ORIGINAL RESEARCH

Short Interval Repeat Colonoscopy After Inadequate Bowel Preparation Is Low Among Veterans

Nicha Wongjarupong, MD[a,b]; Vijay Are, MD[a,b]; Anders Westanmo, PharmD, MBA[b]; Jenson Phung, MD[b]; Richie K. Huynh, MD[c]; Tessa Herman, MD[a]; Nancy R. Murphy, RN, PHN[b]; Mohammad Bilal, MD[b]; Susan M. Lou, MD[b]; Brian Hanson, MD[a]

Background: Adenoma detection rate and interval colon cancer rates are associated with bowel preparation quality. The US Multisociety Task Force recommends repeat colonoscopy for individuals with inadequate bowel preparation (IBP) within 1 year. However, little is known regarding the rate and associated factors of repeat colonoscopy after IBP.

Methods: Individuals undergoing colonoscopy for screening, surveillance, positive fecal immunohistochemistry test, and virtual colonoscopy at the Minneapolis Veterans Affairs Medical Center from January 2016 to October 2021 were included. IBP was classified based on Boston Bowel Preparation Scale score or Aronchick scale.

Results: A total of 10,466 individuals were included, of which 571 (5.5%) had IBP. Repeat colonoscopy within 1 year was recommended for 485 individuals (84.9%); 287 (59.2%) were completed within this time period and 126 (26.0%) never underwent repeat colonoscopy. Proximity to the endoscopy center was associated with a higher rate of repeat colonoscopy within 1 year (61.7% vs 51.0%, P = .02). Current smoking status was associated with a lower rate of repeat colonoscopy within 1 year (25.8% vs 35.9%, P = .02). There were no differences in age, sex, race, inflammatory bowel disease diagnosis, or opioid or anticoagulation use with adherence to repeat colonoscopy within 1 year. There was no difference in adherence to a timely repeat colonoscopy from 1 year before the COVID-19 pandemic (58.9%) vs 1 year postpandemic (59.9%).

Conclusions: The rate of IBP was 5.5%. Only 59.2% of those with IBP underwent recommended repeat colonoscopy within 1 year, and 26.0% never underwent repeat colonoscopy. Additional efforts are needed to ensure that individuals with IBP return for timely repeat colonoscopy.

Author affiliations can be found at the end of this article.
Correspondence: Brian Hanson (brian.hanson@va.gov)

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Colorectal cancer (CRC) is the third-most diagnosed cancer after breast and lung cancer, and is the second leading cause of global cancer-related deaths.[1] In 2023 in the United States, > 150,000 individuals were diagnosed with CRC and 52,000 died.[2]

Colonoscopy is an effective CRC screening method and the lone method recommended for polyp surveillance. Inadequate bowel preparation (IBP) has been estimated to occur in about 6% to 26% of colonoscopies.[3,4] The prevalence varies based on a variety of comorbidities, including immobility, diabetes mellitus, neurologic disorders, and use of opioids, with more occurrences of IBP noted in older adult, non-English speaking, and male individuals.[4-6]

The quality of bowel preparation is integral to the effectiveness of screening and surveillance colonoscopies. IBP has been associated with missed adenomas and significantly lower adenoma detection rates.[7-9] In particular, IBP is independently associated with an increased risk of CRC in the future.[3] Accordingly, the US Multisociety Task Force recommends repeat colonoscopies for individuals with IBP within 1 year.[10] Ensuring that these individuals receive repeat colonoscopies is an essential part of CRC prevention. The benefit of repeat colonoscopy after IBP is highlighted by a retrospective analysis from Fung and colleagues that showed 81% of repeat colonoscopies had adequate bowel preparation, with higher numbers of adenomas detected on repeat compared to initial colonoscopies.[11]

Given the impact of bowel preparation quality on the diagnostic capability of the colonoscopy, adherence to guidelines for repeat colonoscopies in cases of IBP is paramount for effective CRC prevention. This study aims to measure the frequency of repeat colonoscopy after IBP and the factors associated with adherence to recommendations.

