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Trainees' knowledge and application of guideline recommendations for colorectal cancer screening and surveillance

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A B S T R A C T

Background: Data shows that practicing physicians don't recommend colorectal (CRC) screening and surveillance as suggested by guidelines. We assessed knowledge of CRC guidelines in medical trainees.

Methods: A survey assessing confidence and knowledge of published CRC guidelines was emailed to program directors (PDs) of Accreditation Council of Graduate Medical Education approved training programs in the United States. PDs were requested to forward it to trainees. We analyzed trainees' knowledge by answers to clinical vignettes and identification of factors required by guidelines for screening and post polypectomy colonoscopy interval. We compared confidence and knowledge by specialty.

Results: 586 trainees in internal medicine (159), family medicine and primary care (147), gastroenterology (114), general surgery (51), ob/gyn (78), urology (13), and colorectal surgery (13) responded. 97% reported following guidelines. 68% and 50% stated confidence recalling screening and surveillance guidelines, respectively. 16% and 8% correctly identified all factors and answered corresponding vignettes for screening and surveillance, respectively. Overall accuracy of screening ranged between 11–23% and was not different between specialties ($p = 0.11$) while significant differences were noted between specialties in surveillance knowledge (0–39%, $p < 0.001$).

Conclusions: United States trainees' CRC screening and surveillance knowledge is poor. Measures are needed to enhance knowledge of CRC guidelines.

Introduction

Colorectal cancer (CRC) is one of the most common cancers diagnosed in the United States and is a leading cause of cancer death [1]. Fortunately, early detection and prevention through polypectomy has shown to play an important role in the declining incidence and mortality of CRC [2]. Colonoscopy is the mainstay of CRC screening and surveillance with approximately 12 million procedures performed each year in the US [3]. Various studies demonstrate considerable discordance between guideline based recommendations [4–7] and how physicians practice for both the time to incept CRC screening and choosing the appropriate surveillance interval [8–10] resulting in inappropriate overuse and underuse of resources [11].

Studies have shown that the non-conformity between recommendations in published evidence based guidelines and physician recommendations by response to surveys spans different specialties of medical providers including primary care providers (PCPs) [12] as well as gastroenterologists [13] and general surgeons. [14] A myriad of potential elements may contribute to this practice versus recommendations gap including the complexity of the guidelines, medical liability, financial incentives and physician knowledge and acceptance of guidelines. PCPs and specialists are responsible for prescribing average risk CRC screening, high-risk screening colonoscopy when a personal or family history of polyps or cancer is present, and often post polypectomy surveillance colonoscopy.

Residents and medical students in Mexico City were seen to have suboptimal knowledge of cancer screening, including colon cancer. [15] US trainee's knowledge of CRC screening and surveillance guidelines and their ability to correctly apply them has not yet been studied. If poor knowledge is identified in trainees, targets for education and development of tools to remedy any potential deficits would be a priority. We conducted a cross-sectional nationwide study in medical and surgical trainees to assess their knowledge and ability to correctly apply CRC screening and surveillance guidelines.

Methods

The study was approved by the Institutional Review Board at the

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Cleveland Clinic, Cleveland, Ohio. A 16-question anonymous, web based survey was created. Knowledge was tested based on selection of criteria for screening and surveillance as well as four case vignettes. Vignettes were created based on surveys administered to gastroenterologists and internists in prior studies [14, 16, 17] and represented commonly encountered scenarios in our own primary care clinic. Respondents were also asked to pick factors utilized by guidelines regarding CRC screening and surveillance. Five factors (namely age, family history of CRC, personal history of CRC, IBD or polyps) out of a list of 15 for screening; and four (namely number, size, pathology and completeness of resection) of a list of nine for surveillance were used as the standard for comparison. Hereditary CRC syndromes (such as Lynch Syndrome or Familial Adenomatous Polyposis) were not included in the questionnaire. The questionnaire was pre-tested and vetted for content by all the authors, two primary care physicians and piloted on a group of 15 residents not linked to the investigating group for feedback regarding clarity and appropriateness.

