



Alberta Family Physician Electronic Endoscopy study

Quality of 1769 colonoscopies performed by rural Canadian family physicians

Michael R. Kolber MD CCFP MSc Nicole Olivier
Oksana Babenko PhD Ryan Torrie MD CCFP Lee Green MD MPH

Abstract

Objective To determine whether rural FP colonoscopists in Alberta are achieving benchmarks in colonoscopy quality.

Design Prospective, multicentre observational study.

Setting Alberta.

Participants Nine FP colonoscopists.

Main outcome measures Proportion of successful cecal intubations; proportion of patients aged 50 and older with pathologically confirmed adenomas; mean number of adenomas per colonoscopy; and serious adverse events related to colonoscopy.

Results In this 6-month study, 9 rural FPs in Alberta performed 1769 colonoscopies. Overall, all key colonoscopy quality benchmarks were met or exceeded. The proportion of successful cecal intubations was 97.9% (95% CI 97.2% to 98.6%). The proportion of male and female patients aged 50 and older whose first-time colonoscopy results revealed an adenoma was 67.4% (95% CI 62.4% to 72.7%) and 51.1% (95% CI 45.5% to 56.7%), respectively. There were 120 adenomas, 36 advanced adenomas, and 1 colon cancer case per 100 colonoscopies. There were 2 postpolypectomy bleeds and no other serious complications.

Conclusion Alberta rural FP colonoscopists are meeting benchmarks in colonoscopy quality. Ongoing electronic collection of endoscopy quality markers should be encouraged. Supporting and training rural FPs who perform endoscopy might help alleviate current wait times and improve access for rural Canadian patients.

Editor's key points

▶ The Alberta Family Physician Electronic Endoscopy (AFPEE) study examined the quality of colonoscopies performed by FPs in Alberta. Primary outcomes included the proportion of successful cecal intubations, proportion of patients aged 50 and older whose first-time colonoscopy revealed an adenoma, and immediate complication rates. The mean number of adenomas per colonoscopy, a relevant colonoscopy quality metric, was also recorded.

▶ This study demonstrated that Alberta FP colonoscopists are meeting or exceeding key quality benchmarks. For example, the proportion of patients aged 50 and older with an adenoma or a sessile serrated adenoma was 67.4% for men and 51.1% for women. These results exceed standard benchmarks of 30% and 20% for men and women, respectively.

▶ This study found 120 pathologically confirmed adenomas per 100 colonoscopies performed. While no benchmark exists for mean adenomas per colonoscopy, these results suggest that Alberta FP colonoscopists are performing high-quality colonoscopies for reasonable indications and with reasonable surveillance intervals.



Points de repère du rédacteur

► L'étude intitulée l'Alberta Family Physician Electronic Endoscopy (AFPEE) Study examinait la qualité des colonoscopies exécutées par des médecins de famille en Alberta. Parmi les principaux paramètres à l'étude figuraient la proportion d'intubations cæcales réussies, la proportion de patients âgés de 50 ans et plus dont la toute première colonoscopie révélait un adénome, de même que les taux de complications immédiates. Le nombre moyen d'adénomes par colonoscopie, qui représente une mesure de la qualité des colonoscopies, était aussi consigné.

► Cette étude a démontré que les médecins de famille de l'Alberta qui effectuent des colonoscopies atteignent ou surpassent les principaux critères de qualité. Par exemple, la proportion de patients de 50 ans ou plus chez qui on a trouvé un adénome ou un adénome festonné sessile se situait à 67,4 % pour les hommes et à 51,1 % pour les femmes. Ces résultats sont supérieurs aux paramètres standards de 30 et 20 % respectivement pour les hommes et les femmes.

► Dans cette étude, on a compté 120 adénomes confirmés en pathologie par 100 colonoscopies exécutées. Quoiqu'il n'existe pas de paramètres établis pour le nombre moyen d'adénomes par colonoscopie, ces résultats font valoir que les colonoscopies effectuées par des médecins de famille de l'Alberta sont de grande qualité, qu'elles sont effectuées pour de bonnes raisons et à des intervalles de surveillance raisonnables.

Étude sur l'endoscopie électronique effectuée par des médecins de famille en Alberta

La qualité de 1769 colonoscopies effectuées par des médecins de famille canadiens en milieu rural

Michael R. Kolber MD CCFP MSc Nicole Olivier
Oksana Babenko PhD Ryan Torrie MD CCFP Lee Green MD MPH

Résumé

Objectif Déterminer si les médecins de famille qui effectuent des colonoscopies en Alberta satisfont aux critères de qualité d'une telle intervention.

