Original Article

Loss of Efficacy and Cost-Effectiveness When Screening Colonoscopy Is Performed by Nongastroenterologists

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BACKGROUND: Specialty of the endoscopist has been related to the postcolonoscopy interval risk of colorectal cancer (CRC). However, the impact of such a difference on the long-term CRC prevention rate by screening colonoscopy is largely unknown. **METHODS:** A Markov model was constructed to simulate the efficacy and cost of colonoscopy screening according to the specialty of the endoscopist in 100,000 individuals aged 50 years until death. The postcolonoscopy interval CRC risk (0.02%) and the relative risk (1.4) of interval CRC between gastroenterologist (GI) endoscopists and non-GI endoscopists were extracted from the literature. Both efficacy and costs were projected over a steady-state US population. Eventual increase in endoscopic capacity when assuming all procedures to be performed by GI endoscopists was simulated. **RESULTS:** According to the simulation model, screening colonoscopy performed by non-GI endoscopists resulted in a 11% relative reduction in the long-term CRC incidence prevention rate compared with the same procedure performed by GI endoscopists. When projected on the US population, the reduced non-GI efficacy resulted in an additional 3043 CRC cases and the loss of $200 million per year. When increasing the relative risk from 1.4 to 2.0, the difference in the prevention rate between GI endoscopists and non-GI endoscopists increased to 19%. It increased further to 38% when also assuming a 3-fold increase in the risk of interval CRC. An additional 165 screening colonoscopies per endoscopist per year would be required to shift all non-GI procedures to GI endoscopists. **CONCLUSIONS:** When screening colonoscopy is performed by non-GI endoscopists, a substantial reduction in the long-term CRC prevention rate may be expected. Such difference appeared to be greater when a suboptimal efficacy of colonoscopy in preventing CRC was assumed. A 10-year saving of $2 billion may be expected when shifting all screening colonoscopies from non-GI endoscopists to GI endoscopists. ***Cancer* 2012;000:000–000.** © *2012 American Cancer Society.*

KEYWORDS: colorectal cancer screening, endoscopist, specialist, interval cancer, colonoscopy, cost-effectiveness.

INTRODUCTION

Colorectal cancer (CRC) is a major cause of morbidity and mortality.[1] Colonoscopy is highly effective for detecting advanced neoplasia, and CRC prevention by endoscopic polypectomy reduces disease-specific incidence and mortality.[2] Therefore, its use as a preferred screening strategy is supported by official guidelines.[3]

The long-term efficacy of colonoscopy in preventing CRC incidence and/or mortality has been addressed in cohort and case-control studies.[2,4-7] Although the majority of those studies demonstrated a very high CRC prevention rate, some studies reported a suboptimal CRC protection rate.[5,6] This appeared to be related to an unexpectedly high risk of postcolonoscopy CRC in the early years after colonoscopy. In a large administrative cohort of patients with negative colonoscopy, the CRC prevention rate appeared to be markedly higher when assessed 10 years after colonoscopy rather than after 5 years (ie, 72% vs 41%) because of the unexpected occurrence of interval cancer in the early years after colonoscopy.[6] In a large case-control study, Baxter et al reported a substantially lower CRC mortality prevention rate in the first 2 years after colonoscopy compared with the following period.[5] The higher risk of postcolonoscopy CRC also appeared to be represented more in the proximal colon compared with the distal colon.[5-7]

Specialty of the endoscopist has been strictly related to the risk of postcolonoscopy CRC.[8] In large administrative cohort or case-control studies, the risk of interval cancer was substantially lower when the colonoscopy was performed by gastroenterologists compared with other specialties.[7,9-11]

To our knowledge, no study to date has assessed the role of endoscopist specialty in determining the long-term colonoscopy-related CRC prevention rate, causing uncertainty about the potential benefit of such a policy. The objective of this simulation was to calculate the potential impact of endoscopist specialty on the efficacy and costs of screening colonoscopy.