The survey was distributed to trainees in the following manner: an email was sent to all program directors (1594) of U.S. Accrediation Council of Graduate Medical Education approved internal medicine (455), family medicine (381), surgery(196), obstetrics and gynecology (198), urology(98), gastroenterology(208) and colorectal surgery(58) training programs. The program directors were requested to forward the email, which included the survey link to fellows and residents in their program. Two additional reminder emails were subsequently sent one week apart to increase the response rate. The survey was incentivized by voluntary participation in a raffle for five $50 gift cards. Information on medical specialty, knowledge of and confidence in applying CRC screening and surveillance guidelines (specifically United States Preventive Services Task Force (USPSTF) [7], American College Of Gastroenterology (ACG) [5] and United States Multi-society Task Force on Colorectal Cancer (USMSTF) [4, 6] was collected. Confidence was ascertained by a yes/no answer to the following two questions: “Can you confidently recall CRC screening guidelines?” and “Can you confidently recall CRC surveillance guidelines?” Knowledge was assessed by accurate responses to four clinical vignettes and the correct identification of all factors utilized by published guidelines to determine the age to initiate CRC screening and post polypectomy surveillance colonoscopy intervals (Table 1). The correct factors were embedded in a list of factors; an accurate response was deemed based on selection of all the factors utilized in the above-mentioned guidelines. Overall knowledge was defined as the ability to identify all factors and answer corresponding clinical vignettes correctly.

Pearson's chi-square tests were used to compare whether respondents’ confidence and accurate knowledge of CRC screening and surveillance guidelines varied by specialty. Trainees were divided into primary care (PC: family medicine and internal medicine), gastroenterology fellows (GI), digestive disease related surgical trainees (CGS: colorectal surgery and general surgery) and other surgical trainees (OB-GU: obstetrics/gynecology and urology). A $p < 0.05$ was considered statistically significant. For ad-hoc pairwise comparison a significance level of 0.008 was used, applying Bonferroni correction.

Results

A total of 586 trainees responded representing nine specialties: internal medicine (159), family medicine and primary care (147), gastroenterology (114), general surgery (51), ob/gyn (78), urology [13], colorectal surgery [13] and not further specified [11] (Fig. 1). Of respondents 47% of the trainees were male. Eighty five percent ($N = 496$) of the participants reported they ordered CRC screening and colonoscopy surveillance in their practice whereas 29% of trainees ($N = 166$) stated they performed colonoscopy. 97% of trainees [$N = 562$) reported they followed guidelines when making patient recommendations. Of the 3% ($N = 19$) of participants that stated they do not follow CRC guidelines, the most common reason cited was difficulty in recalling guidelines (84%), followed by patient preference (10%) and the rest (6%) did not specify.

Overall 68% of trainees (Table 2) reported they were confident in

Table 1
Questions utilized to ascertain accurate knowledge of CRC screening and surveillance guidelines.

