Leveraging Electronic Medical Record Functionality to Capture Adenoma Detection Rate

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Abstract

Introduction

Measuring the adenoma detection rate (ADR) is critical to providing quality care, however it is also challenging. We aimed to develop a tool using pre-existing electronic health record (EHR) functions to accurately and easily measure total ADR and to provide real-time feedback for endoscopists.

Methods

We utilized the Epic® EHR. With the help of an Epic® analyst, using existing tools, we developed a method by which endoscopy staff could mark whether an adenoma was detected for a given colonoscopy. Using these responses and all colonoscopies performed by the endoscopist recorded in the EHR, ADR was calculated in a report and displayed to endoscopists within the EHR. One endoscopist piloted the tool, and results of the tool were validated against a manual chart review.

Results

Over the pilot period the endoscopist performed 145 colonoscopies, of which 78 had adenomas. The tool correctly identified 76/78 colonoscopies with an adenoma and 67/67 of colonoscopies with no adenomas (97.4% sensitivity, 100% specificity, 98% accuracy). There was no difference in ADR as determined by the tool compared to manual review (53.1% vs. 53.8%, p=0.912).

Conclusions

We successfully developed and pilot tested a tool to measure ADR using existing EHR functionality.

Introduction

Widespread adoption of screening colonoscopy has coincided with a steady decline in the incidence of and mortality associated with colorectal cancer in the United States.(1) However, post-colonoscopy cancers do occur and are primarily attributed to missed cancers or pre-cancerous polyps on preceding colonoscopy.(2) Thus, maximizing the quality of endoscopic inspection is essential in reducing missed lesions and post-colonoscopy cancers. The adenoma detection rate (ADR), or the proportion of screening colonoscopies in which at least one adenomatous polyp is found, has become the established surrogate of colonoscopy quality.(3) Multiple studies have demonstrated that performance of ADR correlates with decreased incidence of post-colonoscopy cancers(3, 4) and that providing endoscopists with feedback related to their ADR can improve their ADR performance.(5, 6) This has led to the elevation of ADR as a priority quality indicator (QI) and the recommendation that all endoscopists measure their ADR to assure delivery of high-quality and high-value care.(7)

The data needed to determine ADR requires coupling of endoscopic and pathology findings which are separated by both time and location within the electronic health record (EHR). Thus, measuring ADR

requires time-intensive chart review either by individual endoscopists or designated staff. Other methods to measure ADR, including the use of natural language processing (NLP) to automatically extract data from endoscopy and pathology text, have been described (8–14); though these require complex data management systems that are likely not available to many endoscopists and are not easily transferable from one practice to another.(15) Alternatives to labor intensive manual review and complex NLP based strategies are needed. We therefore aimed to develop and validate a method using embedded EHR functions in Epic®, the most widely adopted EHR in the US marketplace(16), to facilitate both ADR reporting and feedback.

Materials And Methods

Many EHRs contain functions that allow for automated capture of structed data from EHR text notes.(17) We worked with an Epic® analyst to develop a tool using this EHR functionality to capture total ADR (tADR), or the proportion of all colonoscopies regardless of indication in which at least one adenoma is found. Total ADR has previously been shown to correlate with true ADR.(18). The primary Epic® functions we utilized were the *SmartList* and Reporting Workbench. A *SmartList* is an item of text that can be embedded in a note to produce data that can be pulled into a report. In addition to the *SmartList*, the build elements necessary for our report included a procedure grouper to identify colonoscopy procedures to the report, a custom Epic® property known as results interpreter to interrogate the endoscopist who performed the procedure, and a summary view within the report to display tADR to the endoscopist (Table 1). The *SmartList* was built to record a simple yes or no adenoma response in a note and store it to a *SmartData* element (Table 1, Fig. 1B). The number of yes responses are calculated as a percentage of all colonoscopies and reported as a simple pie chart visible to the endoscopist in the EHR (Fig. 1C). The total count of colonoscopies is determined by looking to the colonoscopy grouper and pulling in all completed procedures for a rolling 90-day lookback, then using the custom results interpreter property to filter the list to the endoscopist(s) of interest thus providing the endoscopist with a real-time tally of their tADR over the last 90 days. The report could be personalized to each endoscopist within our system by changing the name assigned in the results interpreter property. The components of the report needed to determine tADR are displayed in Table 1.

