Quality assurance (QA) is a process that includes the systematic evaluation of a service, institution of improvements and ongoing evaluation to ensure that effective changes were made. QA is a fundamental component of any organized colorectal cancer screening program. However, it should play an equally important role in opportunistic screening. Establishing the processes and procedures for a comprehensive QA program can be a daunting proposition for an endoscopy unit. The present article describes the steps taken to establish a QA program at the Forzani & MacPhail Colon Cancer Screening Centre (Calgary, Alberta) – a colorectal cancer screening centre and nonhospital endoscopy unit that is dedicated to providing colorectal cancer screening-related colonoscopies. Lessons drawn from the authors’ experience may help others develop their own initiatives. The Global Rating Scale, a quality assessment and improvement tool developed for the gastrointestinal endoscopy services of the United Kingdom’s National Health Service, was used as the framework to develop the QA program. QA activities include monitoring the patient experience through surveys, creating endoscopist report cards on colonoscopy performance, tracking and evaluating adverse events and monitoring wait times.

Key Words: Benchmarking; Colonoscopy; Colorectal cancer; Patient satisfaction; Quality assurance; Quality indicators

Colorectal cancer (CRC) is the second most common cause of cancer death in Canadian men and women, resulting in 9,100 deaths in 2010 (1). Screening for CRC is effective at reducing CRC mortality (2) and, therefore, has a clear public health benefit. Screening for CRC is currently recommended for all Canadians 50 to 74 years of age (3).

Colonoscopy is integral to CRC screening. First, colonoscopy is the preferred diagnostic test following a positive screening test, such as a fecal occult blood test (FOBT). Second, colonoscopy is the preferred screening test for individuals who are at increased risk for CRC. Third, colonoscopy may also be used as the primary screening test for individuals who are at average risk. Finally, colonoscopy is used for ongoing surveillance of individuals following removal of an adenomatous polyp or CRC.

Colonoscopy can result in harm, which is concerning because individuals undergoing screening are otherwise healthy and usually at low risk for the cancer of interest. Colonoscopy can lead to harm if it is inaccurate, unpleasant for the patient or leads to serious adverse events. Therefore, to maximize the potential benefits and minimize the potential harms of CRC screening, it is important to ensure that screening-related colonoscopies is of the highest quality. Providing quality colonoscopy services implies the provision of safe, accurate and patient-centred services.

Quality assurance (QA) is a process that includes the systematic evaluation of a service, institution of improvements and ongoing evaluation to ensure that effective changes were made. QA is a fundamental component of any organized CRC screening program (4). However, it should play an equally important role in opportunistic screening (3). Establishing the processes and procedures for a comprehensive QA program can be a daunting proposition for an endoscopy unit. In the present article, we describe the steps we have taken to establish a QA program at the Forzani & MacPhail Colon Cancer Screening Centre (CCSC), a colorectal cancer screening centre and nonhospital endoscopy unit located in Calgary (Alberta) that is dedicated to providing CRC screening-related colonoscopies. Lessons drawn from our experience may help others develop their own initiatives.
In November 2006, the CCSC leadership held a QA retreat. The retreat was attended by seven gastroenterologists and colorectal surgeons who provided colonoscopy screening, three gastroenterology residents, two administrators responsible for gastroenterology endoscopy services, a senior endoscopy nurse, a general internist responsible for QA activities in the Calgary Health Region, a representative from the University of Calgary’s legal services and members of the CCSC planning committee. Dr Roland Valori attended as an invited guest. Dr Valori developed and implemented the GRS during his tenure as endoscopy lead within the UK’s National Health Service. Attendees agreed that the GRS should provide the framework for the CCSC’s QA program. Participants worked to modify the wording of the GRS items and explanatory text for use at the CCSC. No substantial changes to the recommended benchmarks or criteria were made, apart from making wait-time benchmarks consistent with those recommended by the Canadian Association of Gastroenterology (6).

The GRS criteria for an excellent service were then used to guide the development of the CCSC’s QA program. The monitoring and evaluation processes expected of excellent endoscopy units include obtaining patient input on various aspects of care, monitoring clinical outcomes and adverse events, and maintaining a wait-list management system. The following sections describe the processes implemented at the CCSC to achieve these goals.

**Patient experience surveys**

Surveys were used to obtain feedback from a large number of patients on their colonoscopy experience. A prototype questionnaire was selected from several patient questionnaires available from the knowledge management system area of the GRS website (5). The questionnaire was modified and subsequently pilot tested on several patients at the CCSC. The final five-page questionnaire included 41 close-ended and two open-ended questions. The questionnaire included items pertaining to the patient’s experience at the preassessment visit, on the day of the colonoscopy and with aftercare. There were items regarding the information the patient received about CRC screening and colonoscopy, interactions with CCSC staff and physicians, privacy and dignity, and satisfaction with the procedure.