Screening
Factors to determine start of screening (non-exclusive)
Age
BMI/Weight
Diabetes mellitus
Diet
Family history of colorectal cancer
Family history of colon polyps†
Occupation
Personal history of IBD
Personal history of colorectal carcinoma
Personal history of polyps on prior colonoscopy
Personal history of breast or prostate cancer
Race†
Radiation exposure
Sex
Smoking history
Vignettes (correct answers bolded and italicized)
A 40-year-old white man's mother was diagnosed with colorectal carcinoma (CRC) at age 62. He does not have any symptoms or other risk factors for CRC. Which of the following is a current recommendation for CRC screening in him?
• Colonoscopy every 5 years, begin now
• ***Colonoscopy every 10 years, begin now****
• ***Colonoscopy every 10 years, begin at age 50****
• Colonoscopy every 5 years, begin at age 50
A 45-year-old African American woman is meeting with you for a refill on her anti-hypertensive medication regimen. She has no risk factors for colorectal cancer. Which of the following is a current recommendation for average risk CRC screening?
Fecal Immunochemical Tests yearly starting at 45*
Flexible sigmoidoscopy every 3 years starting at 45
Colonoscopy every 5 years starting at 50
Colonoscopy every 10 years starting at 50*
Colon cancer screening not indicated
Surveillance
Factors to determine surveillance interval (non-exclusive)
Gender
Location of polyps†
Method of removal (whole vs. piecemeal)
Number of polyps
Pathology of polyps
Presence of stalk/pedunculated
Proximity of polyps to one another
Race
Size of polyps
Vignettes (correct answers bolded and italicized)
A 63 y/o male underwent average risk screening colonoscopy. The bowel preparation was excellent. Exam complete. A 5 mm tubular adenoma and 8 mm tubulovillous adenoma with high grade dysplasia in the transverse colon were seen and completely removed. What is the appropriate follow up interval for colonoscopy for this patient?
• 1 year
• ***3 years***
• 5 years
• 10 years
• Repeat colonoscopy not indicated
A 58-year-old male undergoes a screening colonoscopy. The cecum was reached and bowel preparation was noted to be adequate. A single 7 mm polyp was found in the transverse colon and removed completely. On pathology the polyp was found to be a Sessile Serrated polyp with no dysplasia, when would you schedule the next colonoscopy?
• 6 months
• 3 years
• ***5 years***
• 10 years

† Not penalized for selection of these factors, as variations noted in guidelines (ACG, USMSTF, USPSTF).

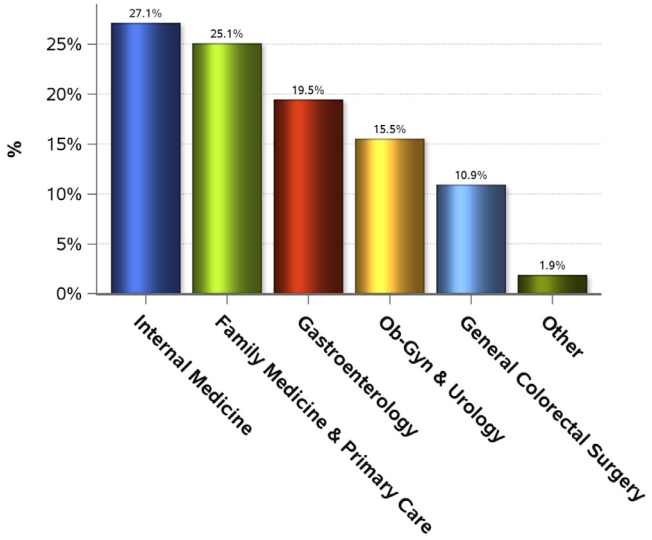

Fig. 1. Trainees by specialty.

recalling CRC screening guidelines but the proportion who stated confidence varied significantly by specialty: 87% of GI fellows, 69% of PC trainees, 63% of CGS and 45% of OB-GU trainees ($p < 0.001$). Over 50% of respondents reported they were confident in recalling surveillance guidelines. This included 90% of GI fellows, 70% of CGS, 40% of PCs and 24% of OB-GU residents ($p < 0.001$).

The percentage of respondents with accurate knowledge of guidelines was substantially lower than the numbers that expressed confidence in their recollection of guidelines. Overall 68% of trainees answered both CRC screening vignettes correct (Table 2). By specialty, it included 76% of PCs, 52% of GI fellows, 70% of CGS, and 62% of OB-GU residents ($p < 0.001$). Approximately a quarter of trainees were able to accurately select all four factors used to determine the onset of CRC screening: 22% of PCs, 43% of GI fellows, 28% of CGS, and 19% of OB-GU trainees ($p < 0.001$). Overall, only 16% of trainees were accurate in identifying all four factors and the correct answers to both vignettes with no significant differences between specialty groups ($p = 0.11$).

