

# The appropriateness of surveillance colonoscopy intervals after polypectomy

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**BACKGROUND:** Adherence to surveillance colonoscopy guidelines is important to prevent colorectal cancer (CRC) and unnecessary workload.

**OBJECTIVE:** To evaluate how well Canadian gastroenterologists adhere to colonoscopy surveillance guidelines after adenoma removal or treatment for CRC.

**METHODS:** Patients with a history of adenomas or CRC who had surveillance performed between October 2008 and October 2010 were retrospectively included. Time intervals between index colonoscopy and surveillance were compared with the 2008 guideline recommendations of the American Gastroenterological Association and regarded as appropriate when the surveillance interval was within six months of the recommended time interval.

**RESULTS:** A total of 265 patients were included (52% men; mean age 58 years). Among patients with a normal index colonoscopy (n=110), 42% received surveillance on time, 38% too early (median difference = 1.2 years too early) and 20% too late (median difference = 1.0 year too late). Among patients with nonadvanced adenomas at index (n=96), 25% underwent surveillance on time, 61% too early (median difference = 1.85) and 14% too late (median difference = 1.1). Among patients with advanced neoplasia at index (n=59), 29% underwent surveillance on time, 34% too early (median difference = 1.86) and 37% later than recommended (median difference = 1.61). No significant difference in adenoma detection rates was observed when too early surveillance versus appropriate surveillance (34% versus 33%; P=0.92) and too late surveillance versus appropriate surveillance (21% versus 33%; P=0.11) were compared.

**CONCLUSION:** Only a minority of surveillance colonoscopies were performed according to guideline recommendations. Deviation from the guidelines did not improve the adenoma detection rate. Interventions aimed at improving adherence to surveillance guidelines are needed.

**Key Words:** Appropriateness; Colonoscopy; Surveillance; Yield

Colorectal cancer (CRC) is a leading cause of cancer-related mortality in the Western world (1). Screening for CRC decreases CRC-related mortality and CRC incidence (2). The adenoma-carcinoma sequence is accepted as the developmental pathway of CRC and, hence, one of the main aims of screening colonoscopy is to detect and completely remove all adenomas (3,4). After neoplasia removal, patients remain at increased risk for adenoma recurrence. Therefore, surveillance after removal of adenomas or CRC is recommended.

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## La pertinence de la surveillance des intervalles de coloscopie après une polypectomie

**HISTORIQUE :** Il est important de respecter les lignes directrices sur la surveillance de la coloscopie pour prévenir le cancer colorectal (CCR) et une charge de travail inutile.

**OBJECTIF :** Évaluer la qualité de l'adhésion des gastroentérologues canadiens aux lignes directrices sur la surveillance de la coloscopie après l'ablation d'un adénome ou le traitement du CCR.

**MÉTHODOLOGIE :** Les chercheurs ont inclus rétrospectivement dans l'étude les patients ayant des adénomes ou un CCR qui ont subi une surveillance entre octobre 2008 et octobre 2010. Ils ont comparé le délai entre la coloscopie de référence et la surveillance aux recommandations des lignes directrices de 2008 établies par l'*American Gastroenterological Association*, et l'ont considéré comme pertinent lorsqu'il se situait dans les six mois du délai recommandé.

**RÉSULTATS :** Au total, 265 patients ont participé à l'étude (52 % d'hommes; âge moyen de 58 ans). Chez les patients ayant une coloscopie de référence normale (n=110), 42 % ont subi la surveillance dans les délais, 38 % l'ont subie trop tôt (différence médiane = 1,2 an trop tôt) et 20 % l'ont subie trop tard (différence médiane = 1,0 an trop tard). Chez les patients qui avaient un adénome non avancé à la coloscopie de référence (n=96), 25 % ont subi la surveillance dans les délais, 61 % trop tôt (différence médiane = 1,85) et 14 % trop tard (différence médiane = 1,1). Chez les patients ayant une néoplasie avancée à la coloscopie de référence (n=59), 29 % ont subi la surveillance dans les délais, 34 % l'ont subie trop tôt (différence médiane = 1,86) et 37 % plus tard que ce qui est recommandé (différence médiane = 1,61). Les chercheurs n'ont observé aucune différence significative des taux de détection des adénomes lorsque la surveillance avait lieu trop tôt plutôt qu'au moment pertinent (34 % par rapport à 33 %; P=0,92) et qu'on comparait une surveillance tardive à une surveillance effectuée au moment pertinent (21 % par rapport à 33 %; P=0,11).

