in the stoppage of many cancer screening programs
- During the pandemic, many patients were due for follow up screening and surveillance colonoscopy
- Many of these follow up procedures were delayed or not scheduled due to the pandemic
- The scope of the number of patients lost to follow up during the pandemic remains unknown. Manual chart review limits the ability to rapidly extract data
- We sought to use a machine learning algorithm to assess the number of patients who were due for a follow-up colonoscopy within 2 years of their initial colonoscopy but lost to follow up during the COVID-19 pandemic
- We also sought to understand why the recommended recall interval for the colonoscopy was not obtained

METHODS

- Retrospective study at a tertiary care academic medical center Beth Israel Deaconess Medical Center in Boston, MA
- Initial colonoscopy was performed between August 2019 – October 2019
- Considered patients who had a follow up colonoscopy recommended within 2 years of their initial colonoscopy
- Halo Solutions LLC developed a natural language understanding pipeline to extract data
- Data was extracted from:
  - Endoscopy writer gGastro (Modernizing Medicine, Florida) -> procedure indication and recommendations
  - Electronic Health Record (WebOMR) -> timing and indication of recall
- The machine learning algorithm extracted the data to determining timing of recall, indication for recall, if a recall order was placed in the system and if recall was performed within the recommended interval
- Cases were audited for accuracy with rates reaching 96%

RESULTS

- 4663 Colonoscopies were performed between Aug 2019 and Oct 2019
- 14% (n=677) had a recommended recall for a follow up colonoscopy within 2 years of the index procedure
- 24% (n=162/677) were flagged as being potentially overdue with no follow up procedure performed
  - 48 cases lacked a recall order
  - 31 were never contacted by scheduling
  - 32 were contacted by scheduling at least once but were lost to follow up
  - 51 (31%) were not indicated for follow up after manual review of full record
    - Surveillance procedure performed at outside facility
    - Patient expired
    - Patient declined procedure
- Most common indications for recall
  - Poor prep
  - Prior adenoma
  - Prior EMR

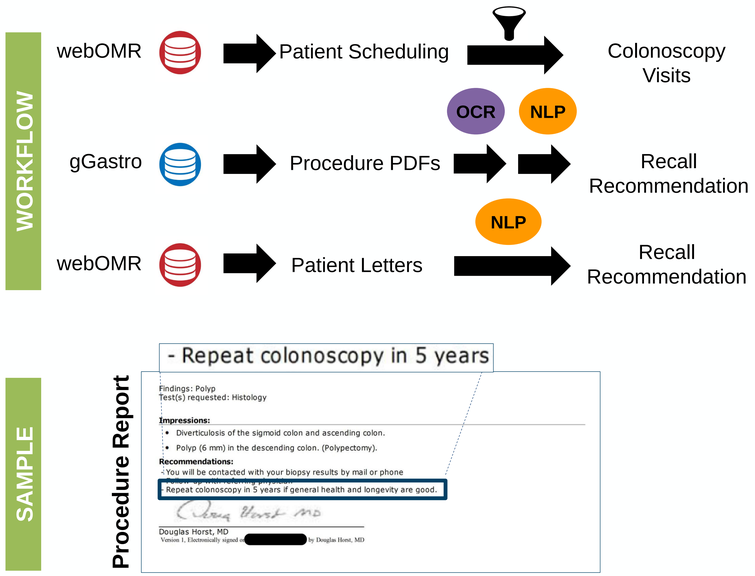

Figure 1. Use of Artificial Intelligence to Extract Clinical Data

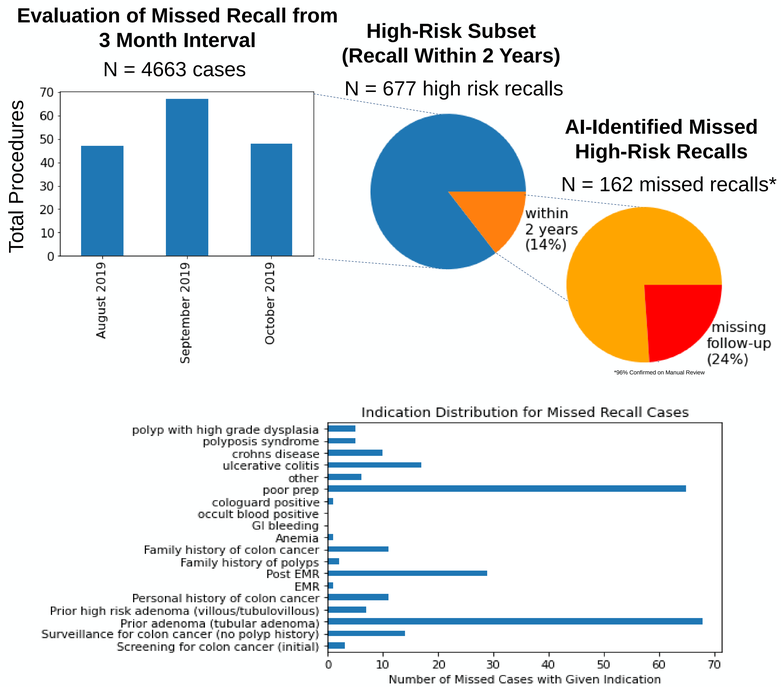

Figure 2. Missed Colonoscopies (Top) and Indications (Bottom)

CONCLUSIONS

- Up to 14% of routine screening procedures may have a recommendation for recall within 2 years
- The COVID-19 pandemic resulted in many patients failing to undergo recommended follow up procedures
- Using an AI algorithm, a large dataset of endoscopy reports and their recommended recall recommendations were extracted with high accuracy
- AI algorithm accurately identifies patients lost to follow up
- AI algorithm resulted in rapid identification of high-risk recall recommendations as well as patients in need of outreach
- AI integration may result in a safer and more effective colon cancer screening system