
Colorectal cancer screening in Canada: results of a national survey

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Abstract

Canadian guidelines recommend colorectal-cancer (CRC) screening for individuals aged 50 to 74 years. The study objective was to estimate rates of CRC screening according to individual and geographical characteristics, and of adherence to current CRC screening guidelines. Respondents to the 2003 Canadian Community Health Survey Cycle 2.1 (aged ≥ 50 years, without past or present CRC) participated. Fecal occult blood test (FOBT) and endoscopy utilization and screening rates were calculated. The sample included 16 747 residents of Newfoundland, Ontario, Saskatchewan and British Columbia. Overall, the FOBT screening rate was 7.7% in the past year, and the endoscopy screening rate was 8.8% in the past 5 years. FOBT screening rates were higher in older and male respondents; endoscopy screening rates were higher in older respondents. Individuals aged 50 to 59 and over 90 years were least likely to have been screened. Approximately 70% of respondents were non-adherent to current CRC screening guidelines. Non-adherence rates were higher in most health regions of British Columbia. National survey data suggest CRC screening in Canada is low; younger persons and residents of British Columbia were least likely to report CRC screening.

Key words: colorectal cancer, screening, survey, FOBT, endoscopy

Introduction

In Canada, colorectal cancer (CRC) is the fourth most commonly diagnosed cancer and the second and third leading cause of cancer deaths in men and women, respectively.¹ CRC screening reduces both CRC incidence through removal of premalignant polyps and CRC deaths through early detection and treatment. Since 1996, several organizations have published CRC screening guidelines for average-risk individuals, defined as those 50 years of age and older with average risk for the development of CRC. Canadian guidelines recommend fecal occult blood testing (FOBT) every 1 to 2 years²⁻⁴ whereas the US guidelines recommend annual FOBT.^{5,6} For other screening modalities, similar periodicities are advocated by Canada and the US: every 10 years for colonoscopy and

every 5 years for each of flexible sigmoidoscopy and double contrast barium enema, although the US guidelines also recommend a combination of annual FOBT with flexible sigmoidoscopy every 5 years.

Despite the widespread distribution of CRC screening guidelines, CRC screening is underutilized. In the US, several studies have employed national survey data and collected information through the use of either random-digit-dialing or in-person interviews. Research based on data from the National Health Interview Survey,⁷ the Behavioral Risk Factor Surveillance System,⁸ the Community Quality Index,⁹ the California Health Interview Survey¹⁰ and the Health Information National Trends Survey¹¹ revealed that CRC screening rates vary from 15% to 65% depending on the

time interval under study. In Ontario, research derived from either administrative or survey data estimates that less than 25% of the screen-eligible population has been screened.¹²⁻¹⁴ In Alberta, a population-based survey revealed that only 14.3% of average-risk individuals were considered up-to-date with CRC screening.¹⁵

As CRC screening advances to the forefront of preventive health care through public and professional awareness, rates of CRC screening in Canada are of growing interest. However, the extent to which Canadians are screened for CRC according to guidelines remains unclear. Moreover, little is known about the characteristics of the individuals who undergo CRC screening and the use of CRC screening procedures over time. With the launching of several provincial CRC screening programs in Canada, understanding CRC screening disparities is pivotal to fostering effective planning, implementation and functioning of CRC screening endeavors. Thus, the purpose of this population-based study was to estimate rates of 1) FOBT and endoscopy as CRC screening procedures; and 2) adherence to current CRC screening guidelines.

Methods

Data sources

The main data source was the Statistics Canada Canadian Community Health Survey (CCHS) Cycle 2.1 (January to December 2003),¹⁶ which aimed to provide estimates of health determinants, health status and health system utilization in Canada. This survey included household residents aged 12 years and older in all provinces and territories. Residents living

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on Indian Reserves or in remote areas, and full-time members of the Canadian Armed Forces were excluded. The CCHS Cycle 2.1 survey contained basic socio-demographic information on all respondents in all health regions. However, the CRC screening module was administered at the discretion of health regions. Respondents to the CRC screening module were from all health regions of Newfoundland and British Columbia, and from 14 of 37 and 7 of 11 health regions of Ontario and Saskatchewan, respectively.¹⁷ *Health regions* are defined by provincial health ministries and generally comprise legislated administrative areas representing geographic areas of responsibility for hospital boards or regional health authorities.¹⁸ Survey data are non-nominative; respondents were not identified.

