Patterns and Trends of Cancer Screening in Canada: Results From a Contemporary National Survey

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ABSTRACT

Background: The aim of this study was to assess the patterns and trends of colorectal, breast, and cervical cancer screening within a contemporary cohort of Canadian adults. **Methods:** Canadian Community Health Survey datasets (2007–2016) were accessed and 3 cohorts were defined: (1) a colorectal cancer (CRC) screening cohort, defined as men and women aged 50 to 74 years with complete information about CRC screening tests and their timing; (2) a breast cancer screening cohort, defined as women aged 40 to 74 years with complete information about mammography and its timing; and (3) a cervical cancer screening cohort, defined as women aged 25 to 69 years with complete information about the Papanicolaou (Pap) test and its timing. Multivariable logistic regression analysis was then performed to evaluate factors associated with not having timely screening tests at the time of survey completion. **Results:** A total of 99,820 participants were considered eligible for the CRC screening cohort, 59,724 for the breast cancer screening cohort, and 46,767 for the cervical cancer screening cohort. Among eligible participants, 43% did not have timely recommended screening tests for CRC, 35% did not have timely mammography (this number decreased to 26% when limiting the eligible group to ages 50–74 years), and 25% did not have a timely Pap test. Lower income was associated with not having a timely recommended screening tests for all 3 cohorts (odds ratios [95% CI]: 1.86 [1.76–1.97], 1.89 [1.76–2.04], and 1.96 [1.79–2.14], respectively). Likewise, persons self-identifying as a visible minority were less likely to have timely recommended screening tests in all 3 cohorts (odds ratios for White race vs visible minority [95% CI]: 0.87 [0.83–0.92], 0.85 [0.80–0.91], and 0.66 [0.61–0.70], respectively). **Conclusions:** More than one-third of eligible individuals are missing timely screening tests for CRC. Moreover, at least one-quarter of eligible women are missing their recommended breast and cervical cancer screening tests. More efforts from federal and provincial health authorities are needed to deal with socioeconomic disparities in access to cancer screening.

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Background

Cancer screening programs represent a pivotal component of all cancer care programs among different Canadian jurisdictions.¹ Previously published evidence has shown that targeted screening for some solid tumors is associated with reduced cancer mortality and significant cost savings for healthcare systems.^{2–6} Routinely collected administrative cancer databases do not provide clear information about uptake and adherence of different screening programs because they focus on individuals with a confirmed cancer diagnosis. Cross-sectional studies may be more relevant to the assessment of adherence to different cancer screening programs.⁷

The Canadian Community Health Survey (CCHS) is a cross-sectional study conducted annually and can provide a better venue for assessing different health behaviors of Canadians, including the use of cancer screening tests.⁸ It can also assess potential disparities in the uptake of recommended cancer screening tests among different populations in Canadian society. This study therefore used the CCHS to evaluate these trends.

Results of the current study are important for policymakers, healthcare providers, and the Canadian public because they can guide future resource allocation and system improvements for different cancer screening programs across the country.

Methods

About CCHS

CCHS is a cross-sectional survey that compiles information every 2 years related to health determinants for the Canadian population aged >12 years. It is based on sampling of a large population of respondents and is designed to provide reliable estimates at the health region level on a regular basis. To provide these estimates, a total of 130,000 respondents is needed on the 2-year basis; 120,000 respondents to represent the population

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aged ≥ 18 years and 10,000 respondents to represent the population aged 12 to 17 years.⁹

Sampling strategy, data collection, and dataset release are organized by Statistics Canada in coordination with relevant federal, provincial, and territorial authorities. A total of 3% of the Canadian population is not represented in CCHS surveys, including members of the Canadian armed forces, people living in medical facilities, individuals living on reserves and other indigenous settlements in the provinces, and people in some northern health regions in the province of Quebec. As described in previously published CCHS documentation,¹⁰ in order to enhance the data from the survey and reduce respondent burden, Statistics Canada combines the information from the CCHS with information provided by respondents (including tax data). Furthermore, Statistics Canada, respondents' respective provincial ministry of health, and the Institut de la Statistique du Québec may combine data provided by respondents with that from other surveys or administrative sources.

The current study is based on CCHS annual cohorts from 2007 to 2016. CCHS data covering this period was released in 5 sequential datasets, each representing 2 consecutive years (2007–2008, 2009–2010, 2011–2012, 2013–2014, and 2015–2016).