METHODS

Individuals who underwent colonoscopy at the Minneapolis Veterans Affairs Medical Center (MVAMC) from January 1, 2016, to October 19, 2021, were identified to allow for 400 days of follow-up from the index colonoscopy to the data collection date. During the COVID-19 pandemic, the colonoscopy procedure capacity was reduced

TABLE Patient Adherence to Repeat Colonoscopy Within 1 Year

Criteria	Repeat colonoscopy (n = 287)	Nonadherent (n = 198)	*P* value
Age, mean (SD), y	66.8 (7.1)	66.4 (7.4)	.49
Male sex, No. (%)	272 (94.8)	188 (95.0)	.93[a]
White, No. (%)	259 (90.2)	176 (88.9)	.80[a]
Hispanic, No. (%)[b]	0 (0)	1 (0.5)	.22[a]
Married, No. (%)	149 (51.9)	94 (47.5)	.34[a]
Distance from VAMC ≤ 40 mi, No. (%)	177 (61.7)	101 (51.0)	.02[a,c]
Body mass index < 30, No. (%)[b]	124 (43.2)	89 (44.9)	.65[a]
Inflammatory bowel disease, No. (%)	13 (4.5)	10 (5.1)	.79[a]
Current smoking, No. (%)	74 (25.8)	71 (35.9)	.02[a,c]
Depression, anxiety, or PTSD, No. (%)	105 (36.6)	74 (37.4)	.86[a]
Diabetes, No. (%)	108 (37.6)	74 (37.4)	.86[a]
Cirrhosis, No. (%)	17 (5.9)	13 (6.6)	.77[a]
Multiple sclerosis, No. (%)	4 (1.4)	1 (0.5)	.34[a]
Parkinson disease, No. (%)	4 (1.4)	4 (2.0)	.59[a]
Medications, No. (%)			
Opioid	18 (6.3)	13 (6.6)	.90[a]
Tricyclic antidepressant	10 (3.5)	4 (2.0)	.34[a]
Anticoagulation	17 (5.9)	8 (4.0)	.36[a]
Antiplatelet excluding aspirin	8 (2.8)	2 (1.0)	.18[a]
NSAID	22 (7.7)	15 (7.6)	.97[a]

Abbreviations: NSAID, nonsteroidal anti-inflammatory drug; PTSD, posttraumatic stress disorder; VAMC, veterans affairs medical center.
[a]1 degree of freedom.
[b]Missing data.
[c]Statistically significant.