**CONCLUSION :** Seule une minorité de coloscopies de surveillance a été exécutée conformément aux recommandations des lignes directrices. La déviation des lignes directrices n'améliorait pas le taux de détection de l'adénome. Des interventions visant à améliorer le respect des lignes directrices de surveillance s'imposent.

Factors associated with an increased risk of adenoma recurrence include the number of previous polyps and the presence of villous features on histology (5). The surveillance interval is generally based on these findings at the index colonoscopy (6).

The demand for colonoscopy procedures has risen considerably over recent years, which has led to increased wait times for gastroenterology care in many regions of the world, including Canada (7-9). The increase in demand for colonoscopy as a part of CRC screening is

**TABLE 1**  
**Patient characteristics at index colonoscopy**

	Total (n=265)	Normal index findings (n=110)	Nonadvanced adenoma (n=96)	Advanced neoplasia (n=59)
Age at index colonoscopy, years, mean $\pm$ SD	58 $\pm$ 10.5	59 $\pm$ 10.8	57 $\pm$ 10.0	59 $\pm$ 11.0
Male sex, n (%)	138 (52)	61 (56)	46 (48)	31 (53)
Cecal intubation rate, n (%)	230 (95)	98 (94)	84 (97)	48 (94)
Adequate bowel preparation, n (%)	238 (90)	97 (88)	89 (90)	55 (93)
Positive family history for colorectal cancer*, n (%)	61 (23)	21 (19)	27 (28)	13 (22)
Interval until surveillance colonoscopy, years, mean $\pm$ SD	3.8 $\pm$ 1.7	4.3 $\pm$ 1.5	3.8 $\pm$ 1.5	2.8 $\pm$ 2.0

\*First-degree relatives with colorectal cancer extracted from endoscopy report if available

likely to further lengthen wait times. Deviation from surveillance guidelines may further lead to unnecessary workload and, consequently, a decrease in the cost effectiveness of CRC screening (10). Previous studies have shown that a significant proportion of gastroenterologists recommend follow-up intervals that deviate considerably from the published guidelines (11-13).

The objective of the present study was to assess the appropriateness of recommended surveillance colonoscopy intervals in the Canadian endoscopy setting (6). Furthermore, we aimed to determine whether the appropriateness of surveillance intervals influenced the detection of colorectal adenomas.

## METHODS

The present retrospective cohort study was conducted at the University of Alberta Hospital, Edmonton, Alberta. Ethics approval for the study was obtained from the Health Research Ethics Board (Pro00013953). Patients were identified and selected from a pilot study performed as a first step in the creation of a CRC screening program (NCT00893503). This screening program, known as Stop Colorectal Cancer through Prevention and Education (SCOPE), was launched in Edmonton to start a regional colon cancer screening program. The program was designed to test several steps in the referral process. The average-risk patient could be referred only if he or she had a positive fecal occult blood test. Patients were also eligible to be referred to the program if they had a personal history of colon cancer or adenomatous polyps, or a family history of colon cancer or polyps. In the pilot study, the program only accepted referrals from gastroenterologists. In all patients who had a personal history of cancer or adenomatous polyps, the baseline endoscopy report and histology of removed polyps was available. For all patients who underwent a previous index colonoscopy during which adenomatous polyps were removed, the program accepted the recommendation that was made by the colonoscopist who performed the index colonoscopy. Patients were included in the current study only if they had a personal history of adenomas or CRC and underwent colonoscopy in the SCOPE program for surveillance purposes. Patients with a history of inflammatory bowel disease, a known hereditary CRC syndrome or patients with colonoscopies that were performed for the evaluation of gastrointestinal symptoms, were excluded.