In regard to knowledge of surveillance guidelines, 31% of respondents got both surveillance vignettes correct (Table 2) and varied significantly by specialty. GI fellows fared the best with 52% accurately answering both vignettes, compared to 26% of PCs trainees, and 27% for both CGS and OB-GU trainees ($p < 0.001$). Overall, 17% were able to identify all four factors to determine surveillance interval correctly; 63% of GI fellows followed by CGS trainees at 22% and PCs and OB-GU trainees at 4% each ($p < 0.001$). Only 8% of the respondents could identify all surveillance factors and answer both surveillance vignettes accurately. This varied from 39% of GI fellows, 6% of CGS trainees and <1% of PCs and OB-GU trainees ($p < 0.001$).

We compared the outcomes between trainees who reported they perform colonoscopy ($N = 166$) and those that did not ($N = 417$); 3 trainees who did not respond to this question were excluded from this part of the analysis. Trainee colonoscopists were either GI fellows ($N = 107$), CGS trainees ($N = 56$) or family medicine trainees ($N = 3$). More trainee colonoscopists reported confidence (78% vs. 64%, $p = 0.001$) in recalling CRC screening guidelines but had a lower accuracy in answering the screening vignettes (56% vs. 73%, $p < 0.001$) compared to their non-colonoscopist peers (Table 3). With regards to recalling surveillance guidelines, more trainee colonoscopists reported confidence (85% vs. 36%, $p < 0.001$) and they demonstrated higher accuracy answering the vignettes (45% vs. 26%, $p < 0.001$), identifying factors (51% vs. 4%, $p < 0.001$) and identifying both factors and correct answers to vignettes (29% vs. 0.24%, $p < 0.001$) than their non-colonoscopist peers.

Discussion

This is the first study evaluating US medical and surgical trainee's knowledge of CRC screening and surveillance recommendations established by national guidelines. We found trainee physicians in multiple specialties show a considerable deficit in their knowledge of CRC screening and surveillance guidelines as tested through responses to an online survey. Although the majority of trainees (>90%) stated that they utilize guidelines in making recommendations to their patients, their confidence in recalling them was far lower; 68% expressing confidence in recalling CRC screening and 50% for CRC surveillance guidelines. This discrepancy between confidence, and accuracy and application of knowledge existed among all trainee specialties for both screening and surveillance. While a higher proportion of trainees in digestive disease specialties (Gastroenterology, General and Colorectal surgery) including those who perform colonoscopy, stated confidence in recalling CRC screening guidelines, they demonstrated a significantly lower performance regarding screening knowledge when compared to their colleagues in primary care specialties. Additionally, only 1% of trainee physicians in primary care specialties could accurately answer the two post polypectomy vignettes and identify the factors used in determining colonoscopy surveillance intervals, highlighting a deficiency.

Over and under-utilization of screening and surveillance modalities has direct and indirect implications on patient health as well as health care costs and is a growing focus of national attention. Colorectal cancer prevention starts with the patient acknowledgement and physician endorsement of the importance of CRC screening. Barriers to the use of screening include patient adherence, physicians' knowledge and

Table 2
Comparison of perceived confidence and knowledge of CRC screening and surveillance guidelines by specialty in trainees.

		Trainees ($N = 586$)%	PC ($N = 306$)%	GI ($N = 114$)%	CGS ($N = 64$)%	OB-GU ($N = 102$)%	*P* value
Confident recalling guidelines	Screening	*68*	69 [b,c]	87 [a,c,d]	63[b]	45 [a,b]	<0.001
	Surveillance	*50*	40 [b,c,d]	90 [a,c,d]	70 [a,b,d]	24 [a,b,c]	<0.001
Answered vignettes correctly	Screening	*68*	76 [b,d]	52 [a]	70	62[a]	<0.001
	Surveillance	*31*	26 [b]	52 [a,c,d]	27[b]	27[b]	<0.001
Identified factors to start/interval	Screening	*26*	22[b]	43 [a,d]	28	19 [b]	<0.001
	Surveillance	*17*	4 [b,c]	63 [a,c,d]	22 [a,b,d]	4[b,c]	<0.001
Answered both vignettes & identified all factors correctly	Screening	*16*	16	23	16	11	0.11
	Surveillance	*8*	0.33[b,c]	39[a,c,d]	6 [a,b]	0 [b]	<0.001