Cohort Selection

The current study contains 3 different cohorts of participants, and selection criteria were based on the recommendations of the Canadian Task Force on Preventive Health Care (CTFPHC).¹¹ The colorectal cancer (CRC) screening cohort was defined as men and women aged 50 to 74 years with complete information about whether and when prior fecal occult blood testing (FOBT) and/or sigmoidoscopy or colonoscopy was performed.¹² Participants were considered adherent to the CTFPHC CRC screening guidelines if they had FOBT performed within the last 2 years or sigmoidoscopy/colonoscopy performed within the last 10 years.

The breast cancer screening cohort was defined as women aged 40 to 74 years with complete information about mammography use and its timing. Because mammography screening for women aged 40 to 49 years was not formally recommended in the most recent update of the CTFPHC breast cancer screening recommendations (rather, a shared decision-making process between physicians and patients was recommended) and because screening practices for this subgroup vary across different Canadian jurisdictions, a sensitivity analysis was conducted, repeating all analyses on women aged 50 to 74 years with complete information about mammography use and its timing.⁵ Women were considered adherent to the CTFPHC breast cancer screening guidelines if they had mammography performed within the last 2 years.

The cervical cancer screening cohort was defined as women aged 25 to 69 years with complete information on Papanicolaou (Pap) test performance and its timing.¹³ Women were considered adherent to the CTFPHC cervical cancer screening guidelines if they underwent a Pap test within the last 3 years. To avoid the possibility that some participants may have had these tests not as a part of regular screening but rather as part of an investigation, treatment, or follow-up for cancer, a sensitivity analysis was conducted in all 3 cohorts excluding patients who reported any concurrent cancer diagnosis (CCHS datasets did not specify the type of cancer). Unfortunately, CCHS does not provide detailed information about cancer symptoms; thus, those data could not be considered in the sensitivity analyses. Prostate cancer screening was not evaluated in the current study because current CTFPHC guidelines recommend against routine prostate-specific antigen screening for men with an average risk of prostate cancer.¹⁴

Note that models for cancer screening differ among different Canadian jurisdictions and among different cancers. In some jurisdictions/cancers, screening is coordinated by a centralized registry that is supported by family physicians and other healthcare providers; in other jurisdictions/cancers, screening coordination is conducted completely by healthcare providers.

Data Collection

The following data were collected (where available) from all included participants in the current study: age at survey completion, sex, racial group (self-identified), marital status, income, self-perceived health, self-perceived mental health, province of residence, and FOBT, colonoscopy/sigmoidoscopy, mammography, or Pap test and timing. Note that information about ≥ 1 of the 3 evaluated cancer screening interventions were not reported in the CCHS from some Canadian jurisdictions. Supplemental eTable 1 provides a detailed description of the availability of data within CCHS according to jurisdiction (available with this article at JNCCN.org).

Statistical Analysis

Chi-square testing was initially used to compare baseline characteristics between participants who had screening tests within the recommended timelines versus those who did not have screening tests within the recommended timelines (as detailed in "Cohort Selection"). This testing was repeated, taking into consideration weights provided within successive CCHS datasets (although it was supposed previously that when pooling weights from multiple survey cycles, the resulting weights represent an average population that does not exist).¹⁵

Multivariable Cox regression analyses was then used to evaluate factors predicting nonadherence to

Table 1. Factors Associated With Nonadherence to CRC Screening (N=99,820)