Patients with a personal history of adenomas or CRC who had a surveillance colonoscopy performed between October 2008 and October 2010 were included. The colonoscopy performed before the procedure performed between October 2008 and October 2010 was defined as the index colonoscopy. Because all patients had a history of adenoma, this index colonoscopy may not have been their actual first-time colonoscopy performed for adenoma or CRC surveillance. Consequently, even if the defined index colonoscopy was normal, these patients, according to the 2008 American Gastroenterological Association (AGA) guidelines (6), were supposed to undergo surveillance colonoscopy every five years because of their adenoma or CRC history. This aspect was not incorporated in the 2006 AGA guideline but was already ensconced in the 2006 American Society for Gastrointestinal Endoscopy (ASGE) guideline (14). The 2008 AGA guidelines were used in the analyses because this was a combination of the AGA and ASGE guidelines from 2006, both of which were available at that time.

## Data collection

The following data were collected from endoscopy reports: demographic information (age and sex); family history of CRC; index and surveillance colonoscopy characteristics, such as date, cecal intubation rate, quality of bowel preparation (if not mentioned in the report it was assumed to be sufficient); and endoscopic findings including diagnosis, number, histology, and site of polyps or cancer. Right-sided adenomas were defined as adenomas found in the cecum, ascending colon, hepatic flexure or transverse colon. Left-sided was defined as the splenic flexure, descending colon, sigmoid colon and rectum. Patients were categorized in different surveillance groups based on their most advanced lesion at index colonoscopy (normal, non-advanced adenoma or advanced neoplasia). Advanced neoplasia was defined as  $\geq 3$  adenomas or adenomas  $>10$  mm in size, with  $>25\%$  villous histology or high-grade dysplasia, or CRC. For patients who were diagnosed with CRC during index colonoscopy, the date of their surgery was used to calculate the optimal surveillance interval.

The actual interval between the index and surveillance colonoscopy was compared with the recommended interval stated in the 2008 AGA guidelines (6). This guideline was used as the Canadian guideline, which has not been updated since 2004 but does not state explicit recommendations for surveillance. A margin of six months around the recommended date was considered to be an appropriate surveillance interval. Outcome measures were defined as the percentage of appropriate, too early and too late procedures. Secondary outcomes were the adenoma detection rates (ADRs) of the three categories, defined as the proportion of patients who had at least one adenoma at surveillance colonoscopy. For the ADR analyses and appropriateness categories, it was deemed appropriate to exclude cases with poor bowel preparation on index procedure.

## Statistical analysis

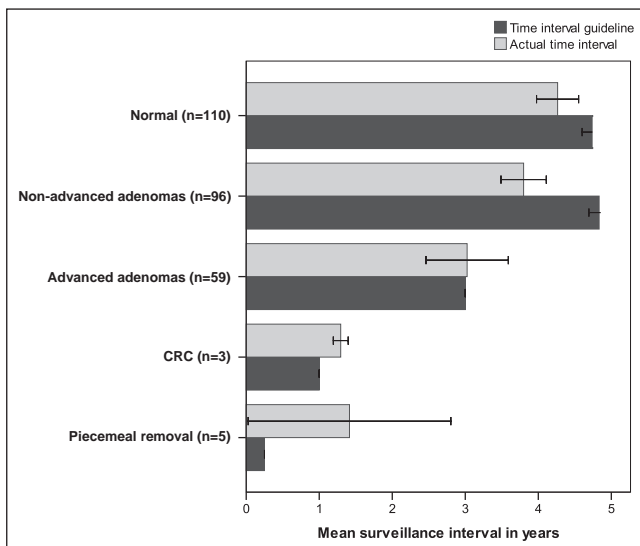
Descriptive statistics were used. Differences were assessed for significance by means of the Student's *t* test for continuous data and the  $\chi^2$  test for categorical data. The level of statistical significance was defined as a two-sided  $P < 0.05$ . All analyses were performed using SPSS PASW version 17.0 (IBM Corporation, USA).

## RESULTS

After excluding 11 cases for which no information about the index findings was available, 265 patients were included in the analyses (52% men; mean [ $\pm$  SD] age on index 58 $\pm$ 11 years). Table 1 summarizes the patient characteristics stratified according to the findings at index colonoscopy. The median number of previous colonoscopies was 1 (range 0 to 6). Index colonoscopy was normal in 42% of the patients (110 of 265), nonadvanced adenomas were found in 36% (96 of 265) and advanced neoplasia was detected in 22% of the cases (59 of 265). Three patients (1%) had CRC.

