

Involvement of Gastroenterology Fellows in Colonoscopy Improves the Adenoma Detection Rate: A Retrospective Cohort Study

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Abstract

Background: The quality of colonoscopy is sometimes questioned by the patient, the family and even the endoscopist when a trainee is involved in the procedure. The adenoma detection rate (ADR) has emerged as the main quality measure for colonoscopy due to its inverse correlation with colorectal cancer (CRC) incidence. Few studies have evaluated the impact of involvement of trainees on the quality of colonoscopy, with conflicting results.

Aims: We aimed to evaluate the effect of fellow involvement on ADR and polyp detection.

Methods: A retrospective chart review was conducted for outpatient colonoscopies (December 2013 to April 2015) done for patients 40-85 years old which were complete and were performed by academic gastroenterologists. Colonoscopies with inadequate bowel preparation were excluded.

Results: 1100 patients were included. Indication was screening or surveillance in 60%. Most were males (93%), and 50% were African American. Mean age was 62.1 years. A gastroenterology fellow participated in 54.7% of the procedures.

Fellow involvement resulted in a significant increase in the ADR (55.2% to 64.6%, $P=0.001$). There was also a substantial increase in mean number of polyps (2.59 to 3.27; $P < 0.001$), adenoma per patient (1.56 to 2.06; $P = 0.001$) as well as detection of at least three adenomas (21.7% to 29.2%; $P = 0.004$).

Conclusions: Participation of trainees in colonoscopy is associated with a higher ADR and a higher number of polyps per patient, providing reassurance to patients and healthcare providers about the quality of the colonoscopy.

Introduction:

In the United States alone, approximately 145,600 new cases of Colorectal Cancer (CRC) are diagnosed annually, resulting in about 51,000 deaths, and making CRC the second cause of cancer-related death for men and women.¹ Observational studies have shown a substantial reduction in incidence and mortality from CRC with screening colonoscopy.² Adenoma Detection Rate (ADR) has emerged as the most important quality measure for colonoscopy, given its inverse correlation with the risk of CRC.^{3,4} Several different factors affecting ADR have been investigated, such as withdrawal time, quality of the bowel preparation, and type of sedation.⁵⁻⁸ Two randomized controlled trials have shown an increase in the number of detected polyps and adenomas with an experienced nurse observing the procedure.^{9,10}

Traditionally, endoscopy is taught during gastroenterology (GI) fellowship through an apprenticeship model of education along with self-learning, allowing the trainees to meet the Accreditation Council for Graduate Medical Education (ACGME) milestones and gain the ability to perform a wide variety of diagnostic and therapeutic endoscopies independently.

Whether participation of fellows in colonoscopy has an effect on ADR has been the subject of a small number of studies with conflicting results.¹¹⁻¹⁷ In our relatively larger study, we aimed to assess the influence of fellow involvement in colonoscopy on ADR.

Methods:

We conducted a retrospective chart review of outpatient colonoscopies performed between December 2013 and April 2015 at the John D. Dingell Veterans Affairs Medical Center (JDD VAMC), Detroit, MI. Inclusion criteria were routine colonoscopies performed by gastroenterologists on patients age 40–85 years with adequate bowel preparation. Exclusion criteria included colonoscopies performed on hospitalized patients, colonoscopies with inadequate bowel preparation and those that were incomplete due to inability to reach the cecum or due to poor patient tolerance.

We collected data on patient demographics, indication for procedure, type of anesthesia, quality of bowel preparation, and involvement of a gastroenterology fellow by year of training. We also collected data on the number, the size, the location, and the histopathology of all resected and retrieved polyps.

Bowel Preparation:

A large volume solution of Polyethylene Glycol-3350 with Electrolytes was used in all patients. Half the patients were instructed to take the entire solution the night prior to their appointment, while the other half of the cohort was instructed to follow a split-dose schedule (2L the night before and 2L early morning on the day of the procedure). Patients were also instructed to follow a clear liquid diet for one day prior to the procedure.

Bowel preparation was reported using the Aronchick Scale.¹⁸ We considered the bowel preparation quality to be adequate if it was described as fair, good, or excellent. We excluded all cases in which bowel preparation was rated as poor, led to discontinuation of the procedure, or if the recommended interval for surveillance was shortened due to the quality of the bowel preparation.

