Measuring colposcopy quality in Canada: development of population-based indicators

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ABSTRACT

Background Colposcopy is a key part of cervical cancer control. As cervical cancer screening and prevention strategies evolve, monitoring colposcopy performance will become even more critical. In the present paper, we describe population-based colposcopy quality indicators that are recommended for ongoing measurement by cervical cancer screening programs in Canada.

Methods The Pan-Canadian Cervical Cancer Screening Network established a multidisciplinary expert working group to identify population-based colposcopy quality indicators. A systematic literature review was conducted to ascertain existing population and program-level colposcopy quality indicators. A systems-level cervical cancer screening pathway describing each step from an abnormal screening test, to colposcopy, and back to screening was developed. Indicators from the literature were assigned a place on the pathway to ensure that all steps were measured. A prioritization matrix scoring system was used to score each indicator based on predetermined criteria. Proposed colposcopy quality indicators were shared with provincial and territorial screening programs and subsequently revised.

Results The 10 population-based colposcopy quality indicators identified as priorities were colposcopy uptake, histologic investigation (biopsy) rate, colposcopy referral rate, failure to attend colposcopy, treatment frequency in women 18–24 years of age, re-treatment proportion, colposcopy exit-test proportion, histologic investigation (biopsy) frequency after low-grade Pap test results, length of colposcopy episode of care, and operating room treatment rate. Two descriptive indicators were also identified: colposcopist volume and number of colposcopists per capita.

Summary High-quality colposcopy services are an essential component of provincial cervical cancer screening programs. The proposed quality and descriptive indicators will permit colposcopy outcomes to be compared between provinces and across Canada so as to identify opportunities for improving colposcopy services.

Key Words Colposcopy, quality of health care, mass screening

INTRODUCTION

In Canada, screening has led to a marked decrease in cervical cancer incidence and mortality1. Cervical cancer screening encompasses all steps along the pathway from the provision of the screening test [Pap or human papillomavirus (HPV) test] to the diagnosis, monitoring, and treatment of pre-cancerous cells using colposcopy. Although the steps along the pathway are completed by individual medical providers, cervical cancer screening in Canada is population-based and administered through provincial programs.

Colposcopy is an integral part of the cervical cancer screening pathway. Colposcopy is the examination of the lower genital tract and cervix using magnification from a colposcope with a light source2. Most provinces and territories and the Society of Canadian Colposcopists have guidelines for referral to colposcopy after an abnormal screening test3. Generally, referral for colposcopy is recommended for persistent atypical squamous cells of undetermined...
significance (ASC-US), persistent or incident low-grade squamous intraepithelial lesions (LSIL), atypical squamous cells when high-grade squamous intraepithelial lesions cannot be excluded, high-grade squamous intraepithelial lesions (HSIL), atypical glandular cells, adenocarcinoma in situ, and when a Pap test suggests squamous or glandular carcinoma. Colposcopy is also recommended when reflex HPV testing shows the presence of oncogenic or high-risk HPV with ASC-US or LSIL cytology.

As screening and prevention strategies in cervical cancer screening evolve, the monitoring of colposcopy performance will become critical. Vaccination for HPV, which will lower the rate of overall and high-grade abnormalities, and HPV testing, which will initially increase the number of colposcopy referrals, will both affect colposcopy services. The HPV FOCAL trial in British Columbia found that colposcopy referral rates were significantly higher in round 1 for women in a primary HPV testing (intervention) group compared with a liquid-based cytology (control) group. However, by 48 months, colposcopy referral rates were lower in the intervention group than in the control group for all ages, and cumulative rates were similar in both groups. In an earlier Canadian study, Louvanto et al. also found a significant increase in referrals to colposcopy after a positive HPV test in the first round of screening. A study in Scotland found a reduction in the colposcopy workload and changes in colposcopy performance (that is, reduced positive predictive value) related to HPV immunization. However, triage algorithms, which largely determine colposcopy referral rates, will likely vary by jurisdiction.