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MATERIALS AND METHODS

Endpoints of this analysis address the following:

1) What is the long-term efficacy of colonoscopy screening based on the available data of postcolonoscopy interval CRC?
2) What is the difference in long-term efficacy of colonoscopy between gastroenterologist (GI) endoscopists and non-GI endoscopists according to the relative risks of postcolonoscopy interval CRC?
3) What is the projected impact on the US population of different degrees of long-term colonoscopy efficacy according to the specialty of the endoscopist?
4) What is the projected increase of endoscopic capacity required for GI endoscopist to cover all the screening colonoscopies actually performed by non-GI endoscopists?

To address these issues, we simulated primary prevention with colonoscopy in a theoretical cohort of 100,000 American men and women generated by a Markov model. In detail, we simulated endoscopic screening that was repeated every 10 years between ages 50 years and 80 years with postpolypectomy surveillance differing according to polyp size and histology. Age-related and site-related CRC incidence and mortality were integrally assumed from the Surveillance, Epidemiology, and End Results (SEER) database for the natural history cohort. Further details on model validation and calibration are available elsewhere.[12]

Efficacy of Colonoscopy Screening

Long-term reduction of CRC incidence and mortality by colonoscopy screening was calculated to match with the risk of postcolonoscopy interval CRC available in the literature. In detail, we calibrated the overall efficacy of colonoscopy screening on the subsequent risk of postcolonoscopy interval CRC to match the 0.02% annual rate of interval CRC reported in the only available large series of screening colonoscopy, including 188,788 person-years of postcolonoscopy follow-up with a mean age of 55 years.[13]

Efficacy of Colonoscopy Screening According to Specialty

To include the role of endoscopist specialty, we further calibrated the long-term efficacy of colonoscopy screening based on the available data on the association between the endoscopist specialty and the postcolonoscopy risk of interval cancer. In detail, we calibrated the long-term efficacy of colonoscopy screening for each specialty to match with the relative risk (RR) of postcolonoscopy interval CRC between non-GI and GI endoscopists recently reported in a large Medicare-based study.[9] In detail, we adopted a 1.4 RR of postcolonoscopy interval CRC between non-GI and GI endoscopists by averaging the specific RRs assessed for the single non-GI endoscopist specialties (colorectal surgery, general surgery, family practice, internal medicine, other, unknown) reported in that study. These data are also similar to the RR between GI and non-GI endoscopists reported in a non-Medicare setting.[10,11] Therefore, the 1.4 RR was applied to the reference case scenario, in which it was assumed that the distribution of screening colonoscopies between GI and non-GI endoscopists was 60% and 40%, respectively, as recently estimated in a Medicare population.[9]

Endoscopic Capacity

To estimate the eventual burden of colonoscopies over GI endoscopists, when simulating the shift of all screening procedures from non-GI to GI endoscopists, we applied this distribution to the 2010 estimate by the American Board of Internal Medicine of 12,907 board-certified gastroenterologists.[14]

Costs

Age-specific, size-specific, and site-specific prevalences of nonadvanced and advanced adenomas were matched with estimates from autopsy and endoscopic data to compute the costs related to polypectomy and follow-up (Table 1). Reimbursement data for direct costs of endoscopy and related complications, as well as for stage-specific CRC treatment, were based on Medicare data.[21] All costs were adjusted to 2011 US dollars using the Medical Consumer Price Index.[22]

Cost-Effectiveness Analysis

The clinical effectiveness of screening is measured in terms of life-years gained through prevention or down-staging of CRC. In the natural history and screening models, the life-years lost by the age-dependent proportion of patients dying prematurely of CRC are accumulated for each cycle during the entire expected lifetime. The number of life-years gained by screening corresponds to the difference in life-years lost from CRC cancer between a Markov model with screening and a model without screening. Future costs and life-years saved were discounted using an annual rate of 3%. The relative performance of the remaining strategies was measured using the incremental cost-effectiveness ratio (ICER), which is defined as the additional cost of a specific strategy, divided by its additional clinical benefit, compared with the next least expensive strategy. An ICER of $50,000 per life-year gained was used as a

Table 1. Model Characteristics and Parameters Used for the Reference Case and Sensitivity Analyses

