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Cecal intubation rates: data from the New Hampshire Colonoscopy Registry

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Abstract

Background and Aims: Women and older or thinner patients have lower colonoscopy cecal intubation rates. We used data from the New Hampshire Colonoscopy Registry (NHCR) to examine the association between these and other endoscopist factors and trends of colonoscopy cecal intubation rates.

Methods: Our sample included patients 40 years from the NHCR with an adequate bowel preparation. We examined colonoscopy completion rates over quartiles (2004-2011, 2012-2014, 2015-2017, and 2018-2021) as stratified by men versus women and body mass index (BMI). In addition to these factors, we also adjusted for age and year of examination. Other variables of interest were specialty of the endoscopist and adenoma detection rates (ADRs).

Results: Our sample included 143,095 individuals (52.5% women [n = 75,180]). Multivariable analysis showed that BMI <25 (odds ratio [OR], .87; 95% confidence interval [CI], .76-.99), obesity (BMI ≥ 30) (OR, .88; 95% CI, .77-.99), and older age (per year) (OR, .96; 95% CI, .96-.97) were associated with a decreased likelihood of having a complete colonoscopy. Men were more likely than women to have a higher completion rate (OR, 1.46; 95% CI, 1.30-1.63). Gastroenterology specialty (OR, 1.78; 95% CI, 1.56-2.03) and an ADR ≥ 25% (OR, 2.01; 95% CI, 1.79-2.26) were associated with an increased likelihood of cecal intubation. These endoscopist-related factors were also observed to be predictive of cecal intubation in a subset of thin (BMI <25) women. Men and obese patients (BMI ≥ 30) were more likely to have incomplete examinations halted in the right-sided versus left-sided colon.

Conclusions: Even after adjusting for endoscopist factors, our study demonstrated that older or female patients and those with a BMI <25 or ≥ 30 had lower colonoscopy completion rates. Our data also suggest that colonoscopies performed in thin women were more likely to be completed if they were performed by a gastroenterologist as opposed to a nongastroenterologist.

Colonoscopy is the cornerstone of colorectal cancer (CRC) screening and prevention in the United States. Ensuring complete visualization of the large bowel is crucial in

identifying all CRC and precursors. Published data have demonstrated an increased risk for postcolonoscopy CRC in the proximal colon, likely in part because of incomplete examinations.¹ Thus, a high cecal intubation rate is important to ensure optimal screening and CRC prevention. American Society for Gastrointestinal Endoscopy and American College of Gastroenterology joint guidelines recommend that the completion rate for screening colonoscopies should be at least 95%, but higher rates should be achieved by experienced endoscopists.²

Women and patients who are thin (body mass index [BMI] <25) or older have been shown to have lower colonoscopy completion rates.³⁻⁶ These significant differences in colonoscopy completion rates may lead to an increase in subsequent testing for individuals with risk factors associated with lower completion rates. The need to repeat colonoscopy with patients under deeper sedation or to use CT colonography or a capsule can increase cost and risk for these patients.

Because colonoscopy outcomes can be operator dependent, endoscopist characteristics can affect performance and completion of colonoscopies. Endoscopist specialty has been shown to be associated with better outcomes, with gastroenterologists as opposed to nongastroenterologists having a higher polyp detection rate and reductions in postcolonoscopy CRC incidence.^{7,8} Quality measures such as adenoma detection rate (ADR), which have been shown to have an association with postcolonoscopy CRC, may also be associated with colonoscopy completion rates.⁹ Thus, it is useful to investigate cecal intubation rates in the context of these physician-related factors.

The goal of the present study was to use data from the New Hampshire Colonoscopy Registry (NHCR) to examine the trends of colonoscopy completion rates over time, stratified by BMI for men and women separately. We also examined the association between endoscopist factors, such as specialty and ADR, and colonoscopy completion rates. The location of the colonoscope tip in incomplete examinations, left-sided versus right-sided colon, was also examined.