Study population

The study population included survey respondents who completed the CRC screening module and reported being 50 years of age and older and without past or present CRC. Respondents failing to provide information on when both FOBT and endoscopy were last performed were excluded. Socio-demographic characteristics included age, sex, highest level of education achieved and household income. Clinical characteristics included bowel disease (having received a diagnosis of either Crohn's disease or ulcerative colitis from a health care professional). Geographical characteristics included residential area (urban vs. rural), health region and province of residence.

Outcome variables

FOBT and endoscopy (defined as sigmoidoscopy or colonoscopy) screening and utilization rates were based on questionnaire responses that assessed when the procedure was last performed and the indication for the procedure (screening, non-screening). *Screening rates* were derived from screening procedures, which were defined as those performed for "regular check-up", "age", "race", or "family history of CRC". The degree of an affected family member was not assessed. *Utilization rates* were derived from screening and non-screening procedures, which were defined as those performed for "follow-up of previous problem" or "other

reason". FOBT can be used in a non-screening context, for example, to detect the presence of blood in the stool of a patient with anemia. Three adherence rates were defined according to CRC screening guideline-recommended periodicities in place at the time of the study. (1) Adherence to FOBT screening guidelines was defined as having an FOBT in the past 2 years; (2) Adherence to endoscopy screening guidelines was defined as having an endoscopy in the past 10 years; (3) Adherence to current CRC screening guidelines was defined as either (1) or (2). The three adherence rates, which were based on procedures performed for *all* indications, provide an estimate of the number of respondents considered up-to-date with CRC screening. The underlying assumption is that once the procedure is performed, repeat testing for screening purposes should follow guideline-recommended periodicities.

Statistical analysis

Descriptive statistics were used to characterize the study population overall and according to screening modality. Screening rates were calculated as the number of respondents reporting a screening procedure, divided by the number of respondents reporting a screening procedure plus those reporting never undergoing the procedure, according to the timing of the last screening procedure. Respondents who underwent the procedure for non-screening purposes were excluded. Utilization rates were calculated as the number of respondents reporting either a screening or non-screening procedure divided by the total number of respondents in the study population, according to the timing of the last procedure. FOBT rates were calculated according to the following 5 time intervals: less than 1 year ago, 1 to 2 years ago, 2 to 3 years ago, more than 3 years ago and never. Endoscopy rates were calculated according to the following 4 time intervals: within the last 5 years, 6 to 10 years ago, more than 10 years ago and never. These time intervals differ from the guideline-recommended periodicities to allow for comparisons over time. Overall screening and utilization rates were computed for the entire study population. Screening rates were also computed by sex, age group, household income level, education level,

bowel disease status and geographical areas (residential area, health region and province of residence).

Rates were computed by aggregating weighted data over the participating health regions. Rates may not be representative of the entire province when only some health regions are sampled. Thus, only *regional* screening rates were reported for Ontario and Saskatchewan. By comparison, *regional* and *provincial* screening rates were reported for Newfoundland and British Columbia, where all health regions were sampled. Rates for the 3 adherence outcomes were calculated overall and according to health regions. Although rates of adherence to current CRC screening guidelines were based on FOBT and endoscopy utilization, respondents having valid information on only one procedure were included and classified accordingly. Bootstrap weights provided by Statistics Canada were employed to compute a 95% confidence interval (95% CI) using the BOOTVARE_V30 program (Version 3.0).¹⁹ All analyses were performed using SAS statistical software.²⁰

The sizes of both the Canadian population at survey time and the study population (i.e. number of Canadians represented by the respondents) were estimated using the weighted design previously mentioned. All figures presented are weighted values, in keeping with the policies of Statistics Canada.

Results

Study population

The CRC screening module was administered to 39 178 individuals (Figure 1). Of these, 16 747 respondents met eligibility criteria and were estimated to represent 2 394 124 Canadians (according to weighting procedures). The size of the Canadian population aged 12 and over was estimated at 26 578 128. Of the eligible respondents, 16 545 and 16 648 provided information on utilization of FOBT and endoscopy, respectively; 14 482 and 13 949 provided information on FOBT and endoscopy screening, respectively.

Table 1 presents the socio-demographic, clinical and geographical characteristics of the study population overall and according to screening modality. Overall, more of the respondents were female, aged 50 to 64, post high-school graduates, born in Canada, white, not employed, without bowel disease, living in urban areas and from British Columbia. Of the 14 482 respondents with FOBT screening information, 21.6% underwent FOBT screening in their lifetimes. Compared to the total study population, a greater percentage of those reporting FOBT screening were aged 50 to 64 and were not employed outside the home. Of the 13 949 respondents with endoscopy screening information, 11.3% underwent endoscopy screening in their lifetimes. Compared to the total study population, a greater percentage of those reporting endoscopy screening were not employed outside the home and were residents of Ontario; a smaller percentage were residents of British Columbia.