The final version of the questionnaire was formatted to a machine-readable data form. The questionnaire, along with a business reply envelope, was distributed at discharge from the endoscopy unit to 1000 consecutive patients from March to June 2008. Completed questionnaires were returned by 629 patients.

Subsequent patient-experience surveys were completed in 2009 and 2010. For the 2009 survey, the questionnaire was revised based on the responses, particularly the written comments, to the 2008 survey. The survey was expanded to 10 pages. Items pertaining to bowel preparation and intravenous catheter insertion were added. The items pertaining to the tolerability of the colonoscopy were revised and expanded to include four items (Table 1). In addition, the physician performing the colonoscopy was identified in the questionnaire to enable physician-specific reporting. The revised questionnaire was distributed to 650 patients in 2009, and 350 participants in 2010, with a response rate similar to the 2008 survey.

Overall, the questionnaire results showed very high levels of satisfaction with the experience of undergoing a colonoscopy at the CCSC. The vast majority of negative comments were related to bowel preparation. After each survey, the CCSC Executive Committee reviewed the results and, where appropriate, took specific actions (Table 2). A written report was provided to all staff and endoscopists, and was made available to patients in the CCSC’s waiting room and on the CCSC website. A sample of written comments, both positive and negative, was provided to all nursing and clerical staff. Because the comments were overwhelmingly positive and often identified individual nurses, it provided a significant boost to staff morale and esteem.

There are costs associated with performing a patient survey including the costs of the questionnaire and business reply envelopes, postage...
Development and implementation of an endoscopy QA program

TABLE 1
Patient comfort ratings from the 2009 Patient Experience Survey

<table>
<thead>
<tr>
<th>Do you think you received the right amount of sedation?</th>
<th>Response, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>88</td>
</tr>
<tr>
<td>No, I would have tolerated the procedure better if I received more sedation</td>
<td>7</td>
</tr>
<tr>
<td>No, I think I would have tolerated the procedure just as well with less sedation</td>
<td>5</td>
</tr>
</tbody>
</table>

On the scale below, please mark your overall assessment of the level of discomfort you experienced during the colonoscopy

| No discomfort | 45 |
| Mild discomfort | 35 |
| Moderate discomfort | 15 |
| Severe discomfort | 4  |

On the scale below, please mark if the colonoscopy experience was worse, better or as you expected

| Worse than expected | 6 |
| As expected         | 33 |
| Better than expected | 60 |

Overall, how acceptable did you find your colonoscopy?

| Procedure was acceptable and I would have it again if necessary | 90 |
| Procedure was acceptable, but uncomfortable. I would only have it again if essential | 10 |
| Procedure was totally unacceptable. I would not have the procedure again | 0.25 |

and questionnaire scanning. At the CCSC, data analysis and the creation of reports were performed by one of the authors. In other settings, modest additional costs may be required for these tasks. Unless the questionnaire is substantially revised for each use, the costs of creating the questionnaire for subsequent surveys are minimal.

Endoscopist report cards

Participation in the quality monitoring program is a requirement for endoscopy privileges at the CCSC. The CCSC provides each endoscopist with an annual report card on their colonoscopy performance. The CCSC uses patient surveys, nurse-completed patient comfort forms and routinely collects clinical indicators to monitor colonoscopy quality.

The first set of endoscopist report cards was prepared in January 2009 based on procedures performed in 2008. There were three sections to the report card: completeness of Endopro reporting; sedation practices; and procedure quality indicators. The completeness of Endopro reporting indicated the percentage of cases in which procedure indication and findings were not entered using the drop-down menus. Sedation practices reported the proportion of procedures performed with no sedation, the proportion of procedures requiring reversal agents, and the average dose of fentanyl and midazolam. Procedure quality indicators included the cecal intubation rate, polyp detection rate and average withdrawal time. Polyp detection rate was defined as the proportion of cases in which a polyp was removed. This indicator was used instead of the adenoma detection rate, by hospital endoscopists or by average-risk individuals, detection rate of adenomas >1 cm in size and advanced adenoma detection rate. Data regarding adenomas were obtained from the pathology summary recorded in the CSEC Referral Management database. The first two reports used the Endopro database quality indicators, but also included patient comfort ratings. These scores were obtained from the patient-completed Patient Experience Surveys and a separate Patient Comfort Questionnaire, which included the same questions on procedural tolerance and comfort. A third report card was distributed in April 2010 based on procedures performed from October 2009 to March 2010 (Figure 1). This report card included various measures of adenoma detection rate, including overall adenoma detection rate, adenoma detection rate in average-risk individuals, detection rate of adenomas >1 cm in size and advanced adenoma detection rate. Data regarding adenomas were obtained from the pathology summary recorded in the CSEC Referral Management database. The first two reports used the Endopro database reporting tools to extract the required data. For the final report, structured language queries that directly extracted the required data were created.