METHODS

The NHCR is a prospective study that includes 33 centers that are both tertiary and community based. The NHCR collects demographic, lifestyle, medical, and family history data from patients having colonoscopies in centers across New Hampshire. Data are also collected from colonoscopies including examination indication, completion status, quality of bowel preparation, and polyp information including the location and size for all polyps. Pathology outcomes are abstracted by trained NHCR staff who match data from pathology reports to polyp-level findings recorded on the NHCR Procedure Form.

NHCR patients provide informed consent. All data collection and study procedures were approved by the Committee for the Protection of Human Subjects at Dartmouth College (CPHS no. 00015834) in accordance with the Belmont Report and the U.S. Common Rule.

Our sample included patients from the NHCR who were aged ≥40 years and had screening, diagnostic, or surveillance examinations with an adequate bowel preparation. Patients with

inflammatory bowel disease or genetic syndromes, including familial polyposis syndromes, serrated polyposis syndrome, and Lynch syndrome, were excluded. Our outcome was the rate of colonoscopy completion rate to the cecum or terminal ileum, which was defined as the cecal intubation rate. For incomplete examinations, we assessed the anatomic location of the tip of the colonoscope when the examination was halted, in the right-sided versus left-sided colon as divided by the splenic flexure.

We subdivided the year of colonoscopy into quartiles: 2004 to 2011, 2012 to 2014, 2015 to 2017, and 2018 to 2021. Other variables of interest were patient BMI (<25 kg/m², 25 to <30 kg/m², and ≥30 kg/m²) for men and women, specialty of the endoscopist (gastroenterologist vs nongastroenterologist), and ADR (<25% vs ≥25%).

The χ^2 test for trend was used to examine differences over time. A multivariable logistic regression predicting risk for completion was then performed adjusting for our variables of interest as well as for age, year of examination, use of propofol, and endoscopist factors. Adjusted odds ratios (ORs) and confidence intervals (CIs) were estimated with 95% CIs. We used SPSS IBM 29 (Chicago, Ill, USA) for all statistical analyses.

RESULTS

A total of 143,095 colonoscopies performed by 166 endoscopists (median volume, 425; interquartile range, 1179) were included in the analyzed sample. Of the sample, 52.5% were women (n = 75,180) and 47.5% were men (n = 67,915). The mean age for women was 59.81 ± 9.28 years and for men 60.73 ± 9.25 years (see Supplementary Table 1). Twenty-seven percent of individuals (n = 38,621) had a BMI <25, 36.3% (n = 51,915) had a BMI of 25 to <30, and 36.7% (n = 52,559) had a BMI ≥30. The mean BMI for women was 28.20 ± 7.36 and for men 29.06 ± 5.98. Sixty percent of endoscopists (n = 100) were gastroenterologists and 40% (n = 66) were nongastroenterologists.

Men had a higher completion rate overall as compared with women (99.2% [67,390/67,915] vs 98.8% [74,305/75,180], respectively; $P < .0001$). Other factors associated with lower completion rates were older age, lower and higher BMI, lower endoscopist ADR (<25%), fewer number of examinations per endoscopist, nongastroenterologist endoscopist, nonacademic setting, fair versus excellent/good bowel preparation, and diagnostic examinations (all $P < .0001$). These data are shown in Table 1.

As shown in Table 2, although the rates for incomplete examinations in men with BMIs <25 and 25 to <30 decreased significantly ($P < .0001$) over the 4 time quartiles, the rates for obese men with a BMI ≥30 ($P = .0700$) did not change significantly over the observed time periods. Also shown in Table 2, the rates of incomplete examinations for women in all 3 BMI groups decreased over the 4 time quartiles ($P < .0001$).

As shown in Table 3, both gastroenterologists and nongastroenterologists had a significant decrease in the rate of incomplete colonoscopies over the 4 time quartiles ($P < .0001$). Gastroenterologists had a higher completion rate overall as compared with nongastroenterologists (99.2% [120,442/121,411] vs 98.0% [21,253/21,684], respectively; $P < .0001$). As shown in Table 3, colonoscopies performed by endoscopists with an ADR

25% ($P = .0110$) and by endoscopists with an ADR $< 25\%$ ($P < .0001$) had a significant decrease in rates for incomplete examinations over the 4 quartiles. Endoscopists with an ADR $\geq 25\%$ had a higher completion rate overall as compared with endoscopists with an ADR $< 25\%$ (99.4% [95,867/96,483] vs 98.3% [45,828/ 46,612], respectively; $P < .0001$).