Clearly, the effect of HPV immunization and testing on colposcopy referral rates, subsequent workload, and clinical outcomes must be monitored to ensure that the quality of screening is optimized and maintained. The first step is the development of comprehensive and standardized population-based colposcopy quality indicators. Quality within a health care context can be defined as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.” Population-based measures of health care quality are advantageous because they aggregate patient-level quality to the system level. Therefore, in May 2015, the Pan-Canadian Cervical Cancer Screening Network (PCCSN) identified as a Network priority the development of population-based quality indicators for colposcopy that could be used nationally in all provincial and territorial programs. The PCCSN is a strategic initiative of the Canadian Partnership Against Cancer (“the Partnership”) and includes members from each province and territory, the College of Family Physicians of Canada, the Society of Obstetricians and Gynaecologists of Canada, the Society of Gynecologic Oncology of Canada, the Canadian Society of Cytology, the Society of Canadian Colposcopists, the Public Health Agency of Canada, and the Canadian Cancer Society.

Although 3 colposcopy quality indicators—time to colposcopy, cytology–histology agreement, and histologic investigation—have been monitored by the PCCSN since 2009, the PCCSN agreed that a more comprehensive set of colposcopy quality indicators were needed to assess the impact of HPV immunization and the possible transition from cytology to HPV testing as the primary cervical cancer screening modality in the context of organized population-based cervical cancer screening programs. A Colposcopy Quality Indicators Working Group was created to carry out the work. In the present paper, we describe the population-based colposcopy quality indicators that are recommended for reporting by organized provincial and territorial screening programs and at the national level in Canada.

METHODS

Identification of Candidate Colposcopy Quality Indicators
A systematic literature review identified existing population and program-level colposcopy quality indicators. Clinic-level quality indicators, indicators focusing on the implementation of synoptic quality reporting, and general guidelines were excluded from the literature search. Academic literature and grey literature published in English within the preceding 10 years (2006–2016) were included in the search. Databases searched for academic literature included MEDLINE and PubMed, EMBASE, and Scopus. The literature search was international, with specific focuses on Canada, the United States, Australia, New Zealand, Europe, and Great Britain and on quality assurance, quality improvement, indicators, targets, and audit. The resulting literature identified 30 potential colposcopy quality indicators. Each indicator, its background, context, calculation, and source can be found in supplemental Table 1.

Development of the Cervical Cancer Screening Pathway
A pathway was developed that describes each step from an abnormal screening test to colposcopy, and back to screening. The indicators from the literature review were assigned a place on the pathway to ensure that all steps on the pathway were represented.

Development of Quality Indicators
A prioritization matrix scoring system was used to score each indicator based on these pre-determined criteria selected by the Working Group:

- Measurable (data to calculate the indicators are available and accessible)
- Actionable (the indicator has the potential to inform improvements)
- Relevant (the indicator is related to the goal of improving quality and clinical outcomes)
- Patient-centred (the indicator is expressed in terms of relevance to the patient rather than to the screening program)
- Population-level (the indicator is measurable at the population level rather than at the colposcopist level)
- Evidence-based (the indicator is informed by the highest quality of evidence available)
- Ease of interpretation (the indicator is clear and easy to interpret)

The 7 criteria were equally weighted. Each working group member scored the indicators for each of the 7
criteria on a scale of 1–4. An average score per group member was calculated for each indicator, and the final score for each indicator was calculated as the average of all individual scores. Supplemental Table 1 shows the final score for each indicator.

**Internal and External Review**

Through discussion, the members of the Working Group came to consensus on a list of 10 indicators, which were then ranked by level of importance (high, medium, low). Discussion about the possibility of including descriptive as well as quality indicators also took place. Data specifications were then developed for each indicator. The data specifications for each indicator included the definition, rationale, target, measurement timeframe, stratification, numerator, denominator, and additional notes.