Colonoscopy:

Colonoscopies were performed using adult or pediatric Olympus Q180 and H180 colonoscopes (Olympus America Inc, Center Valley, PA). Sedation was either moderate sedation using a combination of fentanyl and midazolam, or monitored anesthesia care (MAC), which usually included propofol. Referrals for endoscopy were made by primary care physicians or the GI clinic.

In cases in which a fellow was involved, the usual practice was for the fellow to start the procedure, with the attending physician providing verbal coaching, manual assistance, or taking over as needed. There was no documentation of the extent of fellow participation or grading of their performance during the procedure.

Definitions:

Adenoma Detection Rate (ADR) was defined as the proportion of patients age 40–85 years who had at least one adenomatous polyp, regardless of the indication for the routine colonoscopy.

Advanced-histology adenoma was defined as the histopathological diagnosis of tubulovillous adenoma, adenoma with high grade dysplasia or adenocarcinoma.

Sample Size:

This study was a pre-planned secondary analysis of a study evaluating the impact of split bowel preparation on detection of sessile serrated polyps/adenomas (SSP/A). During July and August of 2014, dosing of bowel preparation medication was transitioned from full dose in the evening-before, to split-dosing. The sample size was calculated to be 1,100 patients, assuming an improvement in detection of at least one SSP/A per colonoscopy from 4–8%.

Data Collection and Statistical Analysis:

We collected information from the electronic medical records and entered it into an electronic spreadsheet using Microsoft Excel 2016 (Microsoft Corp., Redmond, WA, USA). We used JMP 13.1.0 (SAS Institute Inc., Cary NC, USA) for data analysis. We reported categorical variables as counts and percentages, and compared them using chi-square test, while continuous variables were compared using t-test and analysis of variance. We considered a two-tailed p-value of < 0.05 statistically significant.

Result:

Patient Population and Indications:

1,781 charts were reviewed. A total of 681 charts were excluded. 1,100 complete outpatient colonoscopies with adequate bowel preparation were included in the final analysis (Figure 1).

The most common indications for colonoscopy were polyp surveillance (40%), screening (20%), and positive fecal immunochemical test (FIT) (18%). Inflammatory bowel disease was the indication in 2% of the cases, while other indications such as evaluation for anemia was the indication in 20%. As expected in a VA patient population, the vast majority of patients were males, with an equal distribution of African Americans and Caucasians. Table 1 summarizes the characteristics of the patients included in the analysis.

Primary and Secondary Endpoints:

During the study period, all included procedures were performed by the same three academic board-certified attending gastroenterologists with or without the involvement of one of eight gastroenterology fellows of different levels of training. The overall ADR was 61.8%. With fellow participation, ADR improved significantly from 55.2% to 64.6% ($P = 0.001$). This improvement was seen for two of the three attendings. Table 2 summarizes these findings.

In addition to ADR improvement, fellow involvement resulted in detection of more polyps per subject (mean: 2.59 to 3.27; $P < 0.001$) and more adenomas per subject (mean: 1.56 to 2.06; $P = 0.001$). The detection of at least three adenomas (21.7% to 29.2%; $P = 0.004$), and the detection of a greater number of adenomas < 10 mm (mean: 1.30 to 1.79; $P < 0.001$) also increased when a fellow was involved.

The increased ADR was proportional to the year of training of the fellow, as the improvement in the ADR was mainly driven by involvement of third year fellows (Figure 2). The difference in ADR by level of training was statistically significant (1st year: 61.9%; 2nd year: 65.2%; 3rd year: 71.3%; $P = 0.001$). The increased ADR was noted in the right colon (cecum to transverse) and descending colon, but not the sigmoid or rectum (Supplementary table 1). Detection of at least one advanced-histology adenoma did not statistically significantly improve by the participation of a fellow (5.4% without a fellow, and 5.8% with a fellow; $P = 0.07$). The average number of advanced-pathology per subject was 0.06 in the no-fellow-group, and 0.07 in the fellow-group ($P = 0.44$). Detection of at least one SSP/A was not influenced by the participation of fellows (10.24% without vs. 11.96% with a fellow; $P = 0.36$).

Discussion:

In this retrospective study, we found that the participation of gastroenterology fellows in colonoscopy significantly improved the ADR. It also increased the number of detected polyps and adenomas per patient. With more patients found to have at least one adenoma, and more patients with at least 3 adenomas, involvement of a GI fellow led to a shortened surveillance interval in a substantial number of patients. We also found that the level of fellow training is directly associated with adenoma detection, with more senior fellows having a higher ADR. Detection of SSP/A was not influenced by involvement of a fellow.