Most individuals (99.0% [141,695/143,095]) had a complete examination; .7% of individuals ($n = 959$) had an incomplete examination in the right-sided colon and .3% ($n = 441$) had an incomplete examination in the left-sided colon. As shown in Table 4, the rate of examinations terminated in the right-sided versus the left-sided colon decreased over the 4 quartiles ($P < .0190$). Men ($P = .0080$) and patients with BMI ≥ 30 ($P < .0001$) were more likely to have the examination terminated in the right-sided colon in incomplete examinations as compared with women or those with BMI < 25 (Table 5). After adjusting for age and endoscopist factors, men (OR, .70; 95% CI, .55-.90) and those with a BMI > 30 (OR, .59; 95% CI, .44-.78) were less likely to have termination of the examination on the left side of the colon.

As shown in Table 6, after logistic regression analysis, men were still more likely to have a complete examination as compared with women (OR, 1.46; 95% CI, 1.30-1.63). As compared with the reference group of BMI 25 to < 30 , individuals with a BMI < 25 (OR, .87; 95% CI, .76-.99) and obese individuals with a BMI ≥ 30 (OR, .88; 95% CI, .77-.99) were both less likely to have a complete examination. Age was associated with a lower risk for completion (per year; OR, .96; 95% CI, .96-0.97). Year of examination was associated with a higher risk for completion (for yearly increases in time; OR, 1.04; 95% CI, 1.02-1.05). Gastroenterologists as opposed to nongastroenterologists were more likely to complete the colonoscopy (OR, 1.78; 95% CI, 1.56-2.03). Endoscopists with an ADR $\geq 25\%$ were more likely to complete the examination than endoscopists with an ADR $< 25\%$ (OR, 2.01; 95% CI, 1.79-2.26). Propofol use was associated with an increased risk for completion for all patients (OR, 1.55; 95% CI, 1.36-1.76).

Also shown in Table 6, a logistic regression was developed for a sample of women with a BMI < 25 . This model showed age was associated with a lower risk for completion (per year; OR, .97; 95% CI, .95-0.98). Gastroenterologists were more likely to have a complete examination (OR, 2.03; 95% CI, 1.51-2.72) versus other specialties. Endoscopists with an ADR $\geq 25\%$ were more likely to complete the examination than endoscopists with an ADR $< 25\%$ (OR, 2.56; 95% CI, 1.98-3.31). Propofol use was associated with an increased risk for completion (OR, 1.49; 95% CI, 1.13-1.97).

DISCUSSION

Using data from nearly 150,000 NHCR patients over a period of almost 20 years, we observed high overall completion rates for each time quartile. The completion rates for all time quartiles exceeded the benchmarks for completion rate as recommended by the American Society for Gastrointestinal Endoscopy and American College of Gastroenterology of at least 95%. We also observed an increase in completion rates for our entire population over the 4 time quartiles. This increase in completion rates can likely be attributed to advancement in endoscopic technology and techniques allowing for

facilitation of colonoscope navigation through more challenging colons with angulations and looping.^{10,11}

Published data have demonstrated that male patients have a higher colonoscopy completion rate when compared with female patients.^{3-6,11} In our investigation, we observed an increasing colonoscopy completion rate in both men and women over the 4 time quartiles. However, we also observed that even after adjusting for other patient and endoscopist factors, men still had an approximately 50.0% greater likelihood of having a complete colonoscopy as compared with women.

A possible explanation for this observation is that there may be more severe angles to negotiate in the distal colons of women. Our database allowed us to further explore this issue by examining where the examination was terminated in an incomplete colonoscopy. Incomplete examinations in women were more likely to be terminated on the left side as compared with men, which is consistent with severe distal angulation observed in women.