Variable	Reference Case Value (95% CI)	Reference Citation(s)
Model characteristics		
Model type: State transition model, Markov		
Hypothetical population: 100,000 Americans aged 50 y		
Perspective: Third-party payer perspective		
Time horizon: Life-time		
Intervention: Colonoscopy every 10 y between ages 50 and 80 y performed by GI and/or non-GI endoscopists		
Efficacy of endoscopic screening		
Colonoscopy		
Postcolonoscopy CRC interval risk, %	0.02 (0.01-0.06)	Kaminski 2010[13]
Relative risk of postcolonoscopy interval CRC between non-GI and GI endoscopists	1.4 (1-2)	Cooper 2011[9]
Natural history		
Adenoma prevalence at age 50 y, %	15% (10-20)	Hassan 2011,[12] DiSario 1991[15]
New adenomatous polyp rate, %/y	Age specific: 1.9-3.3 (1.3-4.3)	Loeve 2004[16]
Annual transition rate from =5 mm to 6-9 mm, %	5 (3-7)	Hofstad 1996[17]
Annual transition rate from 6-9 mm to ≥10 mm, %	7 (5-9)	Hofstad 1996[17]
Hyperplastic polyp prevalence at age 50 y, %	10 (7-13)	Hassan 2011[12]
Annual hyperplastic polyp incidence rate, %	5 (3-7)	Hassan 2011[12]
Age-specific CRC incidence		SEER 2011[18]
Age-specific CRC mortality		SEER 2011[18]
Screening, %		
Colonoscopy sensitivity for =5 mm polyps	80 (72-87)	Rex 1997[19]
Colonoscopy sensitivity for 6-9 mm polyps	85 (78-92)	Rex 1997[19]
Colonoscopy sensitivity for ≥10 mm polyps	90 (82-97)	Rex 1997[19]
Colonoscopy sensitivity for CRC	95 (91-99)	Rex 1997[19]
Colonoscopy specificity	99 (95-100)	Rex 1997[19]
Colonoscopy perforation rate	0.06 (0.04-0.08)	Rex 1997[19]
Polypectomy bleeding	0.48 (0.3-0.6)	Levin 2006[20]
Polypectomy perforation	0.11 (0.07-0.15)	Levin 2006[20]
Colonoscopy bleeding	0.001 (0.0007-0.0013)	Levin 2006[20]
OC-related death rate	0.006 (0-0.01)	Levin 2006[20]
Costs, $		
Colonoscopy	630 (542-725)	CMS 2008[21]
Colonoscopy with polypectomy	1026 (500-2000)	CMS 2008[21]
Indirect cost OC[a]	210 (133-281)	CMS 2008[21]
Localized CRC treatment	52,000 (33,150-66,900)	CMS 2008[21]
Regional CRC treatment	76,000 (61,500-140,000)	CMS 2008[21]
Distant CRC treatment	80,000 (160,000-240,000)	CMS 2008[21]
Bleeding	5494 (3740-7152)	CMS 2008[21]
Perforation	16,380 (12,310-15,600)	CMS 2008[21]

Abbreviations: CI, confidence interval; CMS, Center for Medicare and Medicaid Services; CRC, colorectal cancer; GI, gastroenterologist; OC, optical colonoscopy; SEER, Surveillance, Epidemiology, and End Results Program of the National Cancer Institute.
[a] These are indirect costs and include 8 hours for the patient plus 4 hours for an escort.

willingness-to-pay threshold to differentiate between efficient and inefficient procedures.[23]

Simulation Output in the United States

In the reference case scenario, we assumed 100% adherence to simulate the efficacy and cost of colonoscopy screening in those actually screened. To obtain the national projection of the CRC prevention rate of a primary colonoscopy screening according to the specialty of the endoscopist, we corrected the initial simulation for the actual adherence rate. In detail, the estimated adherence of the US population to CRC screening was 60%.[24] To project the outcomes of our simulation on the US population, we assumed a steady state for population size and age

Table 2. Costs and Efficacies of All Simulated Strategies for a Cohort of 100,000 Individuals[a]