Table 1
– Build Components and Report Components required for the Epic® based tADR tool

Build Components	***SmartPhrase* – Pre-written text that can be added to a note with a simple dot-phrase.** ***SmartList* – Selectable drop-down menu of text options embedded within the *SmartPhrase.*** ***SmartData* Element – Selections from the *SmartList* stored as discrete data elements (*SmartText*) that can be prospectively recalled into a report.** **Results Interpreter – A custom Epic build by the analyst to identify and filter the colonoscopy procedure grouper by individual endoscopists.** **Dashboard Component – A summary of the report's results displayed in a pie chart format that can be added to an individual providers Epic Dashboard (the screen that is displayed when the provider initially logs into Epic).**
Reporting Workbench Components	**Colonoscopy Procedure Grouper** – pre-existing label encompassing the number of different ways the colonoscopy procedure is identified within Epic. **Results Interpreter** – this property was added to the report so that it could be customized to each individual provider. This property along with the grouper served to determine the denominator of the tADR equation. SmartData **element results** – selections from the *SmartList* stored as either "Yes" or "No" or no response (if there was no polypectomy and thus no indication to utilize the *SmartList*) pulled into the report to determine the numerator of the tADR equation.

To minimize workflow the clinical staff were instructed to embed the *SmartList* in a note at time of pathology review, and one provider was selected to prospectively pilot the tool over a 6-month testing timeframe. Provider workflow and accompanying EHR functions are displayed in Fig. 1A. Multiple Plan Do Study Act cycles were undertaken to improve the report's performance—adjusting the colonoscopy grouper—until the report captured all colonoscopies of interest with 95% sensitivity or greater after which a final 90-day audit of colonoscopies performed by the pilot endoscopist was conducted against a gold standard manual chart review. The sensitivity, specificity and accuracy of the report's ability to capture tADR were calculated against the manual chart review of the pilot endoscopist's procedures and pathology results. Informed consent was waived for this study by the Colorado Multiple Institutions Review Board (COMIRB) because all patient data was de-identified and there was no direct patient contact, nor change in the standard of medical care. This study was reviewed and approved by COMIRB (Protocol Number 19-1378) and was carried out in accordance with all relevant guidelines and regulations.

Results

One hundred and forty-five colonoscopies were included in the final 90-day validation cohort. A manual chart review found that 78 colonoscopies had at least one adenoma (ADR 53.8%). Of the 145 colonoscopies, our EHR method correctly identified 143 (98.6%). The report identified 76/78 of colonoscopies in which at least one adenoma was found and all (67/67) colonoscopies where no

adenoma was found (97.4% sensitivity, 100% specificity and 98.6% accuracy for detection of adenomas). The ADR generated by the EHR report was not clinically or statistically different from the ADR determined by gold standard manual chart review (53.1% vs. 53.8%, $p = 0.912$). The reason the two colonoscopies with adenomas were not captured by our report is because the endoscopist mistakenly did not utilize the *SmartList* at time of pathology review.

Discussion

The ADR is a high-value QI, allowing endoscopists to both measure and improve the quality of care delivered to patients. Thus, it is imperative that all endoscopists have the means to know and track their ADR, and tools to facilitate more widespread measurement of ADR have the potential to support the delivery of high-value care. Here, we describe a novel method, leveraging pre-existing infrastructure within a widely adopted EHR, to do just that. In a pilot testing environment, our tool demonstrated a high sensitivity and accuracy compared to a manual chart review, similar to what studies evaluating NLP methods report.(8–14) To our knowledge, this is the first description of a method using EHR functionality to accurately capture endoscopic QIs.