BMI can also be a factor in colonoscopy completion rates.^{3,4} As we observed in our analysis, lower BMI, especially in women, was associated with lower completion rates.^{3,4,11} Higher BMI in men can also be associated with lower completion rates, perhaps because of excessive looping and redundancy and the inability to pleat the colon because of visceral adipose tissue. We observed that in men and obese patients with BMI ≥ 30 , the examinations were more likely to be terminated on the right side as compared with women or thinner patients. This inability to continue the examination beyond the proximal colon can be consistent with a redundant colon that can be associated with excessive looping of the colonoscope, limiting intubation of the cecum. Our finding that obesity is associated with a lower risk for cecal intubation after adjusting for other factors may be more problematic with rising rates of obesity in the United States.

Overall, it is reassuring that completion rates for thinner women and men have increased over the 4 time quartiles. Although obese men with a BMI ≥ 30 did not have an increase in completion rates over the time period, the overall completion rates exceeded benchmarks. However, after adjusting for all covariates, both a BMI <25 and obesity or a BMI ≥ 30 were still associated with a lower completion rate when compared with the reference group of individuals with a BMI of 25 to <30 .

Our data have implications with respect to performing colonoscopy. Incomplete examinations are associated with increased cost and risk for patients because of the need for subsequent tests such as CT colonography or colonoscopy with the patient under deep sedation. Therefore, every effort should be made to mitigate the risk for an incomplete examination. For male patients, especially those with a high BMI, a water technique or directed abdominal pressure could be used to decrease looping.^{10,12} For thinner or female patients, directed abdominal pressure, water technique, and/or the use of more flexible colonoscopes have been shown to help negotiate the distal colon.^{10,11}

Patient age was also examined. In our sample, we observed a 4.0% less likelihood of a complete examination for each year. Previous studies have also demonstrated a higher risk

for incomplete examinations in older adults; however, we were able to demonstrate this finding with a large patient population.

Although previous studies have examined cecal intubation rates, our analysis provides novel data regarding trends as well as current rates for colonoscopy completion in general practice.¹³⁻¹⁵ Specifically, Gavin et al¹³ performed a cross-sectional analysis using data from approximately 20,000 examinations and observed an overall cecal intubation of 95.8%. This rate was lower than our overall cecal intubation rates for all analyses and subgroups; however, data from Gavin et al¹³ are over 10 years old and may not reflect current practice. In contrast, our data are more recent and likely better reflect current practice. Passi et al¹⁴ used the CORI database to examine the impact of BMI and also observed that individuals with a BMI between 30 and 40 were more likely to have an incomplete colonoscopy as compared with those with a normal BMI. However, they did not examine endoscopist factors, and their data may also not reflect current practice because these were published almost over 10 years ago.

Because colonoscopy is an operator-dependent procedure, we examined the impact of endoscopist factors on colonoscopy completion rates. Both gastroenterologists and nongastroenterologists had cecal intubation rates that exceeded current benchmarks. In addition, both groups had a significant improvement in their colonoscopy completion rates over the 4 time quartiles. However, after adjustment for all factors, endoscopist specialty was shown to have a significant impact on colonoscopy completion rates, with gastroenterologists having a higher overall completion rate and an almost 2-fold greater likelihood of completion compared with endoscopists of other specialties when adjusting for other patient factors.

Previous studies have shown a positive correlation between cecal intubation rates and ADR, an important endoscopist-specific quality measure.^{9,16} We also observed that ADRs had a significant impact on colonoscopy completion rates. Specifically, endoscopists with an ADR $\geq 25\%$ had a 2-fold greater likelihood to complete their colonoscopy as compared with endoscopists with an ADR $<25\%$. An ADR of 25% was still predictive of a higher completion rate even after adjusting for the specialty of the endoscopist as well as the use of propofol. Endoscopists with an ADR $\geq 25\%$ did not have a dramatic increase over time in completion; however, this is likely because of their high completion rates observed in the first quartile. However, those with an ADR $<25\%$ did have a significant increase in completion rates.