	FOBT Within Last 2 Years and/or Sigmoidoscopy/Colonoscopy Within Last 10 Years ^a		OR for Nonadherence (95% CI)
	Yes	No	
Total, n	56,470	43,350	
Age, y			
70–74	9,664 (63.6%)	5,542 (36.4%)	Ref
50–54	8,605 (43.7%)	11,097 (56.3%)	2.65 (2.53–2.79)
55–59	12,302 (54.0%)	10,460 (46.0%)	1.72 (1.64–1.80)
60–64	13,547 (60.2%)	8,955 (39.8%)	1.28 (1.22–1.34)
65–69	12,352 (62.9%)	7,296 (16.8%)	1.07 (1.02–1.12)
Sex			
Female	32,324 (58.0%)	23,442 (42.0%)	Ref
Male	24,146 (54.8%)	19,908 (45.2%)	1.21 (1.18–1.24)
Racial group (self-identified)			
Visible minority	4,049 (51.9%)	3,752 (48.1%)	Ref
White	50,462 (57.1%)	37,910 (42.9%)	0.87 (0.83–0.92)
Marital status			
Married	34,817 (59.7%)	23,527 (40.3%)	Ref
Common-law	2,886 (52.2%)	2,886 (52.2%)	1.21 (1.14–1.28)
Widow/Separated/Divorced	13,959 (54.2%)	13,959 (54.2%)	1.17 (1.13–1.21)
Single/Never married	4702 (47.1%)	5286 (52.9%)	1.28 (1.22–1.35)
Income (CAD\$)			
≥\$80,000	15,758 (59.7%)	10,659 (40.3%)	Ref
<\$20,000	5,634 (50.2%)	5,579 (49.8%)	1.86 (1.76–1.97)
\$20,000 to <\$40,000	12,244 (55.2%)	9,944 (44.8%)	1.57 (1.51–1.64)
\$40,000 to <\$60,000	11,125 (58.3%)	7,964 (41.7%)	1.26 (1.21–1.31)
\$60,000 to <\$80,000	8,049 (58.7%)	5,671 (41.3%)	1.16 (1.11–1.22)
Self-perceived health			
Poor	3,013 (60.2%)	1,989 (39.8%)	Ref
Excellent	8,688 (54.1%)	7,363 (45.9%)	1.64 (1.51–1.77)
Very good	20,122 (57.0%)	15,155 (43.0%)	1.45 (1.35–1.56)
Good	17,191 (56.2%)	13,401 (43.8%)	1.41 (1.32–1.52)
Fair	7,364 (57.9%)	5,360 (42.1%)	1.22 (1.13–1.32)
Self-perceived mental health			
Poor	770 (55.2%)	625 (44.8%)	Ref
Excellent	19,116 (56.6%)	14,683 (43.4%)	1.06 (0.94–1.20)
Very good	20,758 (57.3%)	15,475 (42.7%)	1.02 (0.90–1.15)
Good	12,802 (55.9%)	10,101 (44.1%)	1.05 (0.93–1.19)
Fair	2,908 (55.3%)	2,354 (44.7%)	1.01 (0.89–1.15)

Abbreviations: CRC, colorectal cancer; FOBT, fecal occult blood test; OR, odds ratio.

^aMissing data: self-identified racial group (n=3,647; 3.7%), marital status (n=220; 0.2%), income (n=7,193; 7.2%), self-perceived health (n=174; 0.2%), self-perceived mental health (n=228; 0.2%).

CTFPHC screening guidelines. Each of these models was adjusted for age, racial group, income, marital status, self-perceived health, and self-perceived mental health. For the CRC screening cohort, the model was also

adjusted for sex. All analyses were conducted using SPSS Statistics, version 26 (IBM Corp). Weighted frequencies were conducted through survey analysis section within STATA software, version 14 (STATA corp).

Table 2. Factors Associated With Nonadherence to Timely Mammography (N=59,724)