A significance level of 0.008 was used for pairwise ad-hoc comparisons.
[a] Significantly different from primary care physicians (PCPs) which includes internal medicine, family medicine and primary care.
[b] Significantly different from GI.
[c] Significantly different from surgery.
[d] Significantly different from other which includes Ob/Gyn, urology, and other.

Table 3
Comparison of perceived confidence and knowledge of CRC screening and surveillance guidelines by trainee colonoscopists vs. non-colonoscopists.

		Colonoscopists (N = 166)%	Non-Proceduralists (N = 417)%	P value
Felt confident recalling guidelines	Screening	78	64	0.001
	Surveillance	85	36	<0.001
Answered both vignettes correctly	Screening	57	73	<0.001
	Surveillance	45	26	<0.001
Accurately identified factors to determine start/interval	Screening	39	21	<0.001
	Surveillance	51	4	<0.001
Answered both vignettes & identified all factors correctly	Screening	20	15	0.14
	Surveillance	29	0.25	<0.001

attitude, and organizational factors. A small study of 28 gastroenterologists (including 16 trainee GIs) in an academic medical center by Patel et al., utilizing a review of documented colonoscopy recommendations in practice and guideline knowledge as tested with clinical vignettes, showed that knowledge was significantly associated with adherence to guidelines in practice (OR 1.5, 95% CI 1.2–2.0, p = 0.003). About 68% of the participating physicians accurately estimated the interval for colonoscopy in patients with low risk adenoma, whereas 64% overestimated the interval rate for high-risk adenoma. GI trainee status (OR 2.1, CI 1.1–3.7, p = 0.003) and participants that stated they were strongly influenced by the guidelines (OR 1.8, 95% CI 1.2–2.7, p = 0.04) had a statistically significant higher likelihood of making guideline concordant recommendations, whereas those that stated they did not believe the guidelines were appropriately aggressive were 30% less likely to make guideline concordant recommendations (p = 0.04) [16]. Studies on 1235 primary care (2003) [17] [17] and 116 digestive disease physicians (2007) [18], that were prior to the most recent (2012) United States Multi-Society Task Force on Colorectal Cancer (MSTF) guidelines for post polypectomy surveillance showed that although the physicians express awareness of CRC guidelines, there is a considerable gap when tested for their objective knowledge regarding the initiation, selection of appropriate intervals and specific modalities for both screening and post-polypectomy surveillance. In our study, 85% of the participants prescribed CRC screening and post polypectomy surveillance and 29% performed colonoscopy in their practice. In spite of these practice patterns, a considerable knowledge gap existed when this was tested objectively with only 68% and 31% correctly answering both screening and surveillance vignettes correctly respectively.

Lack of physician knowledge regarding the CRC screening options including modalities available and the recommended interval between examinations was demonstrated in primary care physicians in Canada [19]. A nationally representative sample of over 1000 physicians in the US showed that less than 20% made CRC screening recommendations consistent with published guidelines [8]. Our study shows that among trainees only 16% of the cohort correctly answered both the screening vignettes which tested knowledge of the age to start CRC screening and selected all the factors required to determine the age to initiate screening and subsequent intervals. In our study when respondents were asked when to initiate CRC screening for an individual with a first degree relative diagnosed with CRC at the age of 62, 73% chose to initiate screening correctly and 26% selected options with intervals that were too frequent as per the current guidelines (Table 4). The second vignette that queried age to initiate screening in an average risk African-American woman, 9% selected to initiate screening at the age of 45, which is the recommendation based on the ACG guidelines [5], while most (84%) opted for a colonoscopy at the age of 50, consistent with USPSTF/MSTF guidelines [4, 7]. Interestingly 25% of respondents selected race as a factor associated with the age of initiation of CRC screening.