We also examined other examination-related factors as well such as indication. We observed that the colonoscopy completion rate was lower in diagnostic examinations as compared with screening or surveillance. In addition, we observed that completion rate in fair bowel preparation was associated with a slightly lower risk of completion when compared with excellent and good bowel preparation. We observed no difference in the risk of cecal intubation rates between academic and nonacademic centers. The anesthetic agent used during the procedure can also have an effect on completion rates.^{17,18} The use of propofol was found to be associated with higher colonoscopy completion rates when examining data from all patients as well as in a subsample of women with low BMI. We also examined

the risk of completion in propofol versus nonpropofol stratified by BMI (<25, 25 to <30, and 30+) and observed that propofol was associated with a higher completion rate for all 3 categories (data not shown).

Our data suggest that for more difficult examinations or those with patient factors associated with incomplete examinations, the patient may benefit from having a gastroenterologist perform their colonoscopy. Specifically, we observed that for the subset of thin women, a group that has been shown to have lower completion rates, gastroenterology specialty was associated with an approximately 2-fold increase in likelihood of a complete examination.

Strengths for our study include the large patient population size, which allowed us to examine trends over a nearly 20-year period for men and women as stratified by BMI. Any incomplete examination is problematic for physicians and patients because they prevent complete bowel examination. However, incomplete examinations are a relatively rare occurrence and can be difficult to study because of these low numbers. Our large-scale database allowed us to examine patient, endoscopist, and anatomic location factors associated with incomplete colonoscopies. In addition, our data are collected from over 160 endoscopists in New Hampshire across a 16-year time span. We were also able to examine important endoscopist factors, including specialty and ADR, and to adjust for the use of propofol during the examination.

Limitations of our study include a lack of racial diversity in New Hampshire as compared with other areas of the country. However, notably, our data do include individuals with diverse socioeconomic and geographic backgrounds as well as outcomes from community and academic medical centers.¹⁹ An additional limitation includes the lack of data on type of colonoscope used during the procedure and the insertion technique, both of which may be associated with cecal intubation rates and time. We chose to limit our study to patients over age 40 years to reflect the population who undergo screening and surveillance examinations; however, this does add an additional limitation on our study. We are also limited by the lack of additional patient-related factors including abdominal surgery, presence of diverticula, and the specific bowel agent used during preparation. Additionally, the exact location when the examination was terminated was estimated by the endoscopist, which may be subjective. However, after adjusting for other important factors, we observed that our main patient exposure variables of interest, extremes of BMI, older age, and female sex, were independently associated with a significantly lower risk for cecal intubation. In addition, we also observed that our main endoscopic exposure variables of interest, specialty of the endoscopist and ADR, were independently associated with a significantly higher rate of cecal intubation.

In conclusion, our data demonstrate that overall completion rates in New Hampshire exceed current benchmarks. In addition, completion rates are increasing, even in patients who are at higher risk for incomplete examinations. However, although completion rates have been improving, we observed that some patient, endoscopist, and examination factors are still associated with lower completion rates. Our data suggest that examinations performed by a gastroenterologist with a high ADR may be more likely to have successful cecal intubation. Examination factors associated with higher completion rates include optimal

bowel preparation and the use of propofol. These factors are also important in those patients with difficult colons such as women with a low BMI. In addition, our observations regarding location of the colonoscope tip in incomplete colonoscopies could help endoscopists choose strategies to negotiate difficult colons.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations:

ADR	adenoma detection rate
BMI	body mass index
CI	confidence interval
CRC	colorectal cancer
NHCR	New Hampshire Colonoscopy Registry
OR	odds ratio

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Colonoscopy incompleteness and completion rates by patient, endoscopist, and examination factors

TABLE 1.