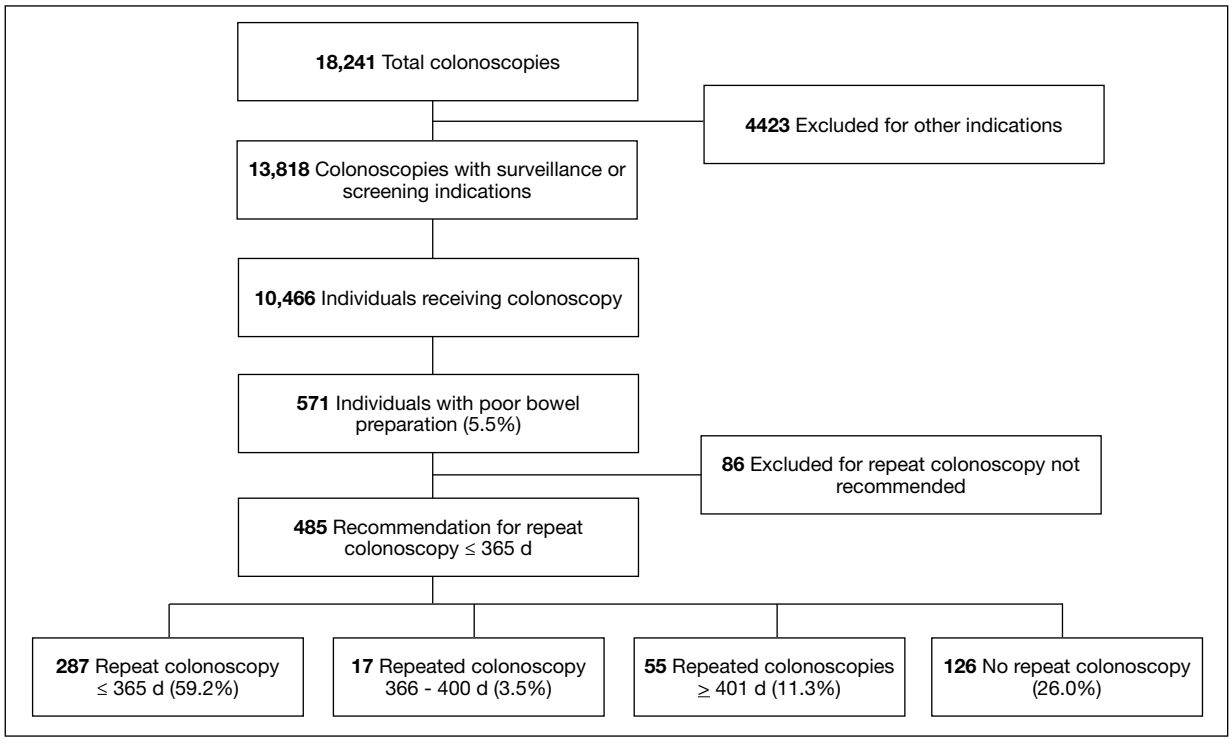
by 50% from June 1, 2020, to December 1, 2020, delaying nonurgent procedures, including screening and surveillance colonoscopies.

Individuals who underwent colonoscopy for CRC screening or polyp surveillance, or following a positive fecal immunohistochemistry test (FIT) or virtual computed tomography colonoscopy were included. Patients with colonoscopy indications for iron deficiency anemia, gastrointestinal bleeding, disease activity assessment of inflammatory bowel disease, abdominal pain, or changes in bowel movement pattern were excluded. IBP was defined as recording a Boston Bowel Preparation Scale (BBPS) score of < 6, or < 2 in any segment, or described as poor or inadequate using the Aronchick scale.

Age, sex, race, marital status, distance to MVAMC, smoking status, comorbidities, and concurrent medication use, including antiplatelet, anticoagulation, and prescription opiates at the time of index colonoscopy were obtained from the Veterans Health Administration (VHA) Corporate Data Warehouse (CDW) using structured query language processing of colonoscopy procedure notes to extract preparation scores and other procedure information. The CDW contains extracts from VHA clinical and administrative systems that contain complete clinical data from October 1999.[12] Current smoking status was defined as any smoking activity at the time the questionnaire was administered during a routine clinic visit within 400 days from the index colonoscopy.

Only individuals who were recommended to have repeat colonoscopy within 1 year were included. The intervals of 365 days and 400 days (1 year + about 1 additional month)

FIGURE 1 Study Population



were used in the event that the individual had a delay in scheduling their 1-year repeat colonoscopy. For individuals who did not undergo a colonoscopy at MVAMC within 400 days, a manual chart review of all available records was performed to determine whether a colonoscopy was performed at a non-VA facility.

Patients received written instructions for bowel preparation 2 weeks prior to the procedure. The preparation included magnesium citrate and a split dose of 4 liters of polyethylene glycol. Patients were also advised to start a low-fiber diet 3 days prior to the procedure and a clear liquid diet the day before the procedure. Patients with a history of IBP or those undergoing procedures with anesthesia received an additional 2 liters for a total of 6 liters of polyethylene glycol.