Post polypectomy surveillance colonoscopy composes a substantial proportion of colonoscopies done in the United States. The resource is limited and thus appropriate utilization of colonoscopy in patients with polyps allows more screening/surveillance colonoscopy to be performed. Determining the surveillance interval following polyp removal requires multiple factors be taken into consideration including the method of polyp removal (enbloc vs. piecemeal), polyp size (< 10 mm vs. ≥ 10 mm), pathology (tubular adenoma vs. any villous histology or high grade dysplasia) and number of polyps (1–2 vs. ≥3). In a survey study (2004) in a sample of 317 gastroenterologists and 125 general surgeons, surveillance colonoscopy was being recommended at intervals not consistent with the guidelines current at the time of the study (Gastroenterology Consortium 1997, American Society for Gastrointestinal Endoscopy, 1997 and American Cancer Society, 1997). [14] In the same study majority of the respondents (>80%) stated that they were influenced by evidence published in literature, whereas only 18–54% selected the various guidelines available at the time as an influencing factor, possibly reflecting lack of faith in the published guidelines. Guidelines for colonoscopy screening and surveillance were published in 2008 and updated in 2012 by the USMSTF. A national survey study published in 2015 of 306 gastroenterologists, found that although 85% of the participants reported awareness of the guidelines, 40% of the respondents received a failing grade (<59% correct answers) to postpolypectomy clinical scenarios. [13] Also noted was that participants in this study that were currently in training (N = 44) were found to be less adherent to guidelines as compared to the 160 physicians who completed training from 1991–2010, (OR 0.72, 95% CI 0.58–0.95, p = 0.004). Respondents that stated they did not follow the guidelines in their practice cited a concern that intervals recommended in the guidelines were too long (62%) and 12% reported difficulty-recalling guidelines as a reason. The gap in knowledge of CRC guidelines has also been shown in family medicine physicians and internists; in a study by Boolchand et al., of 568 primary care physicians that responded to a survey consisting of clinical vignettes, 61% recommended surveillance colonoscopy in ≤ 5 years for an individual with a hyperplastic polyp, 71% chose ≤ 3years for a patient with a single small tubular adenoma and 80% would survey a patient with two 6 mm tubular adenomas in ≤ 3 years, all representing significant overuse [12]. Trainees across specialties in our study also showed similar deficits with 14–28% choosing surveillance intervals that were shorter than recommended by guidelines.

The considerable gap between reported use and confidence in recalling guidelines and actual knowledge is demonstrated across all specialties in the many training programs represented and in trainees that perform colonoscopy in practice. Trainees in primary care specialties demonstrated better knowledge than their gastroenterology fellows when it came to determining the age to start CRC screening and the factors that account for setting that age. This somewhat surprising finding could reflect the fact that the discussion of CRC screening may be more often in the purview of primary care physicians. Not surprisingly, GI fellows demonstrated greater confidence and proficiency as it relates to post polypectomy surveillance, once again reflecting the fact that surveillance is more the purview of subspecialists. This head to head comparison amongst trainees in specialties demonstrates areas for educators to target. Trainees in a prior study have been shown to make more guideline concordant recommendations compared to practicing

Table 4
Percentage response to each screening and surveillance vignette.