Variable	No Screening	Overall Colonoscopy Screening	Non-GI Colonoscopy Screening	GI Colonoscopy Screening
No. of CRC cases	5903	1600	1765	1256
No. of CRCs prevented	—	4442	4138	4647
CRC prevention rate, %	—	75	70	79
No. of CRC deaths	2482	681	805	598
CRC death prevention rate, %	—	73	68	76
Life-years gained	—	14,960	13,902	15,672
Gain in life-expectancy per individual, d	—	55	51	57
Screening cost, $/individual	—	2486	2486	2486
Cost of care for CRC, $/individual	2227	503	621	423
Total cost, $/individual	2227	2989	3107	2909
ICER vs no screening, $ per life-year gained	—	5091	6332	4351

Abbreviations: CRC, colorectal cancer; GI, gastroenterologist; ICER, incremental cost-effectiveness ratio.
[a] The strategy indicated as "overall colonoscopy screening" represents the reference case scenario in which it was simulated that 60% of the colonoscopies were to be performed by GI endoscopists and 40% were to be performed by non-GI endoscopists. The remaining 2 screening strategies simulated a complete screening of the initial cohort by either non-GI endoscopists or GI endoscopists, assuming a 1.4 relative risk of postcolonoscopy interval CRC between the 2 specialties. Note that the GI colonoscopy screening strategy also represents the "high-quality" scenario described in the text.

distribution, represented by the year 2009 US Census data. We then multiplied each age-specific model output by the number of individuals of that age in the US population and corrected the models to represent a 60% participation rate in screening. Adding the results for all ages under each strategy yielded national estimates. No discounting was used in these national projections, because the model outputs reflected all individuals ages 50 to 100 years at a given point in time in the steady state, as opposed to a cohort aging from ages 50 years to 100 years over a span of 50 years. The model was simulated by using Excel spreadsheets (Microsoft Corporation, Redmond, Wash).

Sensitivity Analysis

A systematic sensitivity analysis was performed for all the variables of the model, and the most relevant results are reported.

RESULTS

Table 2 indicates that, in the no-screening simulation, 5903 CRC cases and 2482 CRC-related deaths occurred in the simulated cohort of 100,000 US individuals, resulting into the loss of 31,839 undiscounted life-years. Costs in the no-screening simulation were related purely to the expenditure for CRC care, with an estimate of $2227 per individual (Table 2).

Reference Case Scenario

According to the model, the value of long-term CRC incidence prevention rate by screening colonoscopy corresponding to an age-adjusted 0.02% annual risk of postcolonoscopy interval CRC, as estimated in a previous study,[13] in the individuals who attended screening was equal to 75%. Colonoscopy screening resulted in a substantial decrease in CRC treatment costs compared with no screening ($503 per individual vs $2227 per individual at 3% discounting rate). This was offset by the cost of screening and follow-up testing ($2486 per individual at 3% discounting rate), resulting into an overall discounted cost per individual of $2989 (Table 2). When comparing endoscopic strategies with the no-screening scenario, colonoscopy screening appeared to be a cost-effective alternative with an ICER of $5091 per life-year saved (Table 2).

Efficacy According to Endoscopist Specialty

When assuming a 1.4 RR of interval CRC between non-GI and GI endoscopists, as well as a 40%/60% distribution of the screening colonoscopies, the corresponding long-term CRC incidence prevention rates by screening colonoscopy in the initial cohort of 100,000 individuals were 70% and 79% for non-GI and GI endoscopists, respectively, corresponding to an 11% relative reduction when the procedure was performed by non-GI endoscopists compared with GI endoscopists. The GI strategy also resulted in a substantial reduction in CRC-related costs ($423 per individual vs $621 per individual at 3% discounting rate), although the costs of screening and follow-up testing were equal between the 2 strategies (Table 2).