Statistical analysis

Baseline characteristics were reported as mean (SD) or median and IQR for continuous variables and percentage for categorical variables. Individuals who returned for colonoscopy within 400 days were compared to those who did not identify factors associated with adherence to recommendations. The data on individuals who returned for colonoscopy within 400 days were also analyzed for additional minor delays in the timing of the repeat colonoscopy. Continuous data were compared using Mann-Whitney *U* tests. Categorical data were compared using χ^2 or Fisher exact tests. Missing data were imputed from the analyses. All analyses were performed using SAS JMP Pro version 16. $P < .05$ was considered statistically significant.

RESULTS

There were 18,241 total colonoscopies performed between January 1, 2016, to October 19, 2021, and 13,818 colonoscopies had indications for screening for colon cancer, positive FIT, virtual colonoscopy, or surveillance. Of the 10,466 unique patients there were 5369 patients for polyp surveillance, 4054 patients for CRC screening, and 1043 patients for positive FIT or virtual colonoscopy. Of these, 571 individuals (5.5%) had IBP. Repeat colonoscopy within 1 year was recommended for 485 individuals (84.9%) who were included in this study (153 CRC screenings and 46 positive FITs) but not for 86 individuals (15.1%)

(Figure 1). Among included patients, the mean (SD) age was 66.6 (7.2) years, and the majority were male (460 [94.8%]) and White (435 [89.7%]) (Table). Two hundred and forty-three (50.1%) were married.

Adherence to Recommended Interval Colonoscopy

Of the 485 patients with IBP who were recommended for follow-up colonoscopy, 287 (59.2%) had a colonoscopy within 1 year, and 198 (40.8%) did not; 17 patients (13.5%) had repeat colonoscopy within 366 to 400 days. Five (1.0%) individuals had a repeat colonoscopy the next day, and 77 (15.9%) had a repeat colonoscopy within 7 days. One hundred and twenty-six (26.0%) individuals underwent no repeat colonoscopy during the study period (Figure 2).

To account for the COVID-19 pandemic, the adherence rate of repeat colonoscopy within 1 year prepandemic (January 1, 2016, to December 1, 2018) was calculated along with the adherence rate postpandemic (January 1, 2019 to the end of the study). The rates were similar: 199 of 330 (60.3%) individuals prepandemic vs 88 of 155 (56.8%) individuals postpandemic (Figure 3).

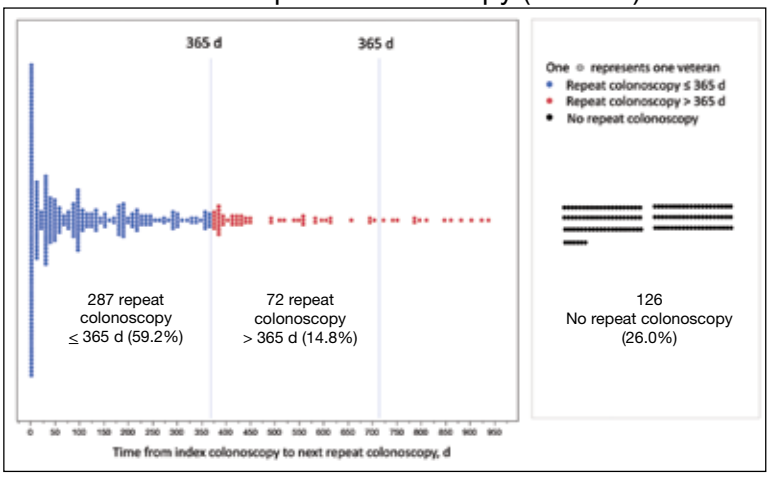
Significant Associations

Age, sex, and race were not associated with adherence to repeat colonoscopy within 1 year. Individuals living ≤ 40 miles from the endoscopy center were more likely to undergo a repeat colonoscopy within 1 year compared with those who lived > 40 miles away (61.7% vs 51.0%, $P = .02$). Current smoking status was associated with a lower rate of repeat colonoscopy within 1 year (25.8% vs 35.9%; $P = .02$). There were no differences with respect to inflammatory bowel disease diagnosis, mental health diagnosis, diabetes mellitus, cirrhosis, or medications used, including opioids, anticoagulation, and antiplatelet therapy.