## Surveillance colonoscopy

Of 265 surveillance colonoscopies, 33% (87 of 265) were classified as procedures performed on time according to the AGA guidelines. In 46% of the patients (121 of 265) the surveillance interval was shorter than recommended, and the remaining 21% (57 of 265) underwent surveillance later than recommended compared with the surveillance guidelines.



**Figure 1** Mean time interval between index and surveillance colonoscopy compared with time intervals recommended by the 2008 American Gastroenterological Association guidelines (6). CRC Colorectal cancer

Figure 1 shows the actual observed mean time interval between index and surveillance colonoscopy compared with the recommended time interval stratified according to the index finding. The median difference between the recommended time interval and the observed interval was  $-1.8$  years (interquartile range [IQR] 1.12) for surveillance colonoscopies that were performed too early, and  $+1.1$  years (IQR 1.34) for those that were performed too late.

Table 2 shows the findings at index colonoscopy per appropriateness category. In 17% of the patients who underwent surveillance colonoscopy too early, a poor bowel preparation quality was mentioned at the index procedure compared with 5% at surveillance procedures performed on time ( $P < 0.01$ ). No significant differences for a positive family history and cecal intubation rates were observed between the three appropriateness categories (all  $P$  values  $> 0.1$ ). After exclusion of patients with poor bowel preparation on index, the proportion of patients with a surveillance colonoscopy performed on time was 35%.

#### Normal index colonoscopy

Among patients with a normal index colonoscopy ( $n=110$ ), 42% (46 of 110) underwent surveillance colonoscopy on time, 38% (42 of 110) too early (median difference =  $-1.23$  years too early; IQR 1.54), and 20% (22 of 110) too late (median difference = 0.98 years late; IQR 0.86).

#### Nonadvanced adenoma at index colonoscopy

Among patients with nonadvanced adenomas at index colonoscopy ( $n=96$ ), 25% (24 of 96) underwent surveillance colonoscopy on time, 61% of cases (59 of 96) too early (median difference =  $-1.85$  years too early; IQR 1.24), and 14% (22 of 96) of patients underwent their surveillance colonoscopy too late (median difference = 1.05 years too late; IQR 1.74). Among patients with normal or nonadvanced findings on index colonoscopy ( $n=206$ ), the percentage of patients undergoing surveillance earlier than recommended was significantly higher (49% [101 of 206]) than patients with advanced neoplasia (34% [20 of 59]) ( $P=0.040$ ).

#### Advanced neoplasia at index colonoscopy

Among patients with advanced neoplasia, 29% (17 of 59) underwent surveillance colonoscopy on time, 34% (20 of 59) too early (median difference =  $-1.86$  years too early; IQR 0.92) and 37% (22 of 59) later than recommended (median difference = 1.61 years too late; IQR 2.08). All patients who had CRC detected at index colonoscopy ( $n=3$ ) received surveillance on time. Of the five patients who underwent piecemeal removal of their advanced adenoma at index colonoscopy,

**TABLE 2**  
Findings at index colonoscopy stratified according to appropriateness based on American Gastroenterological Association (AGA) guidelines

	Surveillance colonoscopy, n (%)		
	On time (n=87)	Too early* (n=121)	Too late* (n=57)
Positive family history of CRC	17 (20)	29 (24)	15 (26)
Cecal intubation rate at index <sup>†</sup>	78 (93)	111 (96)	42 (98)
	(n=84)	(n=116)	(n=43)
Adequate bowel prep at index	83 (95)	100 (83) <sup>‡</sup>	55 (97)
Median difference, years (IQR) <sup>§</sup>	0.07 (0.40)	$-1.8$ (1.12)	1.1 (1.34)
Findings at index			
Normal index	46 (53)	42 (35) <sup>‡</sup>	22 (39)
Nonadvanced adenoma at index	24 (27)	59 (49) <sup>‡</sup>	13 (22)
Advanced neoplasia <sup>¶</sup> at index	17 (20)	20 (17)	22 (39) <sup>‡</sup>

\*Earlier and later than recommended in the 2008 AGA guideline; <sup>†</sup>Total numbers differ due to missing data; <sup>‡</sup>Statistically significant compared with surveillance colonoscopy on time; <sup>§</sup>Mean difference between the recommended time interval and the observed interval between index and surveillance colonoscopy; <sup>¶</sup> $\geq 3$  adenomas or  $>10$  mm, with (tubulo-)villous histology or high-grade dysplasia or colorectal cancer (CRC). IQR Interquartile range; prep Preparation

