Using Data and Information Systems to Measure Colonoscopy Quality

July 18, 2017

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Poll #1: What is your primary healthcare role?

• Researcher
• Operations, VACO-based
• Clinician, mental health
• Clinician, primary care
• Other
Poll #2: How many years of experience do you have working with VA data?

- One year or less
- More than 1, less than 3 years
- At least 3, less than 7 years
- At least 7, less than 10 years
- 10 years or more
Agenda

• Background: Need for colonoscopy quality metrics

• VHA priorities for colonoscopy quality

• QUERI – colonoscopy metrics
  • NLP use for colonoscopy metrics

• Adenoma detection rate

• Future directions
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Need for colonoscopy quality metrics

- Colon cancer screening reduces the incidence and mortality of colorectal cancer.

- ~200,000 colonoscopies are performed annually in VA (50-60% screening)
Quality Indicators for Colonoscopy

Proposed Thresholds

<table>
<thead>
<tr>
<th>Clean: Bowel Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope insertion: Cecal Intubation Rate</td>
</tr>
<tr>
<td>Inspection: Adenoma Detection Rate</td>
</tr>
<tr>
<td>Lesion Characterization</td>
</tr>
<tr>
<td>Polypectomy: Complete</td>
</tr>
<tr>
<td>Cancer</td>
</tr>
</tbody>
</table>

≥ 85%

≥ 95%

Men ≥ 30%
Women ≥ 20%

≥ 90%

100%

< 1%
Significance of Adenoma Detection Rate (ADR)

• The purpose of screening colonoscopy is to reduce the incidence and mortality of colorectal cancer.

• ADR is the quality indicator with the strongest association to interval or “missed” colorectal cancer after screening colonoscopy.
Evaluated Associations between ADR &:

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Adenoma Detection Rate and Risk of Colorectal Cancer and Death

Douglas A. Corley, M.D., Ph.D., Christopher D. Jensen, Ph.D., Amy R. Marks, M.P.H., Wei K. Zhao, M.P.H., Jeffrey K. Lee, M.D., Chyke A. Doubeni, M.D., M.P.H., Ann G. Zauber, Ph.D., Jolanda de Boer, M.B., Bruce H. Fireman, Ph.D., Joanne E. Schottinger, M.D., Virginia P. Quinn, Ph.D., Nirupa R. Ghai, Ph.D., Theodore R. Levin, M.D., and Charles P. Quesenberry, Ph.D.

ABSTRACT

BACKGROUND
The proportion of screening colonoscopic examinations performed by a physician that detect one or more adenomas (the adenoma detection rate) is a recommended quality measure. However, little is known about the association between this rate and patients’ risks of a subsequent colorectal cancer (interval cancer) and death.

- Interval Cancer risk up to 10 years
- Advanced cancers
- Cancer deaths
- Across range of ADRs to evaluate for threshold

ADR is Correlated with Interval Cancer

- 314,872 colonoscopies performed by 136 gastroenterologists at 17 medical centers with 3.3 million members

- ADR range: 7.3 - 52.5%

- Linear relationship across 5 quintiles of ADR from lowest to highest
ADR is Correlated with Interval Cancer

- Each 1% increase in ADR associated with:
  - 3% decrease in interval CRC risk (HR, 0.97, 95%CI: 0.96-0.98)
  - 4% decrease in CRC death risk
  - No threshold effect above which increases in ADR were without benefit

### Table 2. Adenoma Detection Rate and Risk of an Interval Colorectal Cancer among All Patients.

<table>
<thead>
<tr>
<th>Adenoma Detection Rate</th>
<th>Interval Cancer</th>
<th>Hazard Ratio (95% CI)*</th>
<th>Unadjusted Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous rate</td>
<td>712</td>
<td>0.97 (0.96–0.98)</td>
<td>7.7</td>
</tr>
<tr>
<td>Rate quintile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 1: 7.35–19.05%</td>
<td>186</td>
<td>1.00 (reference)</td>
<td>9.8</td>
</tr>
<tr>
<td>Quintile 2: 19.06–23.85%</td>
<td>144</td>
<td>0.93 (0.70–1.23)</td>
<td>8.6</td>
</tr>
<tr>
<td>Quintile 3: 23.86–28.40%</td>
<td>139</td>
<td>0.85 (0.68–1.06)</td>
<td>8.0</td>
</tr>
<tr>
<td>Quintile 4: 28.41–33.50%</td>
<td>167</td>
<td>0.70 (0.54–0.91)</td>
<td>7.0</td>
</tr>
<tr>
<td>Quintile 5: 33.51–52.51%</td>
<td>76</td>
<td>0.52 (0.39–0.69)</td>
<td>4.8</td>
</tr>
</tbody>
</table>
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VHA Priorities for Colonoscopy Quality