The newly developed colposcopy quality indicators were shared with the provincial and territorial screening

<table>
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<th>Table I</th>
<th>Recommended colposcopy indicators</th>
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<td><strong>Indicator</strong></td>
<td><strong>Components</strong></td>
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| Colposcopy referral rate | Numerator: Number of women with an abnormal Pap test result referred or recommended for colposcopy  
Denominator: Number of women with an abnormal screening result |
| Colposcopy uptake | Numerator:  
- Number of women with a high-grade Pap test result (AGC, ASC-H, HSIL, AIS, cancer) that had a follow-up colposcopy within 3, 6, 9, and 12 months after the index Pap test report date  
- Number of days at which the 90th percentile is reached  
Denominator: Number of women with a high-grade Pap test result (AGC, ASC-H, HSIL, AIS, cancer) |
| Failure to attend colposcopy | Numerator: Number of women who had a scheduled colposcopy appointment and who did not attend the appointment  
Denominator: Number of women who had a scheduled colposcopy appointment |
| Historical investigation (biopsy) rate | Numerator: Number of women who underwent histologic investigation (biopsy) within 12 months of the AGC, ASC-H, HSIL, AIS, or cancer cytology finding  
Denominator:  
- Number of women with an AGC, ASC-H, HSIL+, AIS, or cancer Pap test result  
- Number of women who had a colposcopy within 12 months of an AGC, ASC-H, HSIL+, AIS, or cancer Pap test result |
| Histologic investigation (biopsy) rate after low-grade Pap test results | Numerator: Number of women who underwent biopsy at their first colposcopy within 12 months of a low-grade Pap test result (ASC-US, LSIL, or ASC-US HR-HPV–positive)  
Denominator: Number of women that had a colposcopy within 12 months of a low-grade Pap test result (ASC-US, LSIL, or ASC-US HR-HPV–positive). |
| Treatment rate in women 18–24 years of age | Numerator: Number of women 18–24 years of age with an abnormal biopsy result (LSIL or HSIL) who received treatment (cryotherapy, laser, LEEP, or cone biopsy) within 24 months of the abnormal biopsy result  
Denominator: Number of women who had a colposcopy within 12 months of an abnormal biopsy result (LSIL or HSIL) |
| Operating room treatment rate | Numerator: Number of women who underwent treatment (cryotherapy, laser, LEEP, or cone biopsy) in an operating room in the hospital  
Denominator: Number of women who underwent treatment (cryotherapy, laser, LEEP, or cone biopsy) |
| Re-treatment rate | Numerator: Number of women re-treated within 12 months and less than 24 months of receiving their first treatment (cryotherapy, laser, LEEP, cone biopsy, or hysterectomy)  
Denominator: Number of women who received cervical treatment (cryotherapy, laser, LEEP, cone biopsy, or hysterectomy) |
| Colposcopy exit test rate after treatment | Numerator: Number of women who attended colposcopy, received treatment, and underwent exit testing completed within 24 months of treatment (cryotherapy, laser, LEEP, or cone biopsy)  
Denominator: Number of women who attended colposcopy and received treatment (cryotherapy, laser, LEEP, or cone biopsy) |
| Length of colposcopy episode of care | Mean, standard deviation, and median duration of the episode of care |
| Colposcopist volume | Total number of colposcopists and mean, standard deviation, minimum, maximum, percentiles (25th, 50th, 75th, 90th) of colposcopies performed (women 18 years of age and older) |
| Colposcopists per capita | Numerator: Number of colposcopists in a province or territory  
Denominator: Female population 21–69 years of age in the province or territory |

AGC = atypical glandular cells; ASC-H = atypical squamous cells, cannot exclude HSIL; HSIL = high-grade squamous intraepithelial lesion; AIS = adenocarcinoma in situ; ASC-US = atypical squamous cells of undetermined significance; LSIL = low-grade squamous intraepithelial lesion; HR-HPV = high-risk human papillomavirus; LEEP = loop electrosurgical excision procedure.