**TABLE 3**  
Adenoma findings and sites on index and surveillance colonoscopy (SC) stratified according to appropriateness based on American Gastroenterological Association (AGA) guidelines

	SC, n (%)		
	On time (n=87)	Too early* (n=121)	Too late* (n=57)
Right-sided adenomas index	24 (28)	38 (31)	19 (33)
Left-sided adenomas index	17 (20)	29 (24)	14 (25)
Adenomas on both sides	2 (2)	10 (8)	1 (2)
Right-sided adenomas SC	22 (25)	22 (18)	9 (16)
Left-sided adenomas SC	5 (6)	13 (11)	5 (9)
Adenomas on both sides	3 (3)	10 (8)	0 (0)

\*Earlier and later than recommended in the 2008 AGA guidelines

four returned too late and two of these patients had advanced neoplasia at surveillance colonoscopy. Among patients with advanced neoplasia on index ( $n=59$ ), the percentage of patients undergoing surveillance later than recommended was significantly higher (37% [22 of 59]) than in patients with nonadvanced or normal findings (17% [35 of 206]) ( $P=0.001$ ).

#### Adenoma location distribution on index procedure and surveillance practice patterns

The distribution in location of most advanced index findings are presented in Table 3, stratified according to the different appropriateness categories. Overall, the adenoma location was only right-sided in 53% of patients. Among patients who were diagnosed with both left- and right-sided adenomas at index, an earlier surveillance interval than recommended by guidelines was more often seen, compared with surveillance on time according to the guidelines (8% versus 2%;  $P=0.08$ ).

#### Adenoma detection rate at surveillance colonoscopy

Adenomas were found on surveillance in 32% of cases (83 of 265), 8% of patients (20 of 265) had advanced adenomas. No CRC was identified at surveillance colonoscopy.

The ADR for appropriate versus nonappropriate surveillance colonoscopy (stratified according to index findings) are summarized in Table 4. Patients were excluded from this analysis if they underwent a surveillance procedure too early and had a poor bowel preparation

**TABLE 4**  
**Adenoma detection rate (ADR) at surveillance colonoscopy (SC) stratified according to appropriateness based on American Gastroenterological Association (AGA) guidelines**

	SC, n (%)		
	On time (n=87)	Too early* (n=100) <sup>†</sup>	Too late* (n=57)
ADR at SC			
Adenoma at SC	29 (33)	34 (34)	12 (21)
Nonadvanced adenoma at SC	25 (29)	24 (24)	7 (12)
Advanced adenoma <sup>‡</sup> at SC	4 (5)	10 (10)	5 (9)
ADR at SC per index			
Normal index	14 (16)	8 (8)	4 (7)
Nonadvanced adenoma index	8 (9)	14 (14)	4 (7)
Advanced neoplasia at index	7 (8)	12 (12)	4 (7)

\*Earlier and later than recommended in the 2008 AGA guideline; <sup>†</sup>Poor bowel preparation on index excluded; <sup>‡</sup>≥3 adenomas or >10mm, with (tubulo-)villous histology or high-grade dysplasia or colorectal cancer

during the index colonoscopy. The ADR at surveillance colonoscopy was significantly higher in patients with advanced neoplasia at index (26 of 59 [44%]) versus normal index colonoscopy (26 of 100 [26%];  $P=0.01$ ). No significant difference in the ADR on surveillance was observed for procedures that were performed on time according to the guidelines compared with procedures performed too early (33% [29 of 87] versus 34% [34 of 100], respectively;  $P=0.923$ ). The ADR was also not significantly different between appropriate versus too late procedures (33% [29 of 87] versus 21% [12 of 57], respectively;  $P=0.11$ ). The detection of advanced adenomas at surveillance colonoscopy was not significantly different between appropriate versus procedures performed too early (5% [four of 87] versus 10% [10 of 100];  $P=0.161$ ) nor for appropriate versus surveillance performed too late according to the guidelines (5% [four of 87] versus 9% [five of 57];  $P=0.312$ ).