	Incomplete (n = 1400)	Complete (n = 141,695)	P value
Patient factors			
Body mass index			<.0001
<18.5 kg/m ²	1.0 (24)	99 (2414)	
18.5-24.9 kg/m ²	1.1 (404)	98.9 (35,779)	
25.0-29.9 kg/m ²	.9 (461)	99.1 (51,454)	
30.0-34.9 kg/m ²	.8 (262)	99.2 (31,060)	
35.0-39.9 kg/m ²	1.1 (136)	98.9 (12,806)	
40.0+ kg/m ²	1.4 (113)	98.6 (8,182)	
Reported sex			
Female	1.2 (875)	98.8 (74,305)	<.0001
Male	.8 (525)	99.2 (67,390)	
Age, y	63.83 ± 10.33	60.21 ± 9.26	<.0001
Endoscopist factors			
Specialty	.		<.0001
Gastroenterology	8 (969)	99.2 (120,442)	
Nongastroenterology	2.0 (431)	98.0 (21,253)	
Adenoma detection rate			
<25%	1.7 (784)	98.3 (45,828)	<.0001
>25%	.6 (616)	99.4 (95,867)	
No. of examinations			
<2500	1.1 (747)	98.9 (66,089)	<.0001
>2500	.9 (653)	99.1 (75,606)	
Examination factors			
Bowel preparation			
Excellent/good	.9 (1210)	99.1 (130,879)	<.0001
Fair	1.7 (190)	98.3 (10,816)	

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	Incomplete (n = 1400)	Complete (n = 141,695)	P value
Setting			<.0001
Nonacademic	1.0 (1039)	99.0 (107,490)	
Academic	1.0 (361)	99.0 (34,205)	
Indication			<.0001
Screening	.8 (643)	99.2 (79,704)	
Surveillance	.8 (328)	99.2 (41,574)	<.0001
Diagnostic	2.1 (429)	97.9 (20,417)	
Use of propofol			<.0001
Yes	.7 (451)	99.3 (60,885)	
No	1.2 (949)	98.8 (80,810)	<.0001

Values are % (n) or mean ± standard deviation.

Colonoscopy incompletion and completion rates for men and women stratified by their body mass index across time quartiles

TABLE 2.

Male colonoscopy incompletion and completion rates (n = 67,915)				
Body mass index	2004-2011 (n = 14,111)	2012-2014 (n = 20,662)	2015-2017 (n = 16,467)	2018-2021 (n = 16,675)
<25 kg/m ² (n = 12,892)	1.4 (41/2938)	1.3 (47/3688)	.6 (17/3037)	.6 (20/3104)
	98.6%	98.7%	99.4%	99.4%
25-30 kg/m ² (n = 28,561)	1.1 (66/6148)	.7 (62/9022)	.6 (42/6629)	.4 (29/6563)
	98.9%	99.3%	99.4%	99.6%
30+ kg/m ² (n = 26,462)	1.0 (50/4868)	.7 (55/7788)	.8 (54/6688)	.6 (42/6917)
	99.0%	99.3%	99.2%	99.4%
Total incomplete examinations	1.1 (157/13,954)	.80 (164/20,498)	.7 (113/16,354)	.5 (91/16,584)
	98.9%	99.2%	99.3%	99.5%
Female colonoscopy incompletion rates (n = 75,180)				
	2004-2011 (n = 16,326)	2012-2014 (n = 23,194)	2015-2017 (n = 17,783)	2018-2021 (n = 17,877)
<25 kg/m ² (n = 25,729)	1.9 (112/5639)	1.0 (84/7966)	.9 (55/5884)	.9 (52/5937)
	98.1%	99.0%	99.1%	99.1%
25-30 kg/m ² (N = 23,354)	1.7 (90/5195)	1.2 (86/7241)	.8 (41/5366)	.8 (45/5290)
	98.3%	98.8%	99.2%	99.2%
30+ kg/m ² (n = 26,097)	1.7 (88/5202)	1.2 (95/7722)	1.2 (76/6361)	.8 (51/6502)
	98.3%	98.8%	98.8%	99.2%
Total incomplete examinations	1.8 (290/16,036)	1.1 (265/22,929)	1.0 (172/17,611)	.8 (148/17,729)
	98.2%	98.9%	99.0%	99.2%

Values are % (n/N) unless otherwise defined.

Colonoscopy incompleteness rates for endoscopists stratified by the endoscopist specialty (gastroenterologist vs other specialty) and ADR of 25%

TABLE 3.