FOBT screening rates

Table 2 presents FOBT screening rates by time interval, according to socio-demographic, clinical and geographical characteristics. Overall FOBT screening rates were 7.7% in the past year, 5.1% 1 to 2 years ago, 2.5% 2 to 3 years ago, and 6.3% over 3 years ago; 78.4% never had a screening FOBT. FOBT screening rates in the past year and 1 to 2 years ago were higher in males, those with bowel disease and those aged 65 years and older; rates were lowest among the 50 to 59 year age group. No rural vs. urban difference was observed. Provincial FOBT screening rates were higher in residents of British Columbia compared to Newfoundland. Health regional FOBT screening varied within each province (Table 3). Across the 43 health regions of all provinces, FOBT screening rates in the past year ranged from 2.4% to 21.5% and rates of never undergoing FOBT screening ranged from 54.3% to 89.2%. In comparison, overall FOBT utilization rates were: 9.1% in the past year, 6.0% 1 to 2 years ago, 11.8% over 3 years ago; 69.3% never had an FOBT (data not shown).

Endoscopy screening rates

Table 4 presents endoscopy screening rates by time interval, according to socio-demographic, clinical and geographical characteristics. Overall endoscopy screening rates were 8.8% in the past 5 years and 1.5% in the past 6 to 10 years; 88.7% never had a screening endoscopy. Endoscopy screening rates in the past 5 years were higher in respondents with bowel disease and those aged 65 years and older; rates were lowest among the 50 to 59 year and 90 to 100 year age groups. No rural vs. urban difference was observed. Provincial endoscopy screening rates were higher in residents of Newfoundland compared to British Columbia. Health regional endoscopy screening rates varied within each province (Table 3). Across the 43 health regions (i.e. all provinces), endoscopy screening rates in the past 5 years ranged from 4.2% to

16.5%, and rates of never undergoing endoscopy screening ranged from 81.1% to 94.3%. In comparison, overall endoscopy utilization rates were 16.7% in the past 5 years and 3.9% in the past 6 to 10 years; 75.6% never had an endoscopy (data not shown).

Adherence to FOBT screening guidelines

Table 5 shows that 15.1% of respondents were adherent to FOBT screening guidelines. Figure 2 shows that rates of adherence to FOBT screening guidelines were highest in the southern health regions of British Columbia and some health regions of Saskatchewan and Ontario. Rates of never-use of FOBT across all health regions (Figure 3) were highest in eastern health regions of British Columbia, the Saskatoon region, north-eastern Ontario and parts of Newfoundland.

FIGURE 1
Study population selection from the CCHS Cycle 2.1 CRC screening module respondents

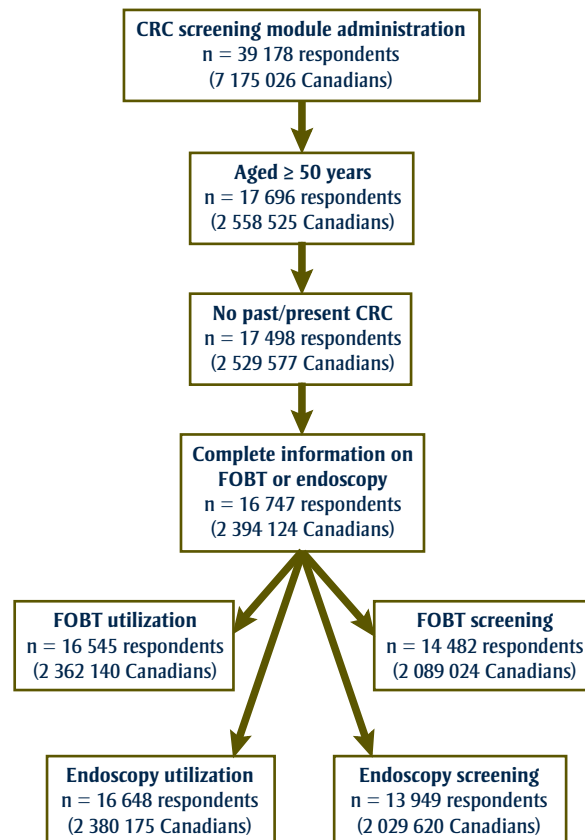


TABLE 1
Socio-demographic, clinical and geographical characteristics of the study population according to FOBT and endoscopy screening status