Other studies have looked at this factor with conflicting results. A meta-analysis of 11 studies through 2013 showed no significant difference in ADR (1.04, 95% CI 0.94–1.15) with or without a fellow.¹⁹ In a more recent retrospective study of 7,503 screening colonoscopies, there was a statistically-significant higher ADR in the fellow-participation group compared to the attending group (34.5% vs. 30.7%; $P = 0.001$), as well as correlation with the level of fellow training, which is similar to the findings of our study.

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Given the complexity of the procedure of colonoscopy and the large number of cases required to achieve proficiency^{20,21}, there is often a concern, sometimes expressed by the patients themselves, that involvement of a trainee might result in a sub-optimal examination. Our results confirm that involvement of a trainee of any level has a positive impact on the findings of the procedure.

The reasons for this improvement are likely multifactorial. One possibility is having an additional set of trained eyes watching the screen, similar to the studies showing that observation of the procedure by an experienced nurse results in a higher ADR.^{9,10} Another possible explanation is that the examination is more meticulous when fellows are present, as the attending would be more likely to role-model optimal

examination technique. Others have shown that recording colonoscopies was associated with an increase in ADR for some physicians²², and having a fellow in the procedure room could have a similar influence on the endoscopist. Senior GI fellows probably have attending-level skill levels, but without being overconfident, and therefore can contribute to a higher ADR.

We decided to only include procedures performed by academic board-certified gastroenterologists, with or without the participation of gastroenterology fellows from the same fellowship program, to increase homogeneity and decrease variability. All of the attending physicians in our study had a high baseline ADR, and it is unknown if extrapolation of our results to endoscopists of other specialties or to those with lower ADR would lead to similar results.

We decided to use an all-indication ADR, rather than a screening ADR, as only a minority of cases are performed at our center for an indication of average-risk screening. This might explain the high baseline ADR. However, all-indication ADR has been shown to correlate well with screening ADR²³, and the European Society of Gastrointestinal Endoscopy (ESGE) recommends to include all indications for calculation of ADR (age 50 and above, and excluding emergent procedures as well as those done for specific therapeutic indication)²⁴.

Our study has a few limitations, some of which are inherent to its retrospective design. Participation of fellows in colonoscopy was not randomized but based on availability and scheduling. Withdrawal time was not being recorded at the time of study. If there was a significant difference in withdrawal time between the two groups, the observed improvement in ADR could be attributed to the longer withdrawal time^[6], rather than to participation of a fellow. The exact degree of fellow participation could not be determined by review of the medical records and probably varies among attendings and between fellows as well. For example, there might be variability in the time that an attending would allow the fellow to handle the scopes during insertion and/or withdrawal before taking over, and this could have an independent effect on the ADR. The high proportion of male patients is typical of studies conducted at Veterans Affairs medical centers. The number of fellows and attending physicians in our study is relatively small, and a larger pool of individuals might lead to different results.

The study has several strengths, including the large number of cases included, as well as the very high ADR without fellows, which further improved with fellows, suggesting that the additional polyps detected were not missed due to sub-optimal examination.

In conclusion, our study found that participation of GI fellows in colonoscopy resulted in a larger number of adenomas per patient, a higher polyp detection rate and a higher adenoma detection rate. Therefore, patients and other stakeholders can be reassured about the impact of the participation of gastroenterology fellows on the quality of colonoscopy.

Declarations

Ethical Approval:

The study was reviewed and approved by the Research and Development committee of the John D. Dingell Veterans Affairs Medical Center (JDD-VAMC) and the Institutional Review Board of Wayne State University (WSU).

Consent For Publication:

All authors approve the publication of this manuscript.

Competing Interest:

The authors declare that they have no conflict of interest.

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Authors' Contributions:

Conception and design: FA, SP, SJ, WK

Data collection: WK, SP, HN, SG

Analysis and interpretation of the data: FA, WK, SP, HN, SJ

Drafting of manuscript: WK and FA

Critical revision of the manuscript: SP, HN, SG, SJ

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Dataset:

The dataset can only be shared after approval from the IRB and VA information security and privacy department.