	Mammography Within Last 2 Years ^a		OR for Nonadherence (95% CI)
	Yes	No	
Total, n	38,760	20,964	
Age, y			
70–74	4,817 (67.2%)	2,349 (32.8%)	Ref
40–44	2,309 (31.2%)	5,088 (68.8%)	5.50 (5.08–5.96)
45–49	3,163 (46.1%)	3,704 (53.9%)	2.79 (2.58–3.01)
50–54	6,025 (67.6%)	2,882 (32.4%)	1.11 (1.03–1.20)
55–59	7,787 (75.3%)	2,550 (24.7%)	0.75 (0.70–0.81)
60–64	7,818 (77.3%)	2,296 (22.7%)	0.64 (0.59–0.69)
65–69	6,841 (76.6%)	2,095 (23.4%)	0.63 (0.58–0.68)
Racial group (self-identified)			
Visible minority	2,890 (55.3%)	2,333 (44.7%)	Ref
White	34,462 (65.9%)	17,803 (34.1%)	0.85 (0.80–0.91)
Marital status			
Married	2,163 (68.1%)	10,375 (31.9%)	Ref
Common-law	2,351 (56.1%)	1,841 (43.1%)	1.30 (1.21–1.41)
Widow/Separated/Divorced	10,841 (65.0%)	5,834 (35.0%)	1.14 (1.08–1.20)
Single/Never married	3,332 (53.8%)	2,860 (46.2%)	1.27 (1.19–1.36)
Income (CAD\$)			
≥\$80,000	10,989 (64.6%)	6,016 (35.4%)	Ref
<\$20,000	4,072 (57.6%)	2,993 (42.4%)	1.89 (1.76–2.04)
\$20,000 to <\$40,000	7,293 (67.3%)	3,547 (32.7%)	1.41 (1.33–1.50)
\$40,000 to <\$60,000	5,318 (67.8%)	2,527 (32.2%)	1.19 (1.12–1.26)
\$60,000 to <\$80,000	5,318 (67.8%)	2,527 (32.2%)	1.05 (0.98–1.12)
Self-perceived health			
Poor	1,538 (58.3%)	1,100 (41.7%)	Ref
Excellent	6,969 (64.2%)	3,878 (35.8%)	0.78 (0.70–0.86)
Very good	14,502 (65.9%)	7,520 (34.1%)	0.72 (0.65–0.80)
Good	11,404 (65.5%)	6,004 (34.5%)	0.73 (0.66–0.81)
Fair	4,298 (63.9%)	2,433 (36.1%)	0.80 (0.72–0.88)
Self-perceived mental health			
Poor	499 (57.0%)	377 (43.0%)	Ref
Excellent	13,177 (66.5%)	6,637 (33.5%)	0.99 (0.84–1.17)
Very good	14,643 (65.6%)	7,664 (34.4%)	1.00 (0.85–1.18)
Good	8,538 (63.2%)	4,963 (36.8%)	1.04 (0.88–1.22)
Fair	1,835 (58.9%)	1,278 (41.1%)	1.06 (0.89–1.26)

Abbreviation: OR, odds ratio.

^aMissing data: self-identified racial group (n=2,236; 3.7%), marital status (n=127; 0.2%), income (n=4,045; 6.8%), self-perceived health (n=78; 0.1%), self-perceived mental health (n=113; 0.2%).

Results

CRC Screening Cohort

A total of 99,820 participants were considered eligible for the CRC screening cohort and included in the analysis. This included 56,470 participants who had FOBT within

the last 2 years and/or colonoscopy/sigmoidoscopy within the last 10 years and 43,350 who did not have any of these procedures. Patients who did not undergo these investigations were more likely to be younger (aged 50–54 years), male, unmarried, and a self-identified visible minority; have better self-perceived health; and have lower income (<\$20,000 CAD)

Table 3. Factors Associated With Nonadherence to Timely Papanicolaou Test (N=46,767)

	Papanicolaou Test Within Last 3 Years ^a		OR for Nonadherence (95% CI)
	Yes	No	
Total, N	34,957	11,810	
Age, y			
65–69	3,092 (56.8%)	2,354 (43.2%)	Ref
25–29	3,713 (85.3%)	641 (14.7%)	0.20 (0.18–0.23)
30–34	4,155 (86.8%)	633 (13.2%)	0.20 (0.17–0.22)
35–39	4,197 (85.8%)	696 (14.2%)	0.22 (0.20–0.25)
40–44	3,907 (82.1%)	852 (17.9%)	0.30 (0.27–0.34)
45–49	3,428 (77.9%)	974 (22.1%)	0.39 (0.35–0.43)
50–54	4,028 (72.7%)	1,510 (27.3%)	0.52 (0.47–0.56)
55–59	4,398 (69.8%)	1,905 (30.2%)	0.61 (0.56–0.66)
60–64	4,043 (64.3%)	2,245 (35.7%)	0.74 (0.68–0.90)
Racial group (self-identified)			
Visible minority	4,099 (71.4%)	1,641 (28.6%)	Ref
White	29,148 (75.4%)	9,520 (24.6%)	0.66 (0.61–0.70)
Marital status			
Married	20,190 (77.1%)	5,986 (22.9%)	Ref
Common-law	3,054 (80.6%)	733 (19.4%)	1.01 (0.91–1.11)
Widow/Separated/Divorced	6,358 (67.7%)	3,038 (32.3%)	0.97 (0.91–1.03)
Single/Never married	5,266 (72.3%)	2,014 (27.7%)	1.46 (1.36–1.56)
Income (CAD\$)			
≥\$80,000	13,124 (83.0%)	2,688 (17.0%)	Ref
<\$20,000	2,764 (60.8%)	1,780 (39.2%)	1.96 (1.79–2.14)
\$20,000 to <\$40,000	5,704 (67.7%)	2,720 (32.3%)	1.56 (1.45–1.67)
\$40,000 to <\$60,000	5,893 (72.7%)	2,213 (27.3%)	1.41 (1.31–1.51)
\$60,000 to <\$80,000	5,318 (78.0%)	1,499 (22.0%)	1.21 (1.12–1.30)
Self-perceived health			
Poor	939 (56.6%)	720 (43.4%)	Ref
Excellent	7,834 (80.5%)	1,902 (19.5%)	0.53 (0.46–0.61)
Very good	14,185 (78.2%)	3,965 (21.8%)	0.57 (0.50–0.65)
Good	9,224 (71.8%)	3,624 (28.2%)	0.70 (0.62–0.80)
Fair	2,741 (63.4%)	1,583 (36.6%)	0.83 (0.73–0.95)
Self-perceived mental health			
Poor	454 (62.2%)	276 (37.8%)	Ref
Excellent	12,141 (76.8%)	3,660 (23.2%)	0.85 (0.71–1.02)
Very good	13,397 (76%)	4,235 (24%)	0.86 (0.72–1.03)
Good	7,193 (71.9%)	2,811 (28.1%)	0.87 (0.72–1.04)
Fair	1,730 (68.7%)	788 (31.3%)	0.85 (0.70–1.03)