## DISCUSSION

Recent studies have reported that there are significant problems with wait times for colonoscopy procedures in many centres in Canada (7). It is expected that, in the context of CRC screening and its associated need for surveillance procedures, the demand on endoscopy units will increase. The present study aimed to assess how well endoscopists in the Canadian endoscopy setting adhere to the guidelines for surveillance colonoscopies and whether improvements that would help to decrease wait times are achievable.

Our study showed that in a significant proportion of patients surveillance colonoscopy was not performed at the recommended time interval. Only 33% of the patients underwent a surveillance colonoscopy according to the AGA guidelines. The largest group consisted of patients who underwent procedures earlier than recommended (46%). Underuse was also reported, reflected by the fact that 21% of the patients received their colonoscopy too late. Shortening or lengthening the surveillance intervals did not significantly affect the ADR.

Several surveys have documented suboptimal usage of surveillance colonoscopy, with physicians often recommending surveillance intervals that are too short (12,15). A Dutch study (11) reported that 52% of the respondents used shorter surveillance intervals than stated by national recommendations. Suboptimal adherence in daily practice has also been shown in several studies (13,16-18). A study from the United States (13) observed considerable disparity between guideline and endoscopists' recommendations in colonoscopy reports, with more surveillance colonoscopies occurring too soon; in only 37% of cases were the recommendations consistent with the guidelines. A study from the Netherlands (17) reported low follow-up rates for surveillance colonoscopy after the removal of adenomas or CRC; slightly

more than one-third of patients (35%) tended not to undergo surveillance colonoscopies although overuse was also observed.

Because the chances of detecting adenomas during surveillance colonoscopy differs based on baseline findings, guideline recommendations for surveillance colonoscopy are stratified according to the index findings (5,6). There is evidence that surveillance colonoscopy is overused in low-risk subjects and underused in high-risk subjects (16). A United States community practice assessment of utilization of surveillance colonoscopy (13) showed underusage of surveillance practice in terms of longer follow-up intervals if high-risk lesions at index colonoscopy existed (31%). In our study, a similar trend was observed in adherence patterns for surveillance practice between advanced and nonadvanced lesions on index procedures (18). Patients with nonadvanced adenomas (49%) often received surveillance too early while patients with advanced neoplasia often underwent surveillance colonoscopy too late according to the guidelines (37%).

Of all patients with index procedures that revealed advanced adenoma, 39% also had adenomas at surveillance colonoscopy (23 of 59). This highlights that advanced adenoma at index colonoscopy is an important risk factor for adenoma recurrence and, therefore, supports the guidelines for more vigilant surveillance (16). However, in our study, the detection rate of recurrent adenomas was also high in 25% of patients with normal index colonoscopies. This emphasizes that our findings for surveillance colonoscopy must be interpreted with caution. The fact that 25% of the patients with a normal index still had adenomas at surveillance colonoscopy indicates that these patients remain at high risk for developing metachronous adenomas, despite normal findings at a previous surveillance colonoscopy. The yield of surveillance colonoscopy did not significantly differ between colonoscopies performed at appropriate or inappropriate times, suggesting that deviating from the guidelines does not necessarily affect the yield of surveillance colonoscopy. However, our sample size may have been too small to detect significant differences in ADR. In addition, similar detection rates in advanced adenomas between on time (8%) versus too late procedures (7%) were observed. It is well established that the detection of adenomas is dependent on the quality of bowel preparation (19). Clinical decisions regarding the surveillance interval derived from colon cleanliness assessment can vary considerably among endoscopists and there is little agreement on what constitutes an insufficient bowel preparation (20). However, in our analyses, it was shown that the surveillance procedures performed too early still yielded appreciably high detection rates if patients with a poor bowel preparation were excluded.