1) Colonoscopy quality monitoring is now required

2) Benchmarking of individual providers & facilities

3) Facilitate focused and ongoing professional practice evaluations
COLORECTAL CANCER SCREENING

1. REASON FOR ISSUE: This Veterans Health Administration (VHA) Directive provides policy on various modalities for providing colorectal cancer (CRC) screening for VA medical facilities.

2. SUMMARY OF MAJOR CHANGES: This Directive is being revised to update the responsibilities of the medical facility Director to include ensuring the quality of colonoscopy as well as monitoring requirements. It also updates recommended screening tests, which are now based upon the screening guidelines coordinated by the VHA National Center for Health Promotion and Disease Prevention (NCP). Guidance has been clarified to increase flexibility in recommending screening options. Other changes include the addition of colonoscopy quality monitoring and recommendations for optimizing bowel preparation.

3. RELATED ISSUES: None.

4. RESPONSIBLE OFFICE: Specialty Care Services (1OP4E) is responsible for the contents of this Directive. Questions may be directed to National Program Director for Gastroenterology at 202-461-7160.


6. RECERTIFICATION: This VHA Directive is scheduled for recertification on or before the last working day of December 2019.

Carolyn M. Clancy, M.D.
Interim Under Secretary for Health

DISTRIBUTION: Emailed to the VHA Publications Distribution List on 12/31/2014.

Directive states that:

1. the Chief of Staff at each medical facility must assess the quality of screening colonoscopy using three specific metrics (bowel prep quality, cecal intubation rate, & ADR)

2. a minimum of 30 records per provider must be assessed annually.
Challenges to Reporting Colonoscopy Quality Metrics

No reliable, efficient way of tracking procedure & pathology results to measure colonoscopy quality for the national Veteran population.

• Significant variability in the documentation of colonoscopy reporting, including procedure note titles.

• Most colonoscopies documented using a text note in Vista/CPRS

• No uniformity of endoscopic report-generating applications (i.e. Endopro, Provation, etc) to facilitate quality measurement.

• None of the current endoscopy reporting programs link to pathology (to determine ADR); and Production level pathology data are not YET in the CDW.
Significant Time & Resources Needed to Report Colonoscopy Quality Metrics

> 5000 person hours/year!

• Directive will require manual chart review of 30 patients per endoscopist (x 500 VHA endoscopists x 20 minutes per chart) for a total of least 5000 person hours (125 person weeks) of time per year.

• Twice as many charts will need to be reviewed to simply select colonoscopies that were done for screening purposes.
Quantitative Assessment of Colonoscopy Quality Measurement

National VA Survey of GI Section Chiefs:

• 90% manual measurement of quality metrics

• 38% not measuring adenoma detection rate (ADR)

• >50% interested in national measurement and reporting
Aim 1: To generate a standardized assessment of colonoscopy quality metrics (ADR, cecal intubation rate & bowel preparation quality) that can be applied to national VHA data.

Aim 2: To test the validity of these metrics (as compared with chart review) at VHA facilities.