Abbreviation: OR, odds ratio.

^aMissing data: self-identified racial group (n=2,259; 5%), marital status (n=128; 0.3%), income (n=3,064; 6.6%), self-perceived health (n=53; 0.1%), self-perceived mental health (n=82; 0.1%).

($P<.001$ for all) (Table 1). Weighted frequencies for this analysis are reported in supplemental eTable 2.

Within multivariable logistic regression analysis, the following factors were associated with not having timely

CRC screening tests: age 50 to 54 years (odds ratio [OR], 2.65; 95% CI, 2.53–2.79), male sex (OR, 1.21; 95% CI, 1.18–1.24), self-identified visible minority (OR for White race vs visible minority, 0.87; 95% CI, 0.83–0.92),

single/never married status (OR, 1.28; 95% CI, 1.22–1.35), income <\$20,000 CAD (OR, 1.86; 95% CI, 1.76–1.97), and better self-perceived health (OR, 1.64; 95% CI, 1.51–1.77) (Table 1). When repeating the analysis excluding patients who reported a concurrent cancer diagnosis, the same results were obtained (data not shown).

Breast Cancer Screening Cohort

A total of 59,724 participants were considered eligible for the breast cancer screening cohort (using the age group of 40–74 years) and were included in the analysis. This included 38,760 participants who underwent mammography within the last 2 years and 20,964 who did not. Patients who did not have timely mammography were more likely to be unmarried, a self-identified visible minority, and aged 40 to 54 years; have worse self-perceived health; and have lower income (<\$20,000 CAD) ($P<.001$ for all) (Table 2). Weighted frequencies for this analysis are reported in supplemental eTable 3.

Within multivariable logistic regression analysis, the following factors were associated with not having timely mammography: age 40 to 44 years (OR, 5.50; 95% CI, 5.08–5.96), self-identified visible minority (OR for self-identified White race vs self-identified visible minority, 0.85; 95% CI, 0.80–0.91), single/never married status (OR, 1.27; 95% CI, 1.19–1.36), income <\$20,000 CAD (OR, 1.89; 95% CI, 1.76–2.04), and poor self-perceived health (OR for excellent vs poor self-perceived health, 0.78; 95% CI, 0.70–0.86) (Table 2). When repeating the same analysis excluding either patients aged <50 years or those who reported a concurrent cancer diagnosis, the same results were obtained in both scenarios (data not shown).

Cervical Cancer Screening Cohort

A total of 46,767 participants were considered eligible for the cervical cancer screening cohort and were included in the analysis. This included 34,957 participants who had the Pap test performed within the last 3 years and 11,810 who did not. Patients who did not have a timely Pap test were more likely to be older (aged 65–69 years), unmarried, and a self-identified visible minority; have worse self-perceived health; and have lower income

(<\$20,000 CAD) ($P<.001$ for all) (Table 3). Weighted frequencies for this analysis are reported in supplemental eTable 4.