There remain weaknesses to the tool we propose. It still requires effort from clinical staff to open a note and utilize the *SmartList* at the time of pathology result documentation. This requires several extra clicks beyond the normal workflow and in our pilot study resulted in 2/78 adenoma positive results being incorrectly classified. Additionally, our tool cannot account for colonoscopy indication, completeness or prep quality; forcing us to utilize the tADR surrogate for ADR. However, as previously noted tADR is an accurate surrogate for ADR, and others have even proposed that it may be a preferred colonoscopy QI as it simplifies measurement and may prevent gaming the ADR metric by changing colonoscopy indication.(18, 19)

We believe the tool we propose has several benefits. Because our tool relies largely on pre-existing abilities imbedded within an EHR, it does not require access to specialized data management systems often needed to adopt NLP based solutions. In addition, while NLP methods are often successful at individual institutions, adapting those tools across more diverse clinical settings has proven challenging.(15) Our tool can be scaled for use by anyone using the Epic® EHR. Our tool provides real-time feedback within the EHR related to QI performance, allowing endoscopists to confront their own performance in the same interface in which they regularly manage patient care. While our tool does require some minimal effort from clinical staff, this is largely within normal clinical workflow and remains far less than what is required for manual extraction. Finally, though our tool was built using the Epic® EHR, multiple EHRs have similar discrete data macro functionalities which could allow a similar tool to be developed in different systems.(17, 20)

Further work is needed to validate this tool among a greater proportion of endoscopists and ideally among multiple centers using the Epic® EHR. Adjusting the structure of the Reporting Workbench algorithm by utilizing other macro data tools like additional *SmartLists* or flowsheets within the EHR may

also allow for capture of additional data such as colonoscopy indication, prep quality and even allow for use of a similar tool to capture QIs in other endoscopic arenas.

This pilot study demonstrates the potential to leverage existing EHR functionality to achieve accurate measurement and feedback of tADR, a reliable surrogate for ADR. This tool may present an easily adoptable alternative to complex NLP based systems or time-intensive chart review to facilitate QI measurement and assure delivery of high-value care.

Abbreviations

ADR, adenoma detection rate

QI, quality indicator

EHR, electronic health record

NLP, natural language processing

tADR, total adenoma detection rate

Declarations

Author Contributions: Drs. Jones and Patel had full access to all of the data and in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and Design: Jones, Pell, Patel

Acquisition, analysis, or interpretation of data: Jones, Espinoza, Patel, Scott, Wani, Austin, Edmundowicz, Chambers

Drafting of the manuscript: Jones, Patel

Critical revision of the manuscript for important intellectual content: Scott, Wani, Pell, Edmundowicz, Austin

Statistical analysis: Jones, Patel

Obtained funding: Jones, Patel

Administrative, technical, or material support: Espinoza, Laborde, Chambers, Austin, Edmundowicz

Supervision: Patel

Final Review and Approval of the Manuscript: Jones, Scott, Espinoza, Laborde, Chambers, Wani, Edmundowicz, Austin, Pell, Patel

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Wani: Consultant Boston Scientific, Medtronic, Cernostics, Interpace.

Edmundowicz: Consultant for and on the advisory board for Provation and Olympus

Patel: Freenome Inc (research support), Olympus America (research support), ERBE USA (honorarium)

References

1. Richardson L, Tai E, Rim SH, et al. Vital signs: Colorectal cancer screening, incidence, and mortality--United States, 2002-2010. MMWR Morb Mortal Wkly Rep. 2011;60(26):884-9.

2. Pohl H, Robertson DJ. Colorectal cancers detected after colonoscopy frequently result from missed lesions. Clin Gastroenterol Hepatol. 2010;8(10):858-64.

3. Kaminski MF, Regula J, Kraszewska E, et al. Quality indicators for colonoscopy and the risk of interval cancer. N Engl J Med. 2010;362(19):1795-803.