Aim 3: To develop a colonoscopy quality report card that is useful to front-line providers and facilities.
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QUERI Quality Colonoscopy Metrics

- Bowel preparation
- Cecal intubation
- ADR
Operational Partners

• GI National Program Office
• GI Field Advisory Committee
• VINCI
• CDW
• HSR&D Center of Innovation: Salt Lake Informatics, Decision-enhancement and Analytic Sciences (IDEAS 2.0) Center
• VA Colonoscopy Collaborative
NLP Development Team

- Domain Experts - Tonya Kaltenbach, Andrew Gawron, Samir Gupta
- NLP Developers - Will Thompson, Olga Patterson, Guy Divita
- Infrastructure - Yiwen Yao
- Annotations - VINCI
- Architecture - Bill Scuba
System Overview of Automated Workflow

- New reports can be generated at any appropriate time interval – daily, weekly, monthly, etc.
Manual Annotation of Gold Standard

CDW
Sample Documents
Colonoscopy Procedure Notes
Pathology Reports
Examination Extent
Bowel Prep
Colonoscopy Report
Indication
Histological Findings
Training
Testing
Manual annotations of sample procedure and pathology reports for gold standard
7/18/2017
NLP Annotation Subsystems
NLP Performance Measurement

Objective: > 90%

PPV (precision) & Sensitivity (recall)

How many selected items are relevant?

Precision = \frac{\text{true positives}}{\text{true positives} + \text{false positives}}

How many relevant items are selected?

Recall = \frac{\text{true positives}}{\text{true positives} + \text{false negatives}}
Exam Extent

- ...reached the cecum
- ...identified by appendiceal orifice and ileocecal valve
- ....advanced to terminal ileum
- ...advanced 90cm...
Exam Extent

...Cecum was confirmed by visualization of the ileocecal valve and appendiceal orifice...

-Colonoscopy Procedure Notes-

-Sectionizer
-Tokenizer
-Anatomical Sites
-Exam Extent Patterns

[Reached: CECUM]
[Visualized: IC_VALVE]
[Visualized: APPENDEICEAL_ORIFICE]

Structured Data
Indication

- low risk screening for colon polyps...
- repeat colonoscopy with history of previous polyps
- family history of colorectal cancer in first degree relative
- recent change in bowel habits
Indication

Indication: screening for colorectal cancer. Personal history of polyps.

Indication: screening for colorectal cancer. Personal history of polyps.
Bowel Preparation Quality

• **Aronchick Scale**, *Aronchick CA. GIE 2004*
  • Qualitative global assessment based on % mucosal surface seen, amount of liquid/solid stool present

• **Boston Bowel Prep Scale**, *Lai EJ GIE 2009*
  • 4 point score applied to 3 regions of the colon: right, transverse & left

• **Ottowa Bowel Prep Scale**, *Rostom A GIE 2004*
  • 14 point score calculated by adding 0-4 ratings for each colon segment (right, mid, rectosig) and 0-2 global fluid quality rating
The quality of the bowel preparation was evaluated using the BBPS (Boston Bowel Preparation Scale) with scores of Right Colon = 1 (something something something), Transverse Colon = 3 (something something something), and Left Colon = 3 (something something something something). The total BBPS score equals 7. The bowel prep was good.
Colonoscopist of Record

Provider: physicians and staff from vha/ccd

Procedure:
Procedure was done by Dr. Jane Smith (attending), under the direct supervision of Dr. Jennet Williams

Signed by: Dr. Jennet Williams

Structured Data

[Colonoscopist: [Name: Jane Smith, Role: Attending]]
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Pathology

Colonoscopy Pathology Reports

A. Polyp, ascending colon
- Tubular adenoma
- Hyperplastic polyp

A. Polyp, ascending colon
- Tubular adenoma
- Hyperplastic polyp

Sectionizer
Tokenizer
Dictionary
Histology Patterns

[Finding: TUBULAR_ADENOMA]
[Finding: HYPERPLASTIC_POLYP]

Structured Data
Adenoma Detection Rate?

Colonoscopy Pathology Reports

- A. Polyp, ascending colon
  - Tubular adenoma
  - Hyperplastic polyp

- A. Polyp, ascending colon
  - Tubular adenoma
  - Hyperplastic polyp

Sectionizer
Tokenizer
Dictionary
Histology Patterns

Structured Data

[Finding: TUBULAR_ADENOMA]
[Finding: HYPERPLASTIC_POLYP]
Components to Calculate Adenoma Detection Rate (ADR)

**Definition:** ADR is the number of screening patients with at least one adenoma divided by total number of consecutive patients aged 50 years or older screened with colonoscopy.