Conception Étude observationnelle prospective multicentrique.

Contexte Alberta.

Participants Neuf médecins de famille qui effectuent des colonoscopies.

Principaux paramètres à l'étude La proportion d'intubations cæcales réussies; la proportion de patients de 50 ans et plus chez qui on a trouvé des adénomes confirmés en pathologie; le nombre moyen d'adénomes par colonoscopie; les événements indésirables graves liés à la colonoscopie.

Résultats Dans cette étude d'une durée de 6 mois, 9 médecins de famille en milieu rural en Alberta ont exécuté 1769 colonoscopies. Dans l'ensemble, tous les principaux critères de qualité d'une colonoscopie ont été atteints ou surpassés. La proportion d'intubations cæcales réussies était de 97,9 % (IC à 95 % de 97,2 à 98,6 %). La proportion d'hommes et de femmes de 50 ans ou plus dont la toute première colonoscopie a révélé un adénome était respectivement de 67,4 % (IC à 95 % de 62,4 à 72,7 %) et de 51,1 % (IC à 95 % de 45,5 à 56,7 %). On a compté 120 adénomes, 36 adénomes à un stade avancé et 1 cas de cancer du côlon par tranche de 100 colonoscopies. On a dénombré 2 hémorragies à la suite d'une polypectomie et aucune complication sérieuse.

Conclusion Les médecins de famille en milieu rural qui effectuent des colonoscopies en Alberta respectent les normes de qualité d'une telle intervention. Il y a lieu d'encourager une collecte électronique continue des marqueurs de qualité. Le soutien et la formation des médecins de famille ruraux qui exécutent des colonoscopies pourraient réduire les temps d'attente actuels et améliorer l'accès des patients canadiens en milieu rural.

In Canada, gastroenterologists and general surgeons perform 97% of colonoscopies.¹ A small number of rural Canadian FPs also perform colonoscopies.² These endoscopists improve endoscopy access for rural patients and help improve provincial endoscopy wait times. Although some studies demonstrate that adequately trained FPs are able to perform high-quality endoscopy,³⁻⁵ other studies question the quality of colonoscopies performed by non-gastroenterologists.⁶⁻⁸

We have previously published the Alberta Primary Care Endoscopy (APC-Endo) study, which evaluated the quality of colonoscopies performed by 10 Alberta FPs and internists.³ However, the APC-Endo study was limited by its short duration (2 months), small sample size (677 colonoscopies), and paper-based data collection.

Expanding on the APC-Endo study and using a novel electronic data collection tool designed by the study team, the Alberta Family Physician Electronic Endoscopy (AFPEE) study aimed to more thoroughly examine the quality of colonoscopies performed by FPs in Alberta.

— Methods —

Primary outcomes included the proportion of successful cecal intubations, proportion of patients aged 50 and older whose first-time colonoscopy revealed an adenoma, and immediate complication rates. Other quality metrics recorded included indications and predominant findings, who provided sedation and the types of sedation agents used, patient comfort, and polyp characteristics (size, morphology, location, and removal process). Finally, we reported the mean number of adenomas per colonoscopy, which might be the most relevant colonoscopy quality metric, as it indirectly measures the extent of bowel examined and the appropriateness of indication and of colonoscopy surveillance intervals.

Individual and group key quality indicators were compared with standard benchmarks in colonoscopy quality. When quality benchmarks differed between jurisdictions or governing bodies, the most stringent benchmarks were used in the study. For example, the American Society of Gastrointestinal Endoscopy recommends that inadequate bowel preparations should occur in 15% or less of procedures,⁹ while the National Health Services Bowel Cancer Screening Program recommends good-quality preparations should occur in more than 90% of cases.¹⁰ We used the 10% benchmark target as our comparator for inadequate bowel preparations.

Physician recruitment

All known Albertan FP colonoscopists—identified by participation in previous studies, attendance at endoscopy conferences, or participation in other endoscopy projects—were contacted to voluntarily participate in the study. Interested physicians (and their teams) were provided study information and a survey to describe

their endoscopic experience, site characteristics, and practice patterns.

Data collection

Using a data collection tool developed by the study team, nurses and physicians entered data in real-time on all colonoscopies performed by physicians during the 6-month study into tablet computers. Pathological reconciliation of lesions was performed when available. Data were collected and managed using REDCap, which is a Web-based application hosted by the Women and Children's Health Research Institute at the University of Alberta in Edmonton.¹¹ Owing to the staggered enrolment of sites into the study, data collection occurred between July 2015 and February 2016.