Gastroenterologist vs nongastroenterologist incompleteness rates				
	2004-2011 (n = 30,437)	2012-2014 (n = 43,856)	2015-2017 (n = 34,250)	2018-2021 (n = 34,552) P value <.0001
Nongastroenterologist (n = 21,684)				
Incomplete	2.6 (111/4160)	2.0 (148/7210)	2.1 (112/5132)	1.2 (60/4751)
Complete, %	97.4	98.0	97.9	98.8
Gastroenterologist (n = 121,411)				
Incomplete	1.3 (336/25,830)	.8 (281/36,217)	.6 (173/28,833)	.6 (179/29,562)
Complete, %	98.7	99.2	99.4	99.4
ADR <25% vs ADR 25% incompleteness rate				
	2004-2011 (n = 30,437)	2012-2014 (n = 43,856)	2015-2017 (n = 34,250)	2018-2021 (n = 34,552) P value <.0001
ADR <25% (n = 46,612)				
Incomplete	2.2 (334/14,976)	1.5 (223/15,095)	1.6 (136/8537)	1.2 (91/7220)
Complete	97.8	98.5	98.4	98.8
ADR 25% (n = 96,483)				
Incomplete	.7 (113/15,014)	.7 (206/28,332)	.6 (149/25,428)	.5 (148/27,093)
Complete	99.3	99.3	99.4	99.5

Values are % (n/N) unless otherwise defined.

ADR, Adenoma detection rate.

TABLE 4.

Anatomic location of the colonoscopy tip in 1400 incomplete examinations (left-sided vs right-sided colon) as stratified by time, male vs female, and body mass index

	Terminated in right-sided colon (n = 959)	Terminated in left-sided colon (n = 441)	P value
Year			
2004-2011	73.8 (330)	26.2 (117)	.0190
2012-2014	67.8 (291)	32.2 (138)	
2015-2017	64.2 (183)	35.8 (102)	
2018-2021	64.9 (155)	35.1 (84)	
Male vs female			
Male	72.8 (382)	27.2 (143)	.0080
Female	65.9 (577)	34.1 (298)	
Body mass index			
<25 kg/m ²	63.8 (273)	36.2 (155)	<.0001
25 to <30 kg/m ²	65.3 (301)	34.7 (160)	
30 kg/m ²	75.3 (385)	24.7 (126)	

Values are % (n).

TABLE 5.
Predictors of left-sided vs right-sided colon location of the colonoscope tip in incomplete examinations

Patient factors	Odds ratio	95% Confidence interval
Male vs female	.70	.55-.90
Time (per y)	1.06	1.03-1.09
BMI <25 kg/m ² (vs BMI <30-25 kg/m ²)	1.02	.77-1.36
BMI ≥30 kg/m ² (vs BMI <30-25 kg/m ²)	.59	.44-.78

Adjusted for patient age and endoscopist factors.
BMI, Body mass index.

Multivariable logistic regression predicting complete examination (odds ratio with 95% s) for all patients (left-sided) as well as a subset of females with BMI <25 (right-sided)

TABLE 6.

Factors	All patients		Women with BMI <25 kg/m ² (subset)	
	Odds ratio	95% Confidence interval	Odds ratio	95% Confidence interval
Patient factors				
Male vs female	1.46	1.30-1.63	NA	NA
Age (per y)	.96	.96-.97	.97	.95-.98
BMI <25 kg/m ² (vs <30-25 kg/m ²)	.87	.76-.99	NA	NA
BMI >30 kg/m ² (vs BMI <30-25 kg/m ²)	.88	.77-.99	NA	NA
Endoscopist factors				
Gastroenterology (vs other specialties)	1.78	1.56-2.03	2.03	1.51-2.72
Adenoma detection rate >25% (vs <25%)	2.01	1.79-2.26	2.56	1.98-3.31
No. of examinations (>2500 vs <2500)	1.02	.91-1.15	.90	.70-1.16
Examination factors				
Time (per y)	1.04	1.02-1.05	1.04	1.01-1.08
Propofol use	1.55	1.36-1.76	1.49	1.13-1.97
Academic (vs nonacademic)	1.12	.98-1.28	.98	.75-1.29
Diagnostic (vs screening)	.43	.38-.48	.47	.36-.61
Surveillance (vs screening)	1.13	.98-1.29	1.14	.83-1.56
Bowel preparation (fair vs excellent/good)	.64	.55-.75	.61	.42-.88

NA, Not applicable.