There were no direct costs to the CCSC in the preparation of physician report cards because database extracts, data linkages, and analysis and preparation of reports were performed by two of the authors. The complexity of each report, and the required data elements and data sources, was increased with each version of the questionnaire (Figure 2).

Adverse events

Before the CCSC opened, a policy and procedure on reporting harms was developed and approved by the CCSC Executive Committee. The policy defined reportable adverse events, which included administration of reversal agents, adverse events requiring transfer to a hospital emergency room and adverse events occurring after discharge from the CCSC. The CCSC was often informed about delayed adverse events, such as postpolypectomy hemorrhage, by hospital endoscopists or by

exported to an Excel spreadsheet to allow for a Word mail merge (Microsoft Corporation, USA) to create each endoscopist’s report. The report also provided each endoscopist with the CCSC average for each indicator and their quartile ranking among all endoscopists at the CCSC for selected indicators.

It is important to validate the quality results obtained from electronic database queries, particularly when endoscopist performance is at issue. In the first set of reports, outliers were identified and studied to ensure that the results obtained were accurate. This review process helped to identify that endoscopists could obtain false results if they used free text data entry instead of defined drop-down menus during endoscopy report generation. The database queries and methodologies were further validated using an external database engine and an independent analysis to ensure the reproducibility and accuracy of the quality reports.

A second physician report card was distributed in October 2009 based on procedures performed from January to June 2009. This report card used the same indicators, but also included patient comfort ratings. These scores were obtained from the patient-completed Patient Experience Surveys and a separate Patient Comfort Questionnaire, which included the same questions on procedural tolerance and comfort. A third report card was distributed in April 2010 based on procedures performed from October 2009 to March 2010 (Figure 1). This report card included various measures of adenoma detection rate, including overall adenoma detection rate, adenoma detection rate in average-risk individuals, detection rate of adenomas >1 cm in size and advanced adenoma detection rate. Data regarding adenomas were obtained from the pathology summary recorded in the CSEC Referral Management database. The first two reports used the Endopro database reporting tools to extract the required data. For the final report, structured language queries that directly extracted the required data were created.

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TABLE 2
Examples of written feedback provided by patients as part of the Patient Experience Survey

<table>
<thead>
<tr>
<th>Representative feedback</th>
<th>Action taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>When phoning to check how to use the Pico Salax, I had to hold for 25 min</td>
<td>Introduction of automated telephone answering system directing callers to specific staff based on nature of inquiry</td>
</tr>
<tr>
<td>In written material, CoLyte is mentioned. I used an alternative. Might be brand name difference, but material should be clear</td>
<td>Instructions sheets revised to include all formulations of PEG-based bowel preparations</td>
</tr>
<tr>
<td>The preparation document should indicate alternatives to CoLyte, because it is hard to find at Calgary (Alberta) pharmacies</td>
<td>It was great. Other than the fact it was hard to get the IV line in</td>
</tr>
<tr>
<td>Specific questions about IV insertion added to survey</td>
<td>It took 3 painful attempts</td>
</tr>
<tr>
<td>Additional in-service training of nursing staff</td>
<td><strong>IV Intravenous; PEG Polyethylene glycol. 1Ferring Pharmaceuticals Inc, Canada; 2Alaven Pharmaceuticals LLC, USA</strong></td>
</tr>
</tbody>
</table>
the patient. In the written instructions provided at the time of discharge from the CCSC, patients were asked to call the CCSC if they had an unexpected hospital admission or emergency department visit within 30 days of the colonoscopy. Adverse events were recorded in an adverse event log. Each adverse event was investigated by the clinical operations manager and the medical director.

Due to the risk of missing adverse events occurring after discharge from the CCSC, a method for identifying these events was developed by linking patient lists from Endopro with two of AHS’s administrative databases, which enabled the identification of emergency room visits and inpatient admissions occurring two days before or within 30 days of a scheduled colonoscopy. This time frame was used to capture events that occurred during bowel preparation that may have resulted in the patient missing their colonoscopy appointment. All charts of patients with an emergency room visit or inpatient admission were reviewed by a trained research assistant using a structured data collection form (Figure 3). All emergency room visits and unexpected inpatient admissions were classified as unrelated, possibly or definitely related to the colonoscopy by one of the authors.

The major costs for the identification of adverse events that were not directly reported to the CCSC were those related to hospital chart reviews. For the first 16,000 CCSC patients, approximately 300 emergency room visits and 100 hospital admissions were identified. The time to review each chart is usually quite short because most were emergency room charts with only one or two relevant pages to review. Because the review was performed as part of a QA activity, the hospitals did not require ethics committee approval or charge a chart access fee as would occur with a research-based review.