* Descriptive indicators.
programs and were subsequently revised based on feedback received. Feedback primarily included information about which indicators were feasible, how to make the indicators more easily understood, and the importance of collecting information for women of a wide age range to ensure ongoing monitoring.

RESULTS

After prioritization and discussion, 10 quality indicators were selected. Figure 1 shows the pathway that was developed by the Working Group. Women with an abnormal screening test result can be referred to colposcopy. A biopsy or endocervical curettage (or both), colposcopic follow-up, or additional treatment might be provided. If treatment is provided, exit testing is performed, with additional follow-up or a recommendation to return to screening. The summary and rationale for each indicator are discussed in the subsections that follow.

Colposcopy Referral Rate

The colposcopy referral rate is the percentage of women with an abnormal Pap test result who are referred or recommended for colposcopy. This indicator provides information about how many women are notified that a colposcopy is required after an abnormal Pap test result. If the referral rate is low, provincial and territorial screening programs might need to implement strategies to ensure that women who need colposcopy are appropriately referred. The colposcopy referral rate also measures the effect of cervical cancer screening on follow-up cancer control or diagnostic services and colposcopy service use.

Colposcopy Uptake

Colposcopy uptake is the percentage of women with a high-grade Pap test result (defined as a Pap test reporting atypical glandular cells, high-grade squamous intraepithelial lesions cannot be excluded, ssr, adenocarcinoma in situ, or cancer) who had their first colposcopy within 3, 6, 9, and 12 months after the index test report date. This indicator is considered an important part of providing high-quality patient-centred care, because delays have the potential to worsen outcomes and increase patient anxiety.

Failure to Attend Colposcopy

Failure to attend colposcopy is the percentage of women who do not attend a scheduled colposcopy appointment. This indicator is a measure of colposcopy use, whether a woman was notified about the need for additional follow-up care or not, and of access to follow-up care. It also reflects the efficiency of the colposcopy system and the additional efforts required to ensure appropriate follow-up care (that is, patient education, reminders, and additional scheduling).

Histologic Investigation (Biopsy) Rate

The histologic investigation (biopsy) rate is the percentage of women with a high-grade Pap test result who undergo colposcopy and histologic investigation (biopsy) within 12 months of the index Pap test result. This indicator is based on a recommendation from the Society of Canadian Colposcopists and the Society of Obstetricians and Gynaecologists of Canada that women with Pap test results showing ssr should be referred to colposcopy.

Histologic Investigation (Biopsy) Rate After Low-Grade Pap Test Result

Histologic investigation (biopsy) rate after low-grade Pap test result is the percentage of women who have a biopsy at colposcopy after a single low-grade Pap test. However, the Society of Canadian Colposcopists recommends that women with persistent asc-us or lsi, or with asc-us and positivity for high-risk HPV, be referred for colposcopy as directed by provincial or territorial guidelines and that lesions identified by colposcopy should be biopsied. Although it might not be possible to distinguish between women who undergo biopsy at colposcopy after a single low-grade Pap test result and those who undergo biopsy at colposcopy after persistent low-grade Pap test results, this indicator will provide information about the overall biopsy rate and could be used for interprovincial comparisons.

Treatment Rate in Women 18–24 Years of Age

Treatment rate in women 18–24 years of age is the percentage of women in that age group with an abnormal
biopsy result (LSIL or HSIL) who receive treatment within 24 months. This indicator measures the rate of treatment in young women. It is recommended that women in this age group be followed without treatment for up to 2 years because their rate of lesion regression is higher13,14.

**Operating Room Treatment Rate**

Operating room treatment rate is the percentage of women who receive their treatment in an operating room. The number of women who receive treatment in an operating room should be small and limited to ensure high-quality care (that is, a general anesthetic is not usually required) and to use resources in an appropriate manner.

**Re-treatment Rate**

Re-treatment rate is the percentage of women receiving cervical treatment who are re-treated within 12 months and 24 months of receiving their first treatment. This indicator measures the quality of the first treatment that a woman receives.