	N(%)
A 40-year-old white man's mother was diagnosed with colorectal carcinoma (CRC) at age 62; He does not have any symptoms or other risk factors for CRC. Which of the following is a current recommendation for CRC screening in him?	
Colonoscopy every 5 years, begin now	54(9.3)
Colonoscopy every 10 years, begin now*	**57(9.8)**
Colonoscopy every 10 years, begin at age 50*	**367(63.3)**
Colonoscopy every 5 years, begin at age 50	102(17.6)
A 45-year-old African American woman is meeting with you for a refill on her anti-hypertensive medication regimen. She has no risk factors for colorectal cancer. Which of the following is a current recommendation for average risk CRC screening?	
Fecal Immunochemical Tests yearly starting at 45*	**54(9.3)**
Flexible sigmoidoscopy every 3 years starting at 45	12(2.1)
Colonoscopy every 5 years starting at 50	13(2.2)
Colonoscopy every 10 years starting at 50*	**488(83.8)**
Colon cancer screening not indicated	15(2.6)
A 63 y/o male underwent average risk screening colonoscopy. The bowel preparation was excellent. Exam complete. A 5 mm tubular adenoma and 8 mm tubulovillous adenoma with high-grade dysplasia in the transverse colon were seen and completely removed. What is the appropriate follow up interval for colonoscopy for this patient?	
1 year	165(28.4)
3 years	**333(57.2)**
5 years	76(13.1)
10 years	7(1.2)
Repeat colonoscopy not indicated	1(0.17)
A 58-year-old male undergoes a screening colonoscopy. The cecum was reached and bowel preparation was noted to be adequate. A single 7 mm polyp was found in the transverse colon and removed completely. On pathology the polyp was found to be a Sessile Serrated polyp with no dysplasia, when would you schedule the next colonoscopy?	
6 months	28(4.8)
3 years	77(13.2)
5 years	**285(49.0)**
10 years	192(33.0)

• Not penalized for selecting either options, as variations noted in guidelines (ACG, USMSTF, USPSTF).

physicians, perhaps from more recent exposure to the guidelines and the evidence on which they are based, [16] however this study could be replicated in practicing physicians in the future to see if the same trend emerges.

The strength of this study is its large nationally representative sample of trainee physicians across specialties. However there are some inherent limitations as results are based on responses to vignettes via survey, which may not match a respondent's actual practice. Inaccuracies have been shown in physicians self-reported rates of practices and what they believe should be recommended [20]. There may also be a response bias, if trainees who thought they were more knowledgeable about CRC guidelines were more likely to respond to our survey, our results, which show poor knowledge, would be an overestimate. To maximize the response rate only four vignettes were included in the questionnaire. Those vignettes, while simple clinical scenarios, do not span the entire gamut of recommendations addressed by guidelines and potentially more questions may have increased the opportunities for improved accuracy. We presumed that the format of our vignette questions, which were restricted to, multiple-choice options and the selection of factors from a list of correct and incorrect choices would enhance the accuracy of responses but this could also inflate the observed accuracy. We did not stratify participants based on their year of training, size or location of training program or belief in validity of the guidelines, which could have a bearing on their knowledge and application of the guidelines. Finally it is fairly probable that trainees and physicians likely rely on online and other resources in order to make recommendations in their clinical practice thus a knowledge deficit demonstrated may not directly impact patient care as much as suggested by our study.

Conclusions

Primary care and subspecialty physicians in training exhibit a lack of accurate knowledge in CRC screening and surveillance guidelines. While the majority of all surveyed trainees stated they followed CRC screening and surveillance guidelines, a substantial gap was noted between their reported use, confidence in recalling the guidelines and their application as demonstrated by accurately answering simple clinical vignettes, or identifying factors utilized by the guidelines to determine the age to start CRC screening or the interval for post polypectomy colonoscopy. This data demonstrates opportunities to design tools or practice aids to address the educational lacunae and to assist care providers in making guideline concordant CRC screening and surveillance recommendations.

Authorship contribution

Authors R.P., A.K. and C.B. participated in study design, conduction, analysis and manuscript preparation. Author R.L. in addition to the above was primarily responsible for statistical analysis.

Declaration

The manuscript has been read and approved by all the authors, that the requirements for authorship as stated earlier in this document have been met, and that each author believes that the manuscript represents honest work

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