4. Corley DA, Jensen CD, Marks AR, et al. Adenoma detection rate and risk of colorectal cancer and death. N Engl J Med. 2014;370(14):1298-306.

5. Keswani RN, Yadlapati R, Gleason KM, et al. Physician report cards and implementing standards of practice are both significantly associated with improved screening colonoscopy quality. Am J Gastroenterol. 2015;110(8):1134-9.

6. Kahi CJ, Vemulapalli KC, Johnson CS, et al. Improving measurement of the adenoma detection rate and adenoma per colonoscopy quality metric: the Indiana University experience. Gastrointest Endosc. 2014;79(3):448-54.

7. Rex DK, Schoenfeld PS, Cohen J, et al. Quality indicators for colonoscopy. Gastrointest Endosc. 2015;81(1):31-53.

8. Gawron AJ, Yao Y, Gupta S, et al. Simplifying Measurement of Adenoma Detection Rates for Colonoscopy. Dig Dis Sci. 2020.

9. Nayor J, Borges LF, Goryachev S, et al. Natural Language Processing Accurately Calculates Adenoma and Sessile Serrated Polyp Detection Rates. Dig Dis Sci. 2018;63(7):1794-800.

10. Harkema H, Chapman WW, Saul M, et al. Developing a natural language processing application for measuring the quality of colonoscopy procedures. Journal of the American Medical Informatics Association. 2011;18(Supplement_1):i150-i6.

11. Mehrotra A, Dellon ES, Schoen RE, et al. Applying a natural language processing tool to electronic health records to assess performance on colonoscopy quality measures. Gastrointest Endosc. 2012;75(6):1233-9.e14.

12. Imler TD, Morea J, Kahi C, et al. Multi-Center Colonoscopy Quality Measurement Utilizing Natural Language Processing. Official journal of the American College of Gastroenterology | ACG. 2015;110(4):543-52.

13. Raju GS, Lum PJ, Slack RS, et al. Natural language processing as an alternative to manual reporting of colonoscopy quality metrics. Gastrointest Endosc. 2015;82(3):512-9.

14. Sohn DK, Shin IW, Yeon J, et al. Validation of an automated adenoma detection rate calculating system for quality improvement of colonoscopy. Ann Surg Treat Res. 2019;97(6):319-25.

15. Carrell DS, Schoen RE, Leffler DA, et al. Challenges in adapting existing clinical natural language processing systems to multiple, diverse health care settings. Journal of the American Medical Informatics Association. 2017;24(5):986-91.

16. Roth M. EPIC DOMINATES EMR MARKET SHARE WARS; CERNER LOSES GROUND [Website]. HealthLeaders; 2020 [updated April 30. Available from: https://www.healthleadersmedia.com/innovation/epic-dominates-emr-market-share-wars-cerner-loses-ground.

17. C. Flint A, Melles RB, Klingman JG, et al. Automated Extraction of Structured Data from Text Notes in the Electronic Medical Record. Journal of General Internal Medicine. 2020.

18. Kaltenbach T, Gawron A, Meyer CS, et al. Adenoma Detection Rate (ADR) Irrespective of Indication is Comparable to Screening ADR: Implications for Quality Monitoring. Clin Gastroenterol Hepatol. 2021.

19. Rex DK, Ponugoti PL. Calculating the adenoma detection rate in screening colonoscopies only: Is it necessary? Can it be gamed? Endoscopy. 2017;49(11):1069-74.

20. Bodagh N, Archbold RA, Weerackody R, et al. Feasibility of real-time capture of routine clinical data in the electronic health record: a hospital-based, observational service-evaluation study. BMJ Open.

2018;8(3):e019790.