Primary outcome definitions

Proportion of successful cecal intubations. The proportion of successful cecal intubations was defined as the number of landmark confirmed cecal intubations divided by the number of colonoscopies attempted. No adjustments to remove procedures limited by poor bowel preparation, strictures, or equipment failure were performed. All cecal landmarks, including whether the terminal ileum was intubated, were recorded. As all study physicians performed both diagnostic and screening colonoscopies, a 90% rate of successful cecal intubations was considered the benchmark for comparison.⁹

Proportion with at least 1 adenoma revealed with first-time colonoscopy. The proportion of male and female patients aged 50 and older undergoing a colonoscopy for the first time with at least 1 pathologically confirmed adenoma revealed was calculated. Current standards suggest that 30% of men and 20% of women having average-risk screening colonoscopies should have an adenoma.⁹ Owing to the fact that average-risk screening colonoscopies are not routinely performed in Canada, we used all colonoscopies performed in the study as the denominator for this outcome. As per the Alberta Colorectal Cancer Screening Program guidelines,¹² we included both adenomas and sessile serrated adenomas (SSAs) in this outcome measure.

Adenomas and advanced adenomas per colonoscopy. We defined the number of adenomas per colonoscopy as the sum of all pathologically confirmed adenomas or SSAs divided by the number of colonoscopies performed. No standard definition or benchmark exists for this outcome. We also determined the number of advanced adenomas per colonoscopy, where an advanced adenoma was defined as an adenoma larger than 1 cm in size or with villous components or high-grade dysplasia on pathology.

Serious adverse events. Serious adverse events, which included bleeding and perforation and events related to

procedural sedation and analgesia, were derived from the American Society for Gastrointestinal Endoscopy^{13,14} and were defined as follows:

- *bleeding*—defined as bleeding related to the colonoscopy that subsequently resulted in a blood transfusion, admission to hospital, a second colonoscopy, or surgery;
- *perforation*—defined as both clinical and radiographic evidence of a perforation; and
- *events related to procedural sedation and analgesia*—defined as premature stopping of the colonoscopy owing to adverse events of procedural sedation and analgesia, the use of reversal agents, artificially ventilating the patient, or admitting the patient to hospital after the procedure for any cardiac or respiratory condition related to the procedural sedation and analgesia agents.

Two academic physicians, not otherwise involved in the study, independently and blindly adjudicated potential adverse events. A gastroenterologist not involved in the study resolved any adjudicator discrepancies. Frequency of serious adverse events was compared with published standards of bleeding (1%),¹⁵ perforation (0.1%),^{9,10,15} and events related to procedural sedation (1%).¹²

Other outcome measures

Other variables recorded in the database included predominant endoscopic indication, the bowel preparation product used and the quality of the bowel preparation, patient discomfort (using the modified Gloucester scale),¹⁰ the sedation agents and doses used, predominant findings, and anticipated referral to another physician for the gastrointestinal complaint for which the colonoscopy was performed.

Statistical analysis

All results were recorded in REDCap and exported to SPSS, version 22, and Microsoft Excel for statistical analysis. Binary outcomes were reported as percentages with 95% CIs and compared with quality standards using *z* statistics. Continuous variables were reported as means and standard deviations or medians and interquartile ranges, as appropriate.

A random audit of 10% of pathology records was performed to examine the accuracy of data collection.

Ethics

The University of Alberta Health Research Ethics Board approved the study, and local site operational approvals were obtained before data collection commenced.

— Results —

Of the 14 identified Albertan FP colonoscopists, 9 consented to participate in the study. The participating physicians had a range of endoscopic experience: 2 had less than 3 years of colonoscopy experience; 3 had between 3 and 10 years of experience; and 4 had more than 10 years

of experience. Seven of the physicians estimated that they had performed more than 2000 colonoscopies before the study. All colonoscopists performed polypectomies.

All procedures were performed in 1 of 11 rural Alberta hospitals using the endoscopy systems by Olympus (high-definition 180 series) or Pentax (the 90i series). In 7 sites, the endoscopist normally also performed the procedural sedation, while in 4 sites anesthetists primarily performed the sedation for colonoscopies. Two sites had a local general surgeon, and 7 sites were at least a 1-hour drive away from the nearest gastroenterologist.

The 9 participating FPs performed a total of 1769 colonoscopies on 1755 unique patients. The mean (SD) patient age was 59.2 (13.0) years; 50.3% were female and 46.8% were first-time colonoscopies. Overall, 44.6% of the colonoscopies were performed for screening, 29.4% were performed for symptom investigation (most commonly rectal bleeding), and 23.1% were performed for polyp, cancer, or inflammatory bowel disease surveillance (Table 1). Positive fecal immunochemical test (FIT) results was the most common specific indication for colonoscopy (422 of 1769 [23.9%] colonoscopies).