Outcomes

Among individuals who had a repeat colonoscopy the day after the index colonoscopy, 53 of 56 individuals (94.6%) had adequate bowel preparation. Among individuals who had a repeat colonoscopy within 7 days, 70 of 77 (90.9%) had adequate bowel preparation. Of 287 individuals with a repeat colonoscopy within 1 year, 251 (87.5%) had adequate bowel preparation on the repeat colonoscopy. By 400 days after the index colonoscopy, 268 of 304 individuals (88.2%) had adequate bowel preparation.

FIGURE 2 Time to Repeat Colonoscopy (N = 485)

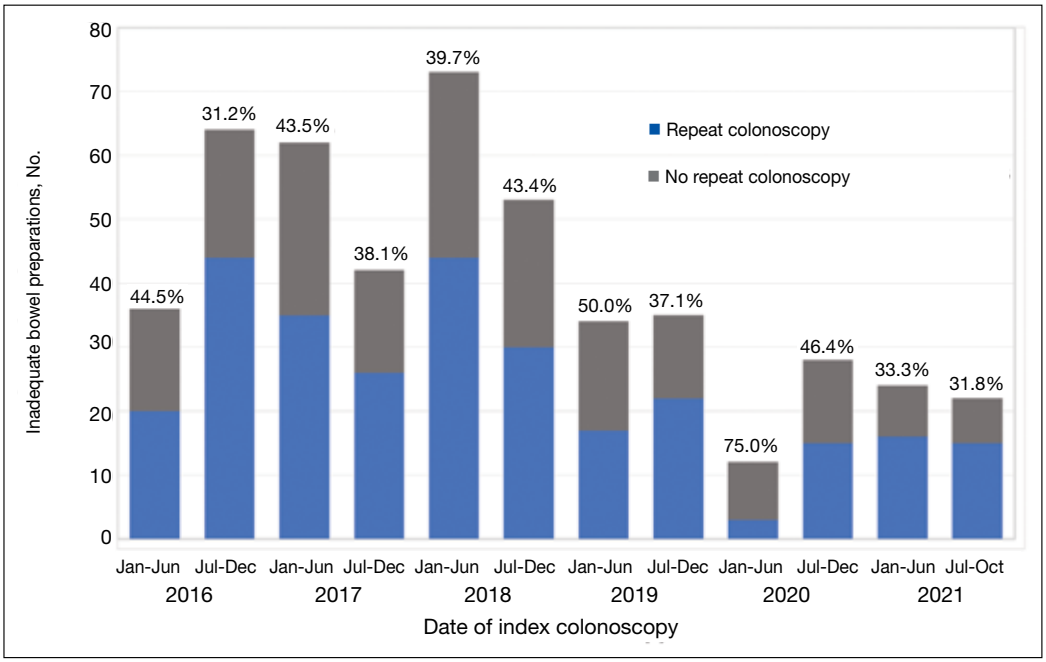


DISCUSSION

In this study conducted at a large VA medical center, we found that 5.6% of individuals undergoing colonoscopies had IBP, a rate comparable to prior studies (6% to 26%).[3,4] Only 59.2% of individuals underwent repeat colonoscopies within 1 year, as recommended after an index colonoscopy with IBP. Smoking and living longer distances (> 40 miles) from the endoscopy center were associated with a decreased adherence to the repeat colonoscopy recommendation.