Variables needed for calculation:

1. extent exam
2. indication
3. bowel preparation
4. pathology

Notes:

- If incomplete due to inadequate prep, patient discomfort, etc, or indication is surveillance or diagnostic, then procedure is not included in the calculation.
- Reference standard of adenoma diagnosis is histopathology
Simplifying the Process of Calculating ADR

1. Report ADR for All Exams (not only screening)

2. Adenoma “Mention” Rate as surrogate for ADR

3. Report ADR for all levels of Providers
ADR: Can we report for all Indications or only screening exams?

<table>
<thead>
<tr>
<th></th>
<th>Screening</th>
<th>Any</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants</td>
<td>49%</td>
<td>50%</td>
<td>0.55</td>
</tr>
<tr>
<td>(n=2638)</td>
<td>(43, 56)</td>
<td>(45, 56)</td>
<td></td>
</tr>
<tr>
<td>Site 1</td>
<td>51%</td>
<td>51%</td>
<td>0.97</td>
</tr>
<tr>
<td>(n=993)</td>
<td>(39, 63)</td>
<td>(46, 55)</td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>50%</td>
<td>50%</td>
<td>0.27</td>
</tr>
<tr>
<td>(n=1645)</td>
<td>(42, 53)</td>
<td>(43, 58)</td>
<td></td>
</tr>
</tbody>
</table>

Adenoma detection rate did not vary between screening and any indication
ADR Simulation Model

![Bar chart showing adenoma detection rates for different simulation scenarios. The chart compares detection rates for screening and overall outcomes in Simulation 4 and Simulation 5.](image)
Adenoma “Mention” Rate

• Adenoma “mention” rate (AMR): Associated pathology results with an adenoma mention divided by colonoscopy procedures identified.

• Simple text searching to query for “adenoma” or “adenomatous” text mentions.

• Validation: Manually reviewed 100 procedures (50 with and 50 without pathology results) each from 3 sites (N=300) representing high, medium, and low AMR.

• Compared AMR to a known ADR independently determined at a single high volume site over two years by manual chart review.
Adenoma “Mention” Rate

AMR: 40.0% across all sites ranged from 12.5% - 62.1%

84% sensitivity and 100% specificity, compared to ADR
Welcome to SCS Endoqual SharePoint site:

Report (alpha-testing)

- Provider Score Card Report
  - Provider-level
  - Hospital-level
Report Card

Report Card Data captured 97% of procedures for 2015
**Colonoscopy Procedures Counts by Provider**

**Provider name: GAWRON, ANDREW J**

<table>
<thead>
<tr>
<th>Month</th>
<th>Procedure Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>6</td>
</tr>
<tr>
<td>February</td>
<td>12</td>
</tr>
<tr>
<td>March</td>
<td>13</td>
</tr>
<tr>
<td>April</td>
<td>5</td>
</tr>
<tr>
<td>May</td>
<td>8</td>
</tr>
<tr>
<td>June</td>
<td>8</td>
</tr>
<tr>
<td>July</td>
<td>11</td>
</tr>
<tr>
<td>August</td>
<td>3</td>
</tr>
<tr>
<td>September</td>
<td>8</td>
</tr>
<tr>
<td>October</td>
<td>6</td>
</tr>
<tr>
<td>November</td>
<td>12</td>
</tr>
<tr>
<td>December</td>
<td>5</td>
</tr>
</tbody>
</table>

**Year: 2015**

![Provider Procedure Count Chart](chart.png)
Adenoma Detection is Not Innate Training & Monitoring is Important
Leadership training to improve adenoma detection rate in screening colonoscopy: a randomised trial

Michal F Kaminski,1 John Anderson,2 Roland Valbi,3 Ewa Kraszewski,1 Miecz J Rupinski,1 Jacek Pachlowski,1 Ewa Wrzoska,1 Michael Brehmeyer,4,5 and Sławomir Thomas-Gibson6,7

ABSTRACT

Objective: Substantial adenoma detection rate (ADR) at colonoscopy is associated with increased risk of interval colorectal cancer. It is uncertain how ADR might be improved. We compared the effect of leadership training versus feedback only on adenoma quality in a countryside randomized trial.