**Colposcopy Exit-Test Rate**

The colposcopy exit-test rate is the percentage of women who attend colposcopy, receive treatment, and have an exit test within 24 months of treatment. Each province or territory will define an exit test according to provincial guidelines. In the absence of guidelines, an exit test could be defined as 1 negative HPV test with or without 1 negative Pap test or biopsy or 3 negative Pap tests within 24 months15. This indicator specifies how many women are given the opportunity to return to routine screening through exit testing.

**Length of Colposcopy Episode of Care**

Length of colposcopy episode of care is the length of the care episode after to an abnormal screening test. “Episode of care” was previously defined in Ontario as a new cytologic diagnosis of cervical dysplasia (HSIL, LSIL, or ASC-US), without an abnormality in the preceding 12 months, beginning with the date of collection of the sample showing abnormal cytology and ending on the date of any cytology report, colposcopy billing claim, or cervical treatment procedure that was followed by an interval of 365 days or more without a further cytology report, colposcopy claim, or treatment16. That definition could be used by other jurisdictions. The length of the episode of care provides information about colposcopy resource-use efficiency (prompt assessment, treatment, and discharge to routine screening).

**Colposcopist Volume and Number of Colposcopists Per Capita**

The colposcopist volume and number of colposcopists per capita are descriptive indicators rather than quality indicators (that is, indicators that describe practice, but that do not measure quality) that were also recommended by the Working Group.

Colposcopist volume is the number of colposcopies performed by a colposcopist in a 1-year time period. Number of colposcopists per capita is the number of colposcopists per female population 21–69 years of age in each province and territory.

**DISCUSSION**

High-quality colposcopy services are an essential component in the cervical cancer screening pathway. We recommend that 10 colposcopy quality indicators and 2 descriptive indicators be measured by organized population-based cervical cancer screening programs in Canada. The proposed colposcopy indicators reflect patient-centred quality of care, system capacity, and the effectiveness of the cervical cancer screening follow-up process. The ability to measure the indicators depends on several factors, including analytic capacity, information infrastructure, and availability of colposcopy, biopsy, and treatment data. Several provinces have integrated colposcopy data into their organized screening program’s information system; others must access colposcopy data from outside the organized program (that is, from laboratory sources or administrative health data)9,10. The indicators will therefore be feasible for some provinces, but some indicators might be aspirational for others.

The colposcopy quality indicators proposed in this paper were selected by a multidisciplinary working group after a comprehensive literature review that was followed by an established prioritization process. The final quality indicators were based on consensus and were then reviewed by screening programs across Canada. Next steps include the development of targets for each indicator and the incorporation of all colposcopy indicators into the routine measurement of cervical cancer screening by provincial screening programs and the pccsn. Periodic review of the colposcopy quality indicators by the pccsn is needed, particularly as primary HPV testing is introduced and women with high-risk HPV are referred to colposcopy, and as the HPV-vaccinated population enters the screening age group. An updated systematic literature review and ongoing feedback from provincial and territorial screening programs are also needed to ensure the continued relevance and validity of the quality indicators17,18.

**CONCLUSIONS**

Colposcopy is a crucial part of cervical cancer prevention and the screening pathway. Colposcopy quality indicators allow for comparisons of performance within provinces and across Canada to continually improve colposcopy services so that they are accurate, safe, effective, patient-centred, equitable, and sustainable17.

**ACKNOWLEDGMENTS**

We acknowledge the assistance of Anna Crosskill, Fatima Jalili, Andrea Coronado, and the leads from the provincial and territorial cervical cancer screening programs for reviewing this manuscript. This work was supported by the Canadian Partnership Against Cancer.

**CONFLICT OF INTEREST DISCLOSURES**

We have read and understood Current Oncology’s policy on disclosing conflicts of interest, and we declare the following interests: SM reports grants and other fees from Merck outside the submitted work, and ML reports personal fees from Merck outside the submitted work. The remaining authors have no conflicts to disclose.
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