In the reference case scenario, we assumed that the distribution of screening colonoscopies between GI and non-GI endoscopists was 60% and 40%, respectively, as actually estimated for the Medicare population.[9] When assuming—in a "high-quality" scenario—that all colonoscopies were to be performed by GI endoscopists, the overall CRC incidence prevention rate by screening colonoscopy (compared with no screening) in the simulated

Table 3. Projection of the Model Outputs on the US Population[a]

Variable	No Screening	Overall Colonoscopy Screening	High-Quality Scenario
No. of CRC cases	144,424	78,007	74,964
No. of CRCs prevented	—	66,417	69,460
No. of CRC deaths	58,311	32,293	31,089
No. of CRC deaths prevented	—	26,019	27,222
Total cost, € billion	9.7	11.0	10.8

Abbreviations: CRC, colorectal cancer.
[a] Note that no discounting was applied, because the model outputs reflected all individuals ages 50 to 100 years at a given point in time in the steady state. The strategy indicated as "overall colonoscopy screening" represents the reference case scenario in which it was simulated that 60% of the colonoscopies were to be performed by gastroenterologist (GI) endoscopists and 40% were to be performed by non-GI endoscopists. The "high-quality" scenario simulates a complete screening of the initial cohort by GI endoscopists.

population increased from 75% (reference case scenario) to 79%. The relative 5% difference in the long-term CRC prevention rate was because of the extension of a 79% CRC prevention rate to the 40% of colonoscopies performed by non-GI endoscopists. The colonoscopy by GI endoscopists-only scenario also resulted in a substantial reduction in CRC-related costs compared with the reference case scenario, resulting in a lower overall cost ($2909 per individual vs $2989 per individual at 3% discounting rate) (Table 2). Because it was more effective and less costly, the reference case scenario appeared to be dominated by the scenario of colonoscopy by GI physicians, the latter resulting in a discounted saving of $81 per individual.

Projection on the US. Population

In the no-screening scenario, the actual numbers of CRC cases and CRC-related deaths simulated for the entire US population were 144,424 and 58,311 per year, respectively, resulting in an annual undiscounted cost of 9.7 $ billion for CRC care (Table 3). When assuming a 60% adherence and the 75% CRC prevention rate demonstrated in the reference case scenario, the absolute numbers of CRC and CRC-related deaths prevented per year by screening colonoscopy in the US population were 66,417 and 26,019, respectively (Table 3). The undiscounted annual cost of this strategy (projected on the US population) was equal to $11 billion. Of these costs, only $4.3 billion were CRC treatment costs, and the remaining $5.7 billion in costs were related to the costs of the screening program.

When we assumed that all screening colonoscopies would be performed by GI endoscopists, the additional reductions in CRC cases and CRC-related deaths, compared with the reference case scenario, were 3043 and 1204 per year, respectively (Table 3). Because of the additional reduction of CRC-related costs (because of the higher CRC prevention rate), the overall cost of this strategy was $10.8 billion, corresponding to an annual difference of $205 million compared with the reference case scenario.

The overall demand for screening colonoscopy in the reference case scenario was estimated at 5.1 million screenings per year. When assuming that 60% of this burden would be performed by GI endoscopists, the annual number of screening colonoscopies per endoscopist appeared to be 247. When dividing the additional number of screening colonoscopies needed to be performed by GI endoscopists in the "high-quality scenario" (ie, 2.1 million per year in the United States) with the total number of board-certified gastroenterologists, this would result in an additional 165 screening colonoscopies per endoscopist per year, representing a 67% increase in capacity compared with the reference case scenario.

Sensitivity Analysis

The difference in CRC prevention rate between GI and non-GI endoscopists was sensitive to the RR of postcolonoscopy interval cancer. When assuming an RR of 2.0 (compared with the baseline RR of 1.4), the long-term CRC incidence prevention rates by screening colonoscopy for GI and non-GI endoscopists were 82% and 64%, respectively, and the absolute difference passed from 9% in the reference case scenario to 19% (Fig. 1). In this scenario, the implementation of a "high-quality" scenario would result in a 7% increase in the long-term CRC prevention rate compared with a mixed GI/non-GI scenario. Alternatively, when assuming a 1.2 RR, the absolute difference in long-term CRC prevention rates between GI and non-GI would be reduced to 6%.