**Wait times**

The GRS requires that endoscopy units have a wait-time management system. The GRS also sets wait-time benchmarks for urgent and routine procedures.

The CCSC referral management database was used to regularly monitor wait times. A more detailed wait-time report was created by extracting information pertaining to the number of new referrals awaiting appointments and wait times from date of referral to date of preassessment visit, and importing it from the database into statistical software that summarized statistics and prepared graphs. Wait-list and wait-time information was reported for all referrals and for each referral priority category. The CCSC uses the following four priority categories: highly urgent priority includes patients with a positive FOBT; urgent priority includes patients with a strong family history of CRC (single first-degree relative diagnosed before 60 years of age, or more than one first-degree relative); moderate priority includes patients with a family history of CRC who do not fulfill the criteria for urgent priority; and routine priority includes all individuals at average risk for CRC. The predefined wait-time goals for the CCSC were based on benchmarks set by the Canadian Association of Gastroenterology (6).

Wait times for all procedures, other than routine (ie, average risk) referrals, decreased substantially during the first 18 months of operations. Long wait times during the first 18 months were due to several factors that included the following:

1. A substantial regional walk list of patients already in existence at the time of opening;
2. A high daily referral volume (150 to 200 referrals);
3. The CCSC opened with an electronic medical record and referral management system that quickly proved to be inadequate; and
4. An insufficient number of clerical staff and inadequate referral management and triage processes to deal with the higher than anticipated daily referral volume in addition to a large referral backlog. As these limitations and barriers to effective triage and scheduling were resolved, wait times dramatically declined to an acceptable level for all nonroutine referrals (Figure 4).

Routinely monitoring wait lists and wait times is essential for maximizing patient care and ensuring a highly productive endoscopy service. After the identification of long wait times for patients at average risk for CRC, the CCSC instituted an FOBT strategy for this group in which the patient was sent an FOBT requisition by mail; their referring physician was informed of the long wait time and requested to ensure that the patient completed an FOBT annually.

GRS RATINGS: ASSESSING THE SUCCESS OF QA ACTIVITIES

The CCSC reported results to the Canadian GRS census four times between October 2008 and October 2010 (Figure 5). The Canadian GRS census uses the version of the GRS developed by the CCSC. The CCSC has achieved A-level ratings on the items for consent, comfort, safety and quality. The lowest ratings have been for three items in the quality of patient experience: equality, timeliness and booking. The CCSC received a low rating for equality because it did not have a demographic/language profile of the local population, nor did it have written information available in languages other than English. The CCSC did not achieve the minimum standard for timeliness in the GRS: “Waits are <8 weeks for urgent procedures and <52 weeks for routines.” However,
this may be an example in which consistent intercountry definitions are lacking. It is unlikely that ‘routine’ in the UK refers to average-risk screening colonoscopy because that service is not provided by the National Health Service. The CCSC’s low rating on booking also likely reflects wording that is specific for the UK. For example, one criteria for the C level is that “>50% of new referrals are directly

Figure 3) Structured data collection form for reviewing charts of patients with a suspected adverse event following colonoscopy. CCSC Colon Cancer Screening Centre; ED Emergency department; GI Gastrointestinal; Prep Preparation; RHRN Regional health records number; sig Sigmoidoscopy; syn Syndrome
questionnaires are available in the public domain and can be obtained required to assess patient experience. Multiple patient satisfaction ment of colonoscopy quality indicators, dedicated data collection is generation of automated QA reports. The CCSC QA reporting maxi-
only the data recorded with the drop-down menus are suitable for the recorded with the first two methods are included in the database, and while previewing the report before saving and printing. Only data and revision of any aspect of the report, similar to a word processor, which are critically important for effective change to occur.

QA activities at the CCSC are facilitated by the collection of unbiased data using an electronic reporting system (Endopro), which is modified to allow entry of QA data as part of the routine clinical operations of the facility. A notable example of this is the routine recording of vital signs at the time of cecal intubation and withdrawal from the rectum, which enable the calculation of withdrawal time. Because data entry is part of routine clinical practice, it is entered in real-time, missing data are minimized and additional resources are not required for their collection. In addition, the reporting templates within Endopro were modified to maximize the consistent and standardized reporting of key clinical outcomes using drop-down menus to facilitate subsequent database queries and analysis.

The feasibility of a comprehensive QA program would be limited in the absence of searchable clinical databases. The need for manual data entry from paper clinical charts would greatly increase the cost of data collection. The existing databases, however, have significant limitations. For example, Endopro allows three methods of data entry: from the rectum, which enable the calculation of withdrawal time. Because data entry is part of routine clinical practice, it is entered in real-time, missing data are minimized and additional resources are not required for their collection. In addition, the reporting templates within Endopro were modified to maximize the consistent and standardized reporting of key clinical outcomes using drop-down menus to facilitate subsequent database queries and analysis.

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