Successful cecal intubations. Overall, 1731 of 1769 (97.9%; 95% CI 97.2% to 98.6%) of the colonoscopies attempted had a successful cecal intubation. All physicians had a higher than 90% rate of successfully completed colonoscopies (ranging from 95.2% to 100.0%) (Table 2). The terminal ileum was intubated 49.0% of the time, and photographic documentation of cecal landmarks occurred 91.5% of the time.

Poor bowel preparation was the reason for 36.8% (14 of 38) of the incomplete colonoscopies. Successful cecal intubation did not differ by patient sex or age. However, the proportion of successful cecal intubations was slightly greater among the 4 higher-volume endoscopists (more than 200 procedures in the study) compared with the 5 lower-volume endoscopists (less than 200 procedures in the study) (98.6% vs 96.2%; *P* = .002).

Adenoma and SSA detection. Overall, the proportion of men and women aged 50 and older with an adenoma or SSA revealed on a first-time colonoscopy was 67.4% (95% CI 62.4% to 72.7%) and 51.1% (95% CI 45.5% to 56.7%), respectively. After excluding SSAs, 62.5% (95% CI 57.1% to 67.9%) of men and 44.6% (95% CI 39.0% to 50.2%) of women had an adenoma revealed on their first-time colonoscopies. All physicians achieved benchmarks of 30% for men and 20% for women having at least 1 adenoma (Table 2).

Mean adenomas or SSAs per colonoscopy and other lesions. From all the colonoscopies performed in the study, there were 2099 pathologically confirmed adenomas or SSAs, 628 advanced adenomas, and 17 cancer cases. Therefore, there were 120 adenomas,

Table 1. Patient characteristics in the AFPEE study: N = 1755 unique patients.

PHYSICIAN	COLONOSCOPIES PERFORMED, N	MEAN PATIENT AGE, Y	FEMALE PATIENTS, %	FIRST-TIME COLONOSCOPY FOR PATIENT, %	INDICATIONS, %		
					SCREENING	SYMPTOM INVESTIGATION	FOLLOW-UP
Physician							
• 1	133	56.1	46.6	31.3	34.6	26.3	32.3
• 2	208	57.8	45.2	40.4	33.7	27.9	33.7
• 3	306	60.9	50.2	49.5	57.8	23.5	16.0
• 4	483	58.6	51.5	49.5	42.9	33.1	21.1
• 5	151	62.9	48.7	34.0	50.3	12.6	34.4
• 6	42	57.8	40.5	47.6	47.6	23.8	26.2
• 7	63	55.5	57.1	73.0	33.3	57.1	7.9
• 8	135	61.4	53.7	44.8	52.6	24.4	17.0
• 9	248	59.2	54.3	53.9	40.7	39.1	17.7
Mean	197	59.2	50.3	46.8	44.6	29.4	23.1

AFPEE—Alberta Family Physician Electronic Endoscopy.

Table 2. Quality markers, by individual physician and overall: N = 1769 colonoscopies.

PHYSICIAN	COLONOSCOPIES PERFORMED, N	PROPORTION OF SUCCESSFUL CECAL INTUBATIONS, %	PROPORTION OF MALE PATIENTS ≥ 50 Y WITH ≥ 1 ADENOMA OR SSA FINDING, %	PROPORTION OF FEMALE PATIENTS ≥ 50 Y WITH ≥ 1 ADENOMA OR SSA FINDING, %	MEAN ADENOMA OR SSA FINDINGS PER 100 COLONOSCOPIES	PATIENTS WITH MODERATE OR SEVERE DISCOMFORT, %	AVERAGE WITHDRAWAL TIME, MIN	SERIOUS ADVERSE EVENTS, N
• 1	133	96.2	69.2	46.7	98	3.1	7.1	0
• 2	208	100.0	55.6	53.3	114	2.4	11.9	0
• 3	306	97.4	54.5	47.5	104	2.6	8.7	0
• 4	483	99.6	78.0	64.9	151	0.4	9.4	0
• 5	151	96.0	61.9	37.5	89	6.0	9.2	0
• 6	42	95.2	42.9	37.5	86	9.5	11.3	0
• 7	63	95.2	50.0	23.8	38	4.8	8.1	0
• 8	135	97.0	72.0	31.8	96	0.7	7.1	0
• 9	248	96.8	74.5	64.0	145	9.3	11	2
Mean	197	97.9*	67.4 [†]	51.1 [‡]	120	3.3	9.4	NA

NA—not applicable, SSA—sessile serrated adenoma.