Within multivariable logistic regression analysis, the following factors were associated with not having a timely Pap test: age 65 to 69 years (OR for age 25–29 vs 65–69 years, 0.20; 95% CI, 0.18–0.23), self-identified visible minority (OR for self-identified White race vs self-identified visible minority, 0.66; 95% CI, 0.61–0.70), income <\$20,000 CAD (OR, 1.96; 95% CI, 1.79–2.14), and poor self-perceived health (OR for excellent vs poor self-perceived health, 0.53; 95% CI, 0.46–0.61) (Table 3). When repeating the same analysis excluding patients who reported a concurrent cancer diagnosis, the same results were obtained (data not shown).

Temporal and Geographic Variations in Screening

Yearly rates of guideline-concordant screening tests among different cohorts are summarized in Figure 1. For the 3 screening cohorts, rates of screening increased modestly throughout the study period (2007–2016). Additional assessment of the variability of screening test adherence among different Canadian jurisdictions is provided in Figure 2A–C, and additional analysis of temporal and geographic variations in screening after adjusting for sample weights is provided in supplemental eFigures 1 and 2.

Discussion

This study provides an assessment of the patterns and trends of the 3 CTFPHC-recommended cancer screening approaches in a contemporary Canadian cohort. It suggests that more than one-third of eligible individuals are missing timely screening tests for CRC. Moreover, at least one-quarter of eligible women are missing their recommended breast and cervical cancer screening tests.

This investigation showed evidence of social and economic disparities regarding adherence to cancer screening recommendations; for instance, individuals with lower income were more likely to miss their recommended screening tests. These findings complement previously published literature that highlighted the

Figure 1. Yearly rates of guideline-concordant screening tests among different cohorts.

Abbreviation: FOBT, fecal occult blood test.

Figure 2. Variability of screening test adherence among different Canadian jurisdictions for (A) colorectal cancer screening (fecal occult blood test within 2 years or colonoscopy/sigmoidoscopy within 10 years), (B) breast cancer screening, and (C) cervical cancer screening (Papanicolaou test within 3 years).

Abbreviations: NWT, Northwest Territories; PEI, Prince Edward Island.

deleterious impact of low socioeconomic status on the outcomes of various cancers in North America.^{16–18} Likewise, the current study suggests that people who self-identify as a visible minority are less likely to have timely screening tests. This is consistent with older studies suggesting a lower uptake of cancer screening among

self-identified visible minorities in North America and highlights the need to address this disparity.^{19,20}

This study has several limitations that must be acknowledged. First, the CCHS surveys are based on self-reporting by participants. The reliance on self-reporting may be associated with different sorts of bias within the

results of this analysis. Previous US population-based studies have suggested that there may be overreporting of cancer screening within national US surveys.^{21,22} Second, some of the screening tests reported in the CCHS datasets may not have been conducted for the sake of screening but rather in the course of investigating a specific symptom. To minimize the impact of this limitation, a sensitivity analysis was performed to exclude participants with a concurrent cancer diagnosis. Third, given the cross-sectional nature of CCHS data collection and the absence of subsequent longitudinal morbidity and mortality follow-up, it is not possible to link non-adherence to screening tests with rates of subsequent cancer diagnosis and/or cancer mortality. Fourth, the linkage process described in the CCHS methodology between responses recorded from participants together with other surveys (that could have been conducted through other federal entities and/or provincial bodies) may have led to different forms of bias in collecting and interpreting the data of the current analysis. In addition, and as described in the methodology of CCHS, there was a redesign of the sampling strategy between the 2015–2016 CCHS datasets and prior published CCHS datasets; thus, Statistics Canada has suggested caution when comparing data from older cycles to data released for the 2015 cycle onward.⁹ Finally, restricting the estimates to patients who do not have cancer likely does little to adjust for testing that is diagnostic instead of testing that is performed for screening purposes because cancer detection will only represent a very small fraction of the proportion of adults who are evaluated for symptoms; in addition, a woman with breast cancer may still be referred to cervical cancer screening and CRC screening. These limitations need to be weighed against the clear strengths of the current analysis, including a large sample size and known quality of the CCHS data collection process.