Current guidelines recommend repeat colonoscopy for individuals with IBP within 1 year.[10] In cases of IBP, the advanced adenoma miss rate is 36% upon repeat colonoscopy within 1 year.[13] Despite the importance of a follow-up colonoscopy, clinician adherence with this recommendation remains low.[10,14,15] However, in this study cohort, 485 of 571 individuals with IBP (84.9%) received recommendations for a repeat colonoscopy within 1 year. In the US, only 31.9% of 260,314 colonoscopies with IBP included recommendations for a follow-up colonoscopy within 1 year.[14] This could be related to variations in endoscopist practice as well as patient risk factors for developing polyps, including family history of cancer and personal

FIGURE 3 Percentage of Patients With No Repeat Colonscopy Within 365 Days of Index Colonoscopy With Inadequate Bowel Preparation



history of prior polyps. The findings of multiple polyps, high-risk adenomas, and cancer on the index colonoscopy also influences the endoscopist for repeat colonoscopy within 1 year.[14]

The timing for repeat colonoscopies within 1 year will be determined by the patients, clinicians, and available scheduling. In this study, the earlier repeat colonoscopies, especially those occurring the day after the index colonoscopy, had the highest success rate of adequate bowel preparation. In a prior study, repeating colonoscopies within the same day or the next day was also found to have a higher rate of adequate bowel preparation than repeat colonoscopies within 1 year (88.9% vs 83.5%).[16]

Ensuring the return of individuals with IBP for repeat colonoscopy is a challenging task. We identified that individuals who live further away from MVAMC and current smokers had a decreased probability of returning for a repeat colonoscopy. Toro and colleagues found a 68.7% return rate for a repeat colonoscopy within 1 year with individuals age ≥ 60 years, and patients who were White were less likely to proceed with a repeat colonoscopy within 1 year.[17] The study did not provide data regarding smoking status or distance to the endoscopy center.[17] In a prior study of veterans, the dual diagnosis of psychiatric disorders and substance abuse was associated with missed and canceled colonoscopy appointments.[18] The distance to the endoscopy center has also been previously identified as a barrier to a colonoscopy following an abnormal FIT.[19] Although not identified in this study due to the homogenous demographic profile, social determinants of health such as socioeconomic status, education, and insurance coverage are known barriers to cancer screening but were not evaluated in this study.[20]

Based on the identified risk factors, we have created a model for utilizing those risk factors to identify individuals at higher risk for noncompliance (ie, those who live further away from the endoscopy center or currently smoke). These individuals are proactively offered to use an intraprocedural bowel cleansing device to achieve adequate bowel preparation or priority rescheduling for a next-day colonoscopy.

Limitations

This study was a single-center study of the veteran population, which is predominantly White and male, thus limiting

generalizability. The study is also limited by minimal available data on adenoma detection and colon cancer incidence on subsequent colonoscopies.

CONCLUSIONS

The rate of IBP was 5.5% in individuals undergoing colonoscopy for colon cancer screening, surveillance, positive FIT, or computed tomography colonography. Only 59.2% of those with IBP underwent the recommended repeat colonoscopy within 1 year. Smoking and distance to the endoscopy center were associated with a decreased adherence to the repeat colonoscopy recommendation. Additional efforts are needed to ensure that individuals with IBP return for timely repeat colonoscopy.

Author affiliations

[a]University of Minnesota, Minneapolis
[b]Minneapolis Veterans Affairs Medical Center, Minnesota
[c]Department of Medicine, M Health Fairview Woodwinds Hospital, Woodbury, Minnesota

Author disclosures

Brian Hanson is a consultant for Motus GI. Mohammad Bilal is a consultant for Boston Scientific. The other authors report no actual or potential conflicts of interest with regard to this article.

Disclaimer

The opinions expressed herein are those of the authors and do not necessarily reflect those of *Federal Practitioner*, Frontline Medical Communications Inc., the US Government, or any of its agencies.

Ethics and consent

This quality improvement study was reviewed by the Minnesota Veteran Affairs Medical Center Institutional Review Board and determined to be exempt.

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