The result of the analysis also varied according to the baseline risk of postcolonoscopy interval cancer in the reference case scenario. By increasing such risk from 0.02% to 0.06%—corresponding to a decrease in colonoscopy efficacy from the baseline 75% to 48%—the

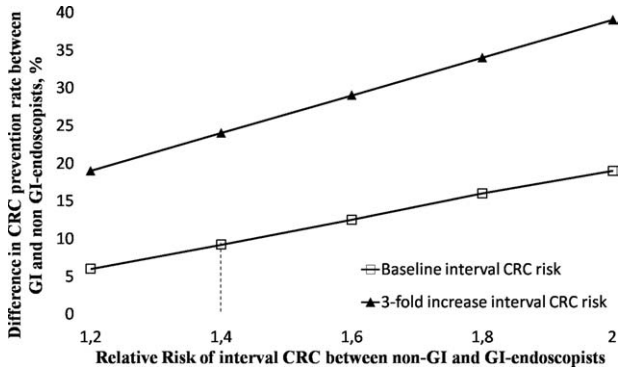

Figure 1. The absolute difference in the long-term colorectal cancer (CRC) prevention rate is illustrated between gastroenterologist (GI) endoscopists and non-GI endoscopists according to the relative risk and the absolute risk of postcolonoscopy interval CRC (see text).

corresponding CRC prevention rates for non-GI and GI endoscopists were 40% and 58%, respectively, and the difference between the 2 specialties increased from the baseline 9% to 18% (Fig. 1). In this case, the implementation of a GI endoscopist only scenario would be associated with a 10% increase in the CRC prevention rate (ie, from 48% to 58%). By further increasing the risk of interval CRC to 0.1%, corresponding to an overall 30% CRC prevention rate by screening colonoscopy, the difference in long-term CRC prevention rate between the 2 specialties would become 26% (13% vs 39%). In a 2-way sensitivity analysis, when assuming a 0.06% risk of interval CRC and a 2.0 RR between GI and non-GI endoscopists, the difference in the CRC prevention rate between GI and non-GI endoscopists would increase further to 38% (66% vs 28%). In this case, the implementation of a GI endoscopist-only scenario would be associated with an 18% increase in the CRC prevention rate (ie, from 48% to 66%). The higher impact of endoscopist specialty in this scenario—in which a reduced overall efficacy of colonoscopy in preventing CRC was simulated—was related to the higher burden of CRC on which the improvement in quality could be applied.

We assumed the same adherence to colonoscopy screening between GI and non-GI endoscopists. When simulating an eventual difference according to the type of specialty, a 10% gap (in favor of non-GI endoscopists) was required to reduce the long-term protection by GI endoscopists to the same level as that of non-GI endoscopists.

The main results of our analysis were robust to changes in overall adherence to colonoscopy screening (ie, equally affecting the 2 specialties), although there was a linear relation between such adherence rate and the absolute economic difference between the reference case scenario and the "high-quality" strategy. The results of our analysis also were robust to changes in the relative distribution of screening colonoscopy between the 2 groups of endoscopists.

DISCUSSION

According to our simulation, there is an 11% relative difference in the long-term CRC prevention rate between GI and non-GI endoscopists, resulting in the lack of prevention of >30,000 cases of CRC and the loss of $2 billion for CRC-related costs every 10 years in the US population. The possibility of adopting a simulation model to convert the RRs of interval CRC in the long-term CRC prevention rate is critical when considering that the exposure time required to assess the interval CRC risk is limited to 2 or 3 years, whereas the detection of an eventual difference in the CRC prevention rate may be delayed up to 10 or 11 years, as recently demonstrated in a randomized setting.[25]