The findings of the current study should serve as a wake-up call to healthcare providers and policymakers in Canada. Proper attention to the treatment of patients with cancer is needed; at the same time, more focus on recommended screening strategies would most likely lead to lower cancer mortality and a significant cost savings to publicly funded healthcare (through a

reduction in the number of individuals presenting with advanced cancer who would need more expensive treatments). A specific focus should be on marginalized racial and socioeconomic demographic groups in Canada who seem to have a higher probability of missing their recommended timely screening investigations. Some strategies have been previously recommended to increase uptake of cancer screening, including convincing physicians of the importance of cancer screening (physician recommendation is the most important factor in adherence to cancer screening²³) and educating the public about the importance of regular cancer screening. Electronic medical record–based reminders (targeting physicians, patients, or both) are also effective to ensure adherence to cancer screening.^{24,25} That being said, some practical issues with differing electronic medical records between different providers may impair this functionality. All primary care practitioners should also have an office policy regarding recommended cancer screening tests.²⁶

Although the suggestions for improving screening rates are useful, it is also important to consider the impact of cultural factors/barriers to screening that exist, particularly for cancers specific to women.²⁷ Studies have suggested that culturally competent outreach to particular immigrant communities is important, particularly in a country that welcomes many immigrants every year such as Canada.^{28,29}

Conclusions

More than one-third of eligible individuals are missing timely screening tests for CRC, and at least one-quarter of eligible women are missing their recommended breast and cervical cancer screening tests. Therefore, greater efforts must be made by federal and provincial health authorities to deal with socioeconomic disparities in access to cancer screening.

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Disclosures: Dr. Abdel-Rahman has disclosed that he is on the advisory board for Eisai Canada.

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Supplemental online content for:

Patterns and Trends of Cancer Screening in Canada: Results From a Contemporary National Survey

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eFigure 1: Yearly Rates of Guideline-Concordant Screening Tests Among Different Cohorts

eFigure 2: Variability of Screening Test Adherence Among Different Canadian Jurisdictions

eTable 1: Availability of Screening Information Among Canadian Jurisdictions

eTable 2: Weighted Frequencies for Factors Associated With Nonadherence to CRC Screening

eTable 3: Weighted Frequencies for Factors Associated With Nonadherence to Timely Mammography

eTable 4: Weighted Frequencies for Factors Associated With Nonadherence to Timely Papanicolaou Test

eFigure 1. Yearly rates of guideline-concordant screening tests among different cohorts, adjusted for sample weights of Canadian Community Health Survey.

Abbreviation: FOBT, fecal occult blood test.

eFigure 2. Variability of screening test adherence among different Canadian jurisdictions, adjusted for sample weights of Canadian Community Health Survey. (A) Colorectal cancer screening: fecal occult blood test within 2 years or colonoscopy/sigmoidoscopy within 10 years. (B) Breast cancer screening: mammography (age 40–74 years) within 2 years. (C) Cervical cancer screening: Papanicolaou test within 3 years. Abbreviations: NWT, Northwest Territories; PEI, Prince Edward Island.

eTable 1. Availability of Screening Information Among Canadian Jurisdictions Within CCHS Datasets			
Province	FOBT ± Sigmoidoscopy/Colonoscopy	Mammography	Papanicolaou Test
Newfoundland & Labrador	Available	Available	Available
PEI	Available	Not available	Available
Nova Scotia	Available	Available	Available
New Brunswick	Available	Available	Available
Quebec	Available	Available	Not available
Ontario	Available	Available	Available
Manitoba	Available	Not available	Not available
Saskatchewan	Available	Available	Available
Alberta	Available	Available	Available
British Columbia	Not available	Not available	Not available
Yukon/NWT/Nunavut	Available	Not available	Available ^a

Abbreviations: CCHS, Canadian Community Health Survey; CRC, colorectal cancer; FOBT, fecal occult blood test; NWT, Northwest Territories; PEI, Prince Edward Island.

^aNunavut only (note that these 3 jurisdictions were reported collectively in all CCHS datasets except in the 2015–2016 dataset, where they were separated).

eTable 2. Weighted Frequencies for Factors Associated With Nonadherence to CRC Screening^a