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Tables

Table 1. Characteristics of the patients, indication, sedation used, preparation schedule and quality of preparation

		All patients (n=1,100)	Without a fellow (n=498)	With a fellow (n=602)	P Value c
Age	Range	40 - 85			
	Mean (SD)	62.1 (7.9)	61.8 (7.9)	62.3 (7.8)	0.3
	Median	63	63	63	
Gender	Male	93%	93.4%	92.7%	0.7
Race					0.3
	African American	50%	51%	49.5%	
	Caucasian	49.3%	48.2%	50.3%	
	Others	< 1%	0.8%	0.2%	
Indication					0.4
	Screening	20.4%	22.5%	18.6%	
	Polyp surveillance	39.7%	38.2%	41.0%	
	Positive FIT	18%	17.9%	18.1%	
	IBD	2.2%	2.6%	1.8%	
	Others	20%	18.9%	20.4%	
Sedation					0.7
	MAC	21%	20.7%	21.3%	
	Moderate Sedation ^a	75.6%	75.5%	75.8%	
	No Sedation	3.4%	3.8%	3%	
Preparation schedule					0.3
	Single dose	50%	51.8%	48.5%	
	Split dose	50%	48.2%	51.5%	
Bowel preparation quality^b					0.9
	Good or excellent	76%	76.1%	75.9%	
	Fair	24%	23.9%	24.1%	

^a Moderate Sedation was provided with Midazolam and Fentanyl

^b Quality of preparation was reported using Aronchick Scale as poor, fair, good or excellent by the attending gastroenterologist. Cases with poor preparation were excluded

^c Comparison is between the group of procedures that involved no fellow participation and the group of cases with fellow participation

Abbreviations: FIT: Fecal Immunochemical Test; MAC: Monitored Anesthesia Care; SD: Standard Deviation; IBD: Inflammatory Bowel Disease

Table 2. Number of colonoscopies performed by each attending, along with percentage of fellow participation, overall ADR, and ADR with and without fellow participation, for each of the three attendings.

Colonoscopies per attending	Fellow Participation rate per each attending	Overall ADR	ADR without a fellow	ADR with a fellow	P Value ^a
Attending physician #1 n = 482	58.5% (n = 282)	69.5%	68.5%	70.2%	0.69
Attending physician #2 n = 298	63.8% (n = 190)	48.3%	32.4%	57.4%	< 0.001
Attending physician #3 n = 320	40.6% (n = 130)	62.8%	56.8%	71.5%	0.007
Combined n=1100	54.7% (n = 602)	61.8%	55.2%	64.6%	0.001

ADR: Adenoma Detection Rate.

^a Comparison is between the group of procedures that involved no fellow participation and the group of cases with fellow participation

Figures

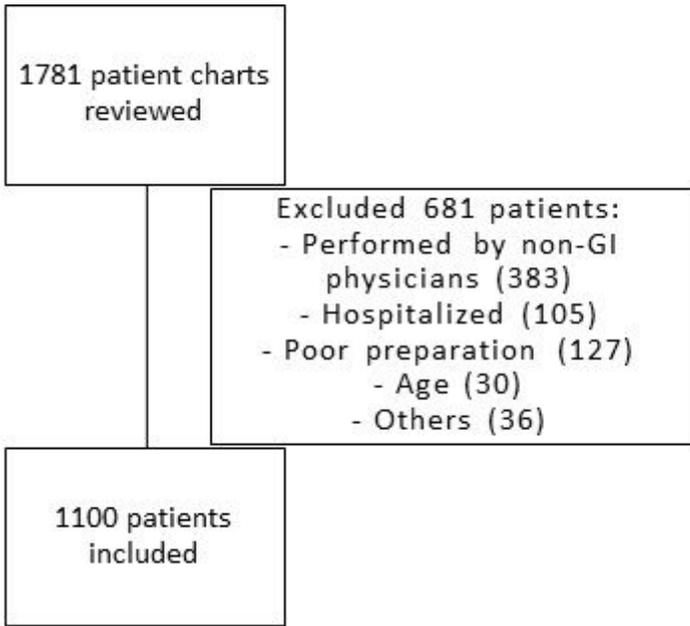


Figure 1

Patient Flow Chart



Figure 2

Adenoma Detection Rate (ADR) Comparison by Level of Training. P value when comparing ADR between without-fellow group and with fellow group = 0.001 P value when comparing ADR by year of training = 0.001