Apart from suboptimal bowel preparation on index procedure, several other explanations have been suggested for the high detection rate and nonadherence to surveillance recommendations, such as an incomplete examination, possibly incomplete removal of lesions and the presence of a family history of CRC (15). Although in the too early surveillance cohort relatively more patients had a family history of CRC (24%) compared with the surveillance on time population (20%), the difference was not significant. It must be acknowledged that we are uncertain how reliable the reporting for family history in CRC in the present retrospective analysis was. Additionally, there were no significant differences between cecal intubation rates in the three appropriateness categories. Quality issues may have been involved but these could not be adequately assessed in a prospective manner. In the cohort of patients that underwent earlier surveillance, 8% of patients had left- and right-sided adenomas versus 2% in the cohort that received surveillance on time ( $P=0.08$ ). Retrospective reports have argued that the effectiveness of colonoscopy for left-sided and right-sided colorectal neoplasia differ. A Canadian study (21) showed that the protective effect of a complete colonoscopy was strong for mortality from distal lesions, but not associated with mortality from proximal lesions. This may be an explanation why physicians recommended a shorter surveillance time interval if patients had lesions in the proximal part of their colon, or to detect synchronous lesions in the proximal and distal colon. However, our data did not show that recommendations for only proximal-sided lesions were shorter compared with surveillance if only distal lesions on index colonoscopy were present.



Additionally, insufficient awareness of guidelines may be an important contributor to physician nonadherence. Several studies have shown that appropriate use of surveillance after the detection of adenomas or CRC depends to a great extent on the knowledge physicians have of surveillance guidelines (12,15). A recent study using hypothetical cases evaluating the knowledge of Canadian endoscopists about guidelines for follow-up colonoscopies showed that many gave the wrong recommendation (22). Another study (23) showed that priming endoscopists by distributing guideline pocket pamphlets for use in endoscopy units increased guideline compliance.

Another possible explanation why endoscopists may recommend premature follow-up colonoscopies is that they base the recommendation on the number of polyps removed during the procedure before the pathology recurred. An example of this would be a patient with four small polyps but the pathology showing adenomas in two. Other explanations for less-effective surveillance programs, apart from physician nonadherence, can be found in patient-related factors such as nonattendance to surveillance colonoscopy. Most studies in this area focus on clinician adherence to published guidelines rather than patient adherence to clinician recommendations. Because our study design was limited only to patients who had returned for their surveillance colonoscopy, it is not known how many patients who underwent an index colonoscopy that warranted follow-up did not return for surveillance colonoscopy.

As previously indicated, patients who had a history of colon cancer or removal of adenomatous polyps could be referred to the SCOPE program. This pilot program did not change any of the recommendations that were made by colonoscopists at index colonoscopy because it was designed to test several steps in the referral process. In general terms, it is often difficult for physicians to change follow-up recommendations made by other physicians, especially if this would mean that follow-up colonoscopy is postponed to a later date. One of the obvious advantages of having an organized CRC screening program is the standardization of follow-up recommendations, which would lead to more optimal use of resources.

One of the limitations of our study was the small sample size. Furthermore, the results of our study were collected from a large city in

Canada and may not be generalizable to other regions. We also did not analyze the characteristics and practice profiles of the endoscopists in our region, such as number of colonoscopies performed per year. Additionally, because the guidelines were revised in 2008, differences in practice by clinicians over time may be attributable to adaptation and incorporation of new guidelines and or heightened awareness as CRC screening became more widespread. Our results should be interpreted also knowing there is a lack of an explicit guideline from the Canadian Association of Gastroenterology (CAG). The CAG surveillance guidelines, compared with the AGA guideline, are less explicit and 'recommendation' implies that endoscopists should decide about the appropriate surveillance interval to a greater extent based on clinical judgment. The CAG guideline of 2004, however, also recommends a five-year interval for one or two adenomas, and a three-year interval for three or more adenomas, similar to the 2008 AGA guideline. Although they do not give specific recommendations for advanced adenomas, they do specify the term and refer to the AGA guideline.

Finally, the six-month margin around the optimal follow-up date for colonoscopy was arbitrarily chosen. There are no data in the literature to indicate the optimal choice for a time interval around appropriateness. However, we believe the six-month interval was a reasonable choice in the context of the current wait time problems for endoscopy in Canada.

## CONCLUSION

A minority of the surveillance colonoscopies are being performed according to the recommendations for surveillance colonoscopy after polypectomy or CRC removal. Where a large proportion of patients who undergo surveillance colonoscopies after the detection of adenomas or CRC are seen too often, another group of patients referred for surveillance or screening colonoscopy face a long wait time for gastrointestinal care. The results suggest that efforts should be made to raise awareness among endoscopists about proper surveillance intervals. Our results indicate that quality improvement programs in this area have the potential to result in important clinical benefits for the endoscopy department, especially in the context of wait times and costs.

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