Design: 40 colonoscopy screening centres with suboptimal performance in the Polish screening programme centre leader ADR (≤ 35% during pre-intervention phase January to December 2011) were randomized to either a Train-Colonoscopy-Leaders (TCL) programme (assessment, hardware training, post-training feedback) or feedback only (individual quality measured). Colonoscopies performed June to December 2012 (early post-intervention) and January to December 2013 (late post-intervention) were used to calculate changes in quality measures. Primary outcome was change in leaders’ ADR. Mixed effect models using OR and 95% CI were calculated.

Results: The study included 24 TCLs (colonoscopies performed by 28 leaders) and 16 TCLs (colonoscopies performed by 18 endoscopists) at the participating centres. The absolute difference between the TCL and feedback group in mean ADR improvement of leaders was 7.1% and 4.2% in early and late post-intervention phases, respectively. The TCL group had larger improvement in ADR in early (OR 1.60, 95% CI 1.32 to 2.01, P = 0.0001) and late (OR 1.33, 95% CI 1.10 to 1.66, P = 0.002) post-intervention phases. In the late post-intervention phase, the absolute difference between the TCL and feedback groups in mean ADR improvement of endoscopists was 3.9% (OR 1.29, 95% CI 1.14 to 1.50, P = 0.017).

Conclusions: Teaching centre leaders in colonoscopy caused improved important quality measures in screening colonoscopy.

Trial registration number NCT01667198.

INTRODUCTION

During recent years, several studies have shown that important patient outcomes measures such as interval cancer rates after screening colonoscopy are often related to quality of hospitals and individual physicians.1-3 However, there is a lack of high-quality studies investigating the effect of quality improvement interventions on patient outcomes.

Screening colonoscopy is widely used for prevention and early detection of colorectal cancer (CRC).4 High quality colonoscopy achieving accurate detection and removal of adenomas is considered key to screening effectiveness.5-7 Professional societies recommend that endoscopists measure quality indicators such as adenoma detection rate (ADR), carcinoid tumour rate (CTR) and colonoscopy withdrawal time.8-9 We have previously shown that an individual endoscopist’s ADR is an independent predictor for interval cancer after screening colonoscopy.10 Recently, a large US study confirmed this association and expanded it to include CRC death.11 Thus, adenoma detection is of paramount importance for the success of CRC screening programmes. However, it has been uncertain how to improve ADR in endoscopists with suboptimal performance.

Significance of this study

What is already known on this subject?

Suboptimal adenoma detection at colonoscopy is associated with increased risk of interval colorectal cancer and colorectal cancer death.

What are the new findings?

- Dedicated Train-Colonoscopy-Leaders course significantly improved adenoma detection rate, proximal adenoma detection rate, and nonpolypoid lesion detection rate in screening colonoscopy.

- The training of screening centre leaders in teaching high quality colonoscopy changed their own practices and had significant effect on overall centre performance.

- The Train-Colonoscopy-Leaders course has sustained effect on colonoscopy performance over 1.5 years.

How might it impact clinical practice in the foreseeable future?

- Developed training curriculum may help to improve adenoma detection rate and nonpolypoid lesion detection rate at colonoscopy.
Increases in ADRs from Individual Providers Reduces Interval Cancer

- 294 Endoscopists, Poland
- Annual feedback & quality benchmark indicators
- Increase in ADR associated with reduction in interval cancer
  - Incidence, 0.63 (0.45-0.88)
  - Death, 0.50 (0.27-0.95)

Kaminski MF, Wieszczy P, Rupinski M et al. Gastroenterology 2017

7/18/2017
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Future Directions

• Testing of NLP Pipelines

• Validation of Simplified ADR Metric

• Qualitative Study on Report Card Dash

• Evaluation and Training Initiatives
For further information:

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Measurement Science QUERI, Colonoscopy Quality
Associate Professor of Clinical Medicine, UCSF
Director of Advanced Endoscopy, San Francisco VA
Next QUERI Presentation

Tuesday, August 15, 2017
12 pm ET

Using VA Data to Inform the Design of Partnered Randomized Program Evaluations

Melissa Garrido, PhD
James J. Peters VA Medical Center GRECC
Bronx, New York

Taeko Minegishi, MS
VA Boston Healthcare System