	FOBT Within Last 2 Years and/or Sigmoidoscopy/Colonoscopy Within Last 10 Years ^a	
	Yes	No
Total	55.4%	44.6%
Age		
50–54 y	43.5%	56.5%
55–59 y	54.7%	45.3%
60–64 y	60.8%	39.2%
65–69 y	63.1%	36.9%
70–74 y	64.1%	35.9%
Sex		
Male	54.2%	45.8%
Female	56.6%	43.4%
Racial group (self-identified)		
White	56.9%	43.1%
Visible minority	47.3%	52.7%
Marital status		
Married	57.6%	42.4%
Common-law	50.8%	49.2%
Widow/Separated/Divorced	52.4%	47.6%
Single/Never married	47.0%	53.0%
Income (CAD\$)		
<\$20,000	47.3%	52.7%
\$20,000 to <\$40,000	52.8%	47.2%
\$40,000 to <\$60,000	55.8%	44.2%
\$60,000 to <\$80,000	55.2%	44.8%
>\$80,000	58.9%	41.1%
Self-perceived health		
Excellent	54.4%	45.6%
Very good	55.7%	44.3%
Good	54.9%	45.1%
Fair	56.6%	43.4%
Poor	58.6%	41.4%
Self-perceived mental health		
Excellent	5.6%	44.4%
Very good	56.1%	43.9%
Good	54.2%	45.8%
Fair	54.9%	45.1%
Poor	54.7%	45.3%

^aMissing data: racial group (3.9%), marital status (0.2%), income (7.1%), self-perceived health (0.2%), self-perceived mental health (0.2%).

eTable 3. Weighted Frequencies for Factors Associated With Nonadherence to Timely Mammography

	Mammography Within Last 2 Years ^a	
	Yes	No
Total	62.6%	37.4%
Age		
40–44 y	33.7%	66.3%
45–49 y	48.5%	51.5%
50–54 y	69.0%	31.0%
55–59 y	75.4%	24.6%
60–64 y	78.4%	21.6%
65–69 y	76.6%	23.4%
70–74 y	67.9%	32.1%
Racial group (self-identified)		
White	63.9%	36.1%
Visible minority	56.2%	43.8%
Marital status		
Married	64.8%	35.2%
Common-law	56.4%	43.6%
Widow/Separated/Divorced	62.3%	37.7%
Single/Never married	53.0%	47.0%
Income (CAD\$)		
<\$20,000	54.8%	45.2%
\$20,000 to <\$40,000	61.2%	38.8%
\$40,000 to <\$60,000	64.2%	35.8%
\$60,000 to <\$80,000	63.8%	36.2%
>\$80,000	63.5%	36.5%
Self-perceived health		
Excellent	63.3%	36.7%
Very good	62.9%	37.1%
Good	62.5%	37.5%
Fair	62.1%	37.9%
Poor	56.8%	43.2%
Self-perceived mental health		
Excellent	64.8%	35.2%
Very good	62.3%	37.7%
Good	61.3%	38.7%
Fair	57.0%	43.0%
Poor	54.9%	45.1%

^aMissing data: racial group (3.9%), marital status (0.2%), income (7.1%), self-perceived health (0.2%), self-perceived mental health (0.2%).

eTable 4. Weighted Frequencies for Factors Associated With Nonadherence to Timely Papanicolaou Test

	Papanicolaou Test Within Last 3 Years ^a	
	Yes	No
Total	77.3%	22.7%
Age		
25–29 y	82.0%	18.0%
30–34 y	85.6%	14.4%
35–39 y	83.6%	16.4%
40–44 y	83.0%	17.0%
45–49 y	80.5%	19.5%
50–54 y	75.8%	24.2%
55–59 y	71.9%	28.1%
60–64 y	66.8%	33.2%
65–69 y	57.3%	42.7%
Racial group (self-identified)		
White	79.3%	20.7%
Visible minority	71.5%	28.5%
Marital status		
Married	78.7%	21.3%
Common-law	82.3%	17.7%
Widow/Separated/Divorced	72.7%	27.3%
Single/Never married	73.3%	26.7%
Income (CAD\$)		
<\$20,000	65.1%	34.9%
\$20,000 to <\$40,000	69.7%	30.3%
\$40,000 to <\$60,000	74.8%	25.2%
\$60,000 to <\$80,000	79.1%	20.9%
>\$80,000	83.3%	16.7%
Self-perceived health		
Excellent	82.2%	17.8%
Very good	80.4%	19.6%
Good	73.9%	26.1%
Fair	66.5%	33.5%
Poor	61.8%	38.2%
Self-perceived mental health		
Excellent	78.8%	21.2%
Very good	78.5%	21.5%
Good	75.7%	24.3%
Fair	70.3%	29.7%
Poor	61.6%	38.4%

^aMissing data: racial group (4.4%), marital status (0.2%), income (6.1%), self-perceived health (0.1%), self-perceived mental health (0.1%).