*95% CI 97.2% to 98.6%.

[†]95% CI 62.4% to 72.7%.

[‡]95% CI 45.5% to 56.7%.

36 advanced adenomas, and 1 colon cancer case per 100 colonoscopies (Table 3).

Patient sedation and discomfort. The colonoscopists provided the sedation in 1185 (67.0%) of the procedures, while anesthesiologists performed sedation in 33.0% of the procedures. The most commonly used sedation agents were midazolam and fentanyl, which were used in 97.5% and 87.3% of the cases,

respectively. Overall, 96.7% of patients experienced none, minimal, or mild discomfort as defined by the modified Gloucester scale.¹⁰ This result compares favourably to the benchmark of less than 10% of patients having a nurse-assessed patient comfort score of 6 or greater.¹² Fifteen procedures were performed without sedation, and all of these patients who were not sedated experienced “none” or “mild” discomfort during the procedure.

Table 3. Pathologically confirmed lesions per 100 colonoscopies

PATHOLOGICALLY CONFIRMED LESIONS	TOTAL NO. OF LESIONS	LESIONS PER 100 COLONOSCOPIES
Adenoma or SSA	2099	120
SSA	404	23
Advanced adenoma	628	36
Cancer	17	1

SSA—sessile serrated adenoma.

Serious adverse events. Of the 5 reported potentially serious adverse events, 2 postpolypectomy bleed events met the study criteria for immediate serious adverse events according to adverse event adjudicators. There were no perforations or serious adverse events related to procedural sedation.

The first postpolypectomy bleed occurred in a 55-year-old man who during the colonoscopy had cancer and 10 adenomas removed. The bleed occurred after polypectomy of a 2.5-cm polyp and was successfully treated with clips. After the procedure, the patient was admitted to his local hospital without requiring any further treatment.

The second postpolypectomy bleed occurred in a 69-year-old man who had a total of 8 polyps removed. The bleed occurred after removal of a 2.5-cm sessile polyp. Clips were used to treat the bleed and the patient was admitted to the local hospital for observation. Four hours later rebleeding occurred, necessitating a transfer to a tertiary care setting where no further bleeding occurred and at repeat colonoscopy no therapeutics were required. The postpolypectomy bleed rate of 2 of 1769 (0.1%; 95% CI 0.0% to 0.3%) compares favourably with the standard benchmark of 1%.¹⁵

Seventy-seven patients (4.4%) were referred to another physician for their gastrointestinal problems, with 48.1% of those patients being referred for definitive surgery.

— Discussion —

The AFPEE study is the largest multicentre study of FP colonoscopy results ever reported. The study demonstrated that Alberta FP colonoscopists are meeting or exceeding key quality benchmarks. For example, the proportion of patients aged 50 and older with an adenoma or SSA was 67.4% for men and 51.1% for women. Even after excluding SSAs, 62.5% of men and 44.6% of women aged 50 and older had at least 1 adenoma. These results substantially exceed standard benchmarks of 30% and 20% for men and women, respectively.

In Canada, few average-risk screening colonoscopies are performed, and we therefore used all first-time colonoscopies to compare with the adenoma detection benchmark. Our high adenoma detection rates might also be partially explained by the fact that almost 25% of

the colonoscopies in our study were performed for positive FIT results. Our results are comparable to results from a large Canadian tertiary care screening centre, where 58% of patients with positive FIT results had an adenoma.¹⁶ Finally, published evidence shows that patients from rural Canada and those of lower socioeconomic status have higher colorectal cancer incidence¹⁷ and mortality.¹⁸ Therefore, the rurality and socioeconomic status of the patients in our study might also be influencing the adenoma detection rates.

Other recent quality studies from FP colonoscopists warrant discussion. Four Texas FPs reported cecal intubations of 96.3%, with 38.2% of male and 26.0% of female patients having adenomas on their first-time screening colonoscopies.¹⁹ Oregon rural endoscopists (including gastroenterologists, FPs, internists, and surgeons) reached the cecum between 87.4% and 89.3% of the time.²⁰

Previous systematic reviews exploring the quality of colonoscopies performed by FPs found a range of results.^{21,22} The outliers (which did not meet quality benchmarks) are from 3 studies published more than 20 years ago. Owing to technological advances in endoscopic equipment, future systematic reviews should consider including only studies performed in the past 20 years.