Figures

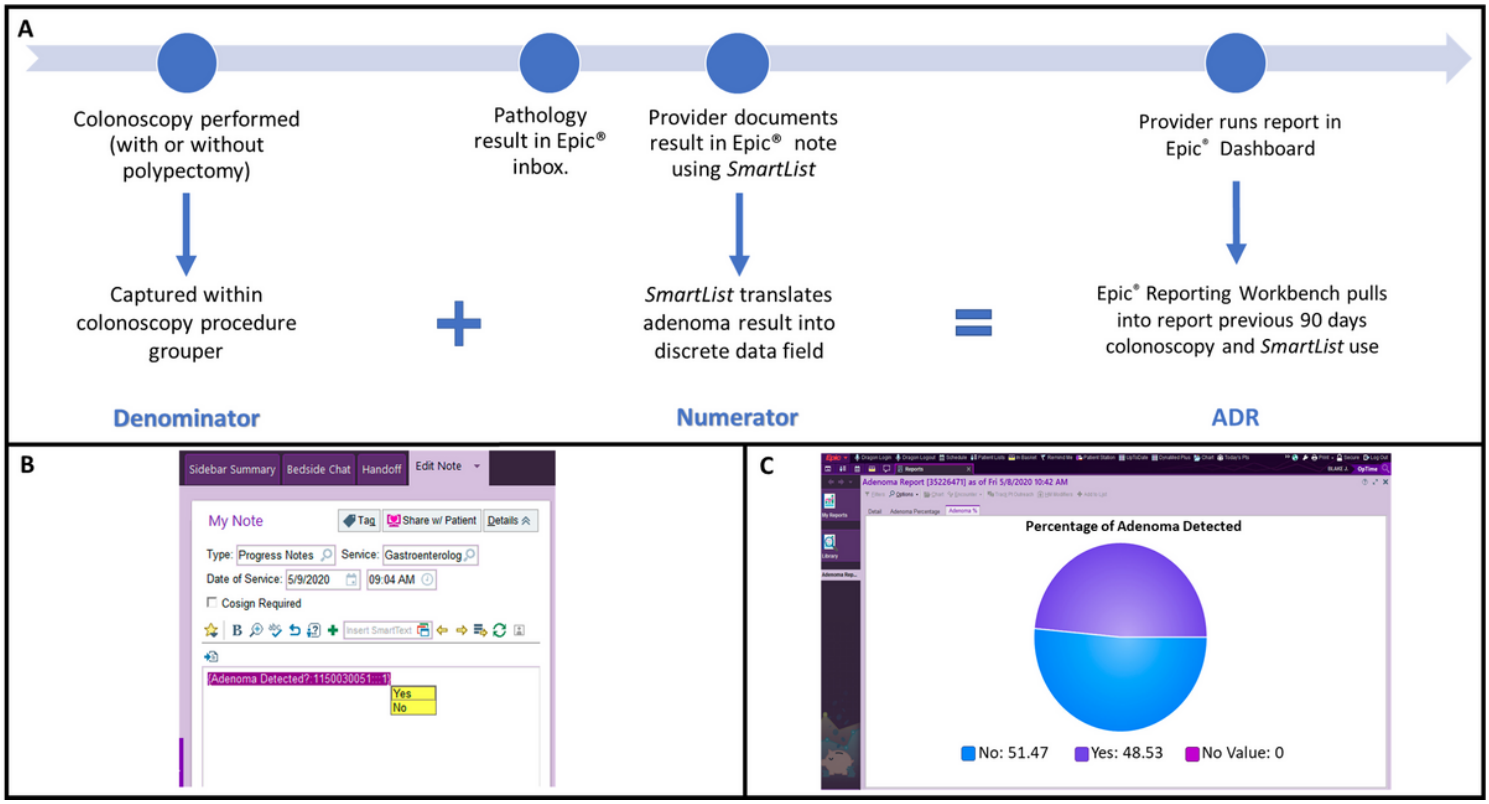

Figure 1

A. Workflow timeline for utilizing the SmartList tool. When the report is run, all colonoscopies from the previous 90 days are included and linked to instances of SmartList use in the patient's chart to calculate the tADR in the report. B. The SmartList as displayed in a simple note. C. The pie-chart display of the Reporting Workbench results representing the tADR.