Our sensitivity analysis also demonstrated that the impact of specialty on the efficacy and costs of screening colonoscopy depended strictly on the overall long-term protection of colonoscopy and the RR of postcolonoscopy interval CRC between the 2 specialties. In the reference case scenario, we estimated a relatively high efficacy of screening colonoscopy. The 75% CRC prevention rate was based on the very low risk of interval CRC reported by a large prospective study of screening colonoscopy.[13] When assuming a reduced protection by screening colonoscopy, the difference in the CRC prevention rate between GI and non-GI endoscopists substantially increased. When assuming the same 0.1% risk of interval CRC recently estimated in Canada[6] (corresponding to an overall 30% efficacy of colonoscopy in preventing CRC), the difference in the CRC prevention rate between GI and non-GI endoscopists was increased 2-fold. When also assuming in this scenario a 1.9 RR in interval CRC between non-GI and GI endoscopists, as recently estimated,[11] the absolute difference in the CRC prevention rate between the 2 specialists appeared to increase 4-fold to nearly 40%. Conversely, our sensitivity analysis demonstrated that a potential advantage for non-GI endoscopists may be represented by an eventual increase in the level of adherence to colonoscopy screening compared with the level among GI endoscopists, as recently suggested for African Americans.[26]

We also demonstrated that the eventual shift of screening colonoscopies from non-GI to GI specialties would be associated with a 67% increase in the volume of

screening colonoscopies for the 12,907 US gastroenterologists. However, the absolute increase would be limited to 165 procedures per year for each endoscopist, corresponding to a daily increase of less than 1 procedure.

We based our simulation on the specialty of the endoscopist, because it has been demonstrated consistently that this factor affects important colonoscopy outcomes.[7,9-11,27,28] Thus, it has been observed consistently that the performance of colonoscopy by non-GI endoscopists predicts a greater risk of incident CRCs before the next colonoscopy.[9-11] To our knowledge, no study that has examined this issue has indicated that colonoscopy by non-GI endoscopists is as effective or more effective in preventing CRC compared with colonoscopy by GI endoscopists.[9-11,27] Non-GI endoscopists also are more likely to overuse colonoscopy than GI endoscopists, ie, to perform colonoscopy at shorter-than-recommended intervals.[29,30] Thus, performance of colonoscopy by non-GI endoscopists may be associated with reduced cost-effectiveness compared with colonoscopy by GI endoscopists.

Our study has several possible implications and conclusions for CRC prevention. One potential conclusion is to transfer the performance of colonoscopy from non-GI to GI endoscopists. This conclusion may be particularly relevant in urban areas in which GI endoscopists are more available, and it would be less appropriate and feasible in rural areas. Such a policy undoubtedly would face political obstacles that would make it impractical in many instances. In addition, such a policy would not be fair to all non-GI endoscopists, because our study considered only average performance by GI and non-GI endoscopists, when, in reality, performance is quite variable within specialties,[31,32] and some non-GI endoscopists may have superior colonoscopy performance compared with some GI endoscopists. Indeed, interval cancers also have been associated with lower adenoma detection rates,[13] lower polypectomy rates,[11] and lower rates of cecal intubation.[33] Thus, we believe that our results support the current quality movement in the technical performance of colonoscopy within the GI community[8,34] and the need to transfer this movement aggressively to the non-GI community that is performing colonoscopy. In this way, improvements in quality and the removal of colonoscopy privileges for individual practitioners who cannot reach quality targets could be based on measurements of individual performance rather than on sometimes inappropriate generalizations based on specialty. However, our simulation certainly supports the appropriateness of mandating quality measurements by both GI and non-GI endoscopists, because no reasonable explanation other that quality has been offered for the differences in outcomes between and within specialty. Finally, our results may have implications for non-GI training programs in colonoscopy, because the differences in quality of performance that likely underlie the observed differences in cancer protection and cost-effectiveness between specialties may have their basis in suboptimal training in non-GI programs. A recent study indicated that substantial differences in polyp detection existed between gastroenterology and surgical trainees at the same institution.[35]

When screening colonoscopy is performed by non-GI specialists, a relative 11% reduction in the long-term CRC prevention rate compared with GI endoscopists may be expected, resulting in a substantial loss of life-years and economic resources. We recommend mandated quality measurements for both GI and non-GI colonoscopists and improvements in colonoscopy training for non-GI colonoscopy training programs.

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