Recent quality results from a multi-country randomized controlled study (patients randomized to receive screening colonoscopy or not) found that 17% and 29% of endoscopists did not meet cecal intubation or adenoma detection benchmarks, respectively.²³ They also found a range (5% to 40%) of patients with at least 1 adenoma. Previous studies have demonstrated that endoscopists with high adenoma detection rates have a lower incidence of future colorectal cancers in their patients.^{24,25} For example, one study demonstrated that patients who underwent colonoscopy with a physician whose adenoma detection rate was less than 11% had more than 10 times the risk of a postcolonoscopy cancer compared with patients of endoscopists with adenoma detection rates higher than 20%.²⁴ Another study reported that for every 1% increase in adenoma detection rates, there is a 3% decrease in future interval colorectal cancers.²⁵ While it is possible that patients having a colonoscopy within the AFPEE study (given the high number of adenomas removed) might have lower future colorectal cancer rates, long-term follow-up of AFPEE patients is beyond the scope of this project.

We found 120 pathologically confirmed adenomas per 100 colonoscopies performed. While no benchmark exists for mean adenomas per colonoscopy, our results suggest that Alberta FP colonoscopists are performing high-quality colonoscopies for reasonable indications and with reasonable surveillance intervals. Our results compare favourably to our earlier study of Alberta FPs and internists, which found 62 adenomas per 100 colonoscopies and only 2 endoscopists who had more than 1 adenoma per colonoscopy.³ Evidence

suggests that when endoscopists receive report cards pertaining to the quality of their procedures, future key performance indicators improve.²⁶⁻²⁸ It is possible that Alberta FP endoscopists, many of whom participated in our initial APC-Endo study³ and received report cards, have reflected upon their results and collectively have improved their endoscopic performance.

Our results are also consistent with recent results from a colorectal cancer screening centre in Calgary, Alta, which found 50 adenomas per 100 screening colonoscopies and 140 per 100 colonoscopies with positive FIT results.¹⁶ As almost 25% of the AFPEE study colonoscopies were performed for positive FIT results, 120 adenomas per 100 colonoscopies appears congruent with the Calgary results. These findings can provide meaningful comparators for future quality studies.

About 5% of cases in the study had an SSA. While this result compares to the published benchmark of 4.5%, ongoing research is needed to establish a firm benchmark for comparisons.²⁹


Limitations and future directions

The study was voluntary and not all Alberta FP colonoscopists participated. Whether those who did not participate in the study would have similar results is unknown. In addition, we were only able to capture immediate complications. Delayed colonoscopy complications occur,^{30,31} and therefore complication rates could be under-reported in this study. Finally, although this study was 6 months long, it is possible that the Hawthorne effect might have influenced endoscopists' behaviour patterns.

We found that busy predominantly fee-for-service physicians and their teams were willing to incorporate an electronic data-capturing tool into their work flow. As evidence suggests that providing endoscopists with quality report cards improves future endoscopic performance,²⁶⁻²⁸ all practising endoscopists and trainees should be recording and receiving their colonoscopy quality results in a report card. Participating endoscopists and their sites or programs can then self-reflect and implement individual or programmatic changes if necessary. Data collection should be electronic to allow for easier synthesis and analysis. To calculate the proportion of patients with an adenoma and mean number of adenomas per colonoscopy, pathology reconciliation should continue in future studies pertaining to colonoscopy quality. Finally, in order to capture immediate and delayed complications, all unplanned medical visits of colonoscopy patients up to 14 days after the procedure need to be examined.^{30,31}

Conclusion

Rural FP colonoscopists in Alberta are currently performing high-quality colonoscopies—meeting or exceeding standard quality metrics including proportion of cecal intubations, proportion of patients with adenomas, and

serious adverse events. Ongoing electronic colonoscopy quality data collection should continue with regular feedback occurring through individual and group report cards. Training additional rural FPs in gastrointestinal medicine and endoscopy might help alleviate current wait times and improve access for rural Canadian patients. 

Dr Kolber is Professor with the PEER (Patients, Experience, Evidence, Research) Group in the Department of Family Medicine at the University of Alberta in Edmonton.

Ms Olivier is Project Manager in the Department of Family Medicine at the University of Alberta. **Dr Babenko** is a researcher in the Department of Family Medicine at the University of Alberta. **Dr Torrie** is a practising family physician at the Taber Health Centre in Alberta. **Dr Green** is Professor and Chair in the Department of Family Medicine at the University of Alberta.

Acknowledgment

The Alberta Family Physician Electronic Endoscopy (AFPEE) study was funded by Alberta's Rural Health Professions Action Plan and the University of Alberta Department of Family Medicine. In kind funding was provided through Enhancing Alberta Primary Care Research Networks. We thank the AFPEE study physicians, their amazing local endoscopy teams, and their local and regional administrators for their effort and support in participating in this study. The list of AFPEE study physicians is as follows: **Bredesen LE, Goosen H, Greidanus R, Kolber MR** (also study author), **MacCarthy C, Murphy J, Rottger J, Torrie RD** (also study author), and **Van Bussel J**. Data collection occurred at the Bonnyville Healthcare Centre, St Mary's Hospital in Camrose, Daysland Health Centre, Lac La Biche Healthcare Centre, Peace River Community Health Centre, Pincher Creek Health Centre, Ponoka Hospital and Care Centre, Taber Health Centre, Whitecourt Healthcare Centre, Vermilion Health Centre, and Viking Health Centre, all in Alberta. We also thank **Matt Taylor** for computer programming assistance and **Caitlin Finley** for helping prepare the AFPEE report cards.

Contributors

Drs Kolber, Torrie, and Green, and Ms Olivier conceived and designed the study. The Alberta Family Physician Electronic Endoscopy physicians performed the data collection and data verification of the study. **Drs Kolber and Babenko** and **Ms Olivier** analyzed the data. **Dr Kolber** and **Ms Olivier** created the study data collection tool. All authors contributed to writing or editing the manuscript and approving the final version for submission.

Correspondence

Dr Michael R. Kolber; e-mail mkolber@ualberta.ca

References

- Hilsden RJ, Tepper J, Moayyedi P, Rabeneck L. Who provides gastrointestinal endoscopy in Canada? *Can J Gastroenterol* 2007;21(12):843-6.
- College of Family Physicians of Canada, Canadian Medical Association, Royal College of Physicians and Surgeons of Canada. *National Physician Survey 2004*. Mississauga, ON: College of Family Physicians of Canada; 2004. Available from: <http://nationalphysiciansurvey.ca/wp-content/uploads/2012/10/NPS2004-National-Binder.pdf>. Accessed 2018 Nov 1.
- Kolber MR, Wong CK, Fedorak RN, Rowe BH; APC-Endo Study Physicians. Prospective study of the quality of colonoscopies performed by primary care physicians: the Alberta Primary Care Endoscopy [APC-Endo] study. *PLoS One* 2013;8(6):e67017.
- Kolber M, Szafran O, Suwal J, Diaz M. Outcomes of 1949 endoscopic procedures. Performed by a Canadian rural family physician. *Can Fam Physician* 2009;55:170-5.
- Wilkins T, LeClair B, Smolkin M, Davies K, Thomas A, Taylor ML, et al. Screening colonoscopies by primary care physicians: a meta-analysis. *Ann Fam Med* 2009;7(1):56-62. Erratum in: *Ann Fam Med* 2009;7(2):181.
- Rabeneck L, Paszat LF, Saskin R. Endoscopist specialty is associated with incident colorectal cancer after a negative colonoscopy. *Clin Gastroenterol Hepatol* 2010;8(3):275-9. Epub 2009 Oct 29.
- Bressler B, Paszat LF, Chen Z, Rothwell DM, Vinden C, Rabeneck L. Rates of new or missed colorectal cancers after colonoscopy and their risk factors: a population-based analysis. *Gastroenterology* 2007;132(1):96-102.
- Singh H, Nugent Z, Demers AA, Bernstein CN. Rate and predictors of early/missed colorectal cancers after colonoscopy in Manitoba: a population-based study. *Am J Gastroenterol* 2010;105(12):2588-96. Epub 2010 Sep 28.
- Rex DK, Schoenfeld PS, Cohen J, Pike IM, Adler DG, Fennerty MB, et al. Quality indicators for colonoscopy. *Gastrointest Endosc* 2015;81(1):31-53. Epub 2014 Dec 2.
- Valori R; Joint Advisory Group on GI Endoscopy. *A guide to auditing quality and safety items of Endoscopy Global Rating Scale*. London, UK: Royal College of Physicians.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42(2):377-81. Epub 2008 Sep 30.
- Sadowski DC. *Quality reporting of colonoscopy performance standards for the Alberta Colorectal Cancer Screening Program*. Edmonton, AB: Alberta Health Services; 2013. Available from: http://screeningforlife.ca/wp-content/uploads/2016/09/Sadowski-QI-Standards-and-Reporting_Oct_23_13-1.pdf. Accessed 2018 Nov 1.
- Dominitz JA, Eisen GM, Baron TH, Goldstein JL, Hirota WK, Jacobson BC, et al. Complications of colonoscopy. *Gastrointest Endosc* 2003;57(4):441-5.
- Eisen GM, Baron TH, Dominitz JA, Faigel DO, Goldstein JL, Johanson JF, et al. Complications of upper GI endoscopy. *Gastrointest Endosc* 2002;55(7):784-93.
- Rex DK, Petrini JL, Baron TH, Chak A, Cohen J, Johanson JF, et al. Quality indicators for colonoscopy. *Gastrointest Endosc* 2006;63(Suppl 4):S16-28.

16. Hilsden RJ, Bridges R, Dube C, McGregor SE, Naugler C, Rose SM, et al. Defining benchmarks for adenoma detection rate and adenomas per colonoscopy in patients undergoing colonoscopy due to a positive fecal immunochemical test. *Am J Gastroenterol* 2016;111(12):1743-9. Epub 2016 Oct 11.
17. Singh H, Nugent Z, Decker K, Demers A, Samaddar J, Torabi M. Geographic variation and factors associated with colorectal cancer incidence in Manitoba. *Can J Public Health* 2018;108(5-6):e558-64.
18. Torabi M, Green C, Nugent Z, Mahmud SM, Demers AA, Griffith J, et al. Geographical variation and factors associated with colorectal cancer mortality in a universal health care system. *Can J Gastroenterol Hepatol* 2014;28(4):191-7.
19. McClellan DA, Ojinnaka CO, Pope R, Simmons J, Fuller K, Richardson A, et al. Expanding access to colorectal cancer screening: benchmarking quality indicators in a primary care colonoscopy program. *J Am Board Fam Med* 2015;28(12):713-21.
20. Holub JL, Morris C, Fagnan LJ, Logan JR, Michaels LC, Lieberman DA. Quality of colonoscopy performed in rural practice: experience from the Clinical Outcomes Research Initiative and the Oregon Rural Practice-Based Research Network. *J Rural Health* 2018;34(Suppl 1):S75-83. Epub 2017 Jan 3.
21. Evans DV, Cole AM, Norris TE. Colonoscopy in rural communities: a systematic review of the frequency and quality. *Rural Remote Health* 2015;15(2):3057. Epub 2015 May 19.
22. Wilkins T, LeClair B, Smolkin M, Davies K, Thomas A, Taylor ML, et al. Screening colonoscopies by primary care physicians: a meta-analysis. *Ann Fam Med* 2009;7(1):56-62. Erratum in: *Ann Fam Med* 2009;7(2):181.
23. Bretthauer M, Kaminski MF, Løberg M, Zauber AG, Regula J, Kuipers EJ, et al. Population-based colonoscopy screening for colorectal cancer: a randomized clinical trial. *JAMA Intern Med* 2016;176(7):894-902.
24. Kaminski MF, Regula J, Kraszewska E, Polkowski M, Wojciechowska U, Didkowska J, et al. Quality indicators for colonoscopy and the risk of interval cancer. *N Engl J Med* 2010;362(19):1795-803.
25. Corley DA, Jensen CD, Marks AR, Zhao WK, Lee JK, Doubeni CA, et al. Adenoma detection rate and risk of colorectal cancer and death. *N Engl J Med* 2014;370(14):1298-306.
26. Harewood GC, Petersen BT, Ott BJ. Prospective assessment of the impact of feedback on colonoscopy performance. *Aliment Pharmacol Ther* 2006;24(2):313-8.
27. Lin OS, Kozarek RA, Arai A, Gluck M, Jiranek GC, Kowdley KV, et al. The effect of periodic monitoring and feedback on screening colonoscopy withdrawal times, polyp detection rates, and patient satisfaction scores. *Gastrointest Endosc* 2010;71(7):1253-9.
28. Kahi CJ, Ballard D, Shah AS, Mears R, Johnson CS. Impact of a quarterly report card on colonoscopy quality measures. *Gastrointest Endosc* 2013;77(6):925-31. Epub 2013 Mar 6.
29. East JE, Vieth M, Rex DK. Serrated lesions in colorectal cancer screening: detection, resection, pathology and surveillance. *Gut* 2015;64(6):991-1000. Epub 2015 Mar 6.
30. Marquez Azalgará V, Sewitch M, Joseph L, Barkun AN. Rates of minor adverse events and health resource utilization postcolonoscopy. *Can J Gastroenterol Hepatol* 2014;28(11):595-9.
31. Armstrong D, Barkun A, Bridges R, Carter R, de Gara C, Dubé C, et al. Canadian Association of Gastroenterology consensus guidelines on safety and quality indicators in endoscopy. *Can J Gastroenterol* 2012;26(1):17-31.

This article has been peer reviewed.

Cet article a fait l'objet d'une révision par des pairs.

Can Fam Physician 2018;64:e553-60