Characteristic	Category	Overall		FOBT screening ^a		Endoscopy ^b screening	
		n (2 394 124)	% ^c	n (451 669)	% ^c	n (229 578)	% ^c
Socio-demographic							
Sex	male	1 140 566	47.6	233 372	51.7	112 541	49.0
	female	1 253 559	52.4	218 298	48.3	117 037	51.0
Age	50 to 64	1 429 679	59.7	222 473	49.3	122 450	53.3
	65+	964 446	40.3	229 197	50.7	107 128	46.7
Education	< high school	630 647	27.0	110 676	25.1	56 249	25.0
	high school grad.	462 201	19.8	89 306	20.3	42 533	18.9
	post high school	143 139	6.1	23 708	5.4	17 793	7.9
	post high school grad.	1 095 953	47.0	216 554	49.2	108 544	48.2
Country of birth	Canada	1 653 452	70.3	315 685	70.9	171 337	75.5
	other	697 280	29.7	129 554	29.1	55 543	24.5
Cultural/racial origin	white	2 067 992	88.0	405 037	91.1	205 344	90.8
	other	281 342	12.0	39 630	8.9	20 748	9.2
Household income	low to low medium	656 704	33.2	116 925	31.1	64 074	33.7
	upper medium	685 018	34.7	132 543	35.2	64 003	33.6
	high	635 229	32.1	126 742	33.7	62 152	32.7
Employment status (over past year)	full-time	864 382	37.0	126 254	28.6	68 193	30.2
	part-time	211 809	9.1	39 937	9.0	21 600	9.6
	no job	1 258 634	53.9	275 747	62.4	135 673	60.2
Clinical							
Bowel disease	yes	86 080	3.6	16 664	3.7	10 699	4.7
	no	2 305 488	96.4	434 428	96.3	218 770	95.3
Geographical							
Residential area	urban	1 895 462	79.2	355 944	78.8	183 465	79.9
	rural	498 663	20.8	95 725	21.2	46 114	20.1
Residential province	Newfoundland & Labrador	155 166	6.5	19 859	4.4	15 673	6.8
	Ontario	889 608	37.2	171 566	38.0	111 762	48.7
	Saskatchewan	168 279	7.0	31 603	7.0	15 508	6.8
	British Columbia	1 181 072	49.3	228 641	50.6	86 636	37.7

All numbers are weighted

Numbers may not be equal to the population n due to missing data

^a Respondents reporting lifetime FOBT screening

^b Respondents reporting lifetime endoscopy screening

^c Based on valid responses (excludes missing values)

TABLE 2
FOBT screening rates by time interval according to socio-demographic, clinical and geographical characteristics (n^a = 14 482)

Characteristic	Last reported FOBT screening															
	< 1 year			1 to 2 years			2 to 3 years			3+ years			never			
OVERALL	Rate	95% CI		Rate	95% CI		Rate	95% CI		Rate	95% CI		Rate	95% CI		
	7.7	7.1	8.4	5.1	4.6	5.6	2.5	2.2	2.8	6.3	5.8	6.9	78.4	77.5	79.3	
Sex																
male	9.3	8.2	10.3	5.8	5.0	6.6	2.3	1.8	2.7	5.7	5.0	6.5	76.9	75.5	78.4	
female	6.2	5.5	7.0	4.4	3.8	5.0	2.7	2.3	3.2	6.9	6.2	7.6	79.7	78.6	80.9	
Age (years)																
50 to 64	6.6	5.7	7.4	4.5	3.8	5.1	1.8	1.5	2.2	4.8	4.1	5.4	82.4	81.2	83.6	
65+	9.5	8.4	10.6	6.0	5.3	6.8	3.5	3.0	4.1	8.7	7.9	9.6	72.2	70.7	73.7	
50 to 59	5.7	4.8	6.6	3.8	3.2	4.5	1.7	1.2	2.2	4.2	3.5	4.9	84.5	83.2	85.9	
60 to 69	9.3	8.1	10.5	5.9	4.9	6.9	2.7	2.1	3.3	6.5	5.4	7.6	75.6	73.8	77.4	
70 to 79	10.3	8.8	11.8	6.5	5.4	7.7	3.7	2.8	4.5	9.0	7.7	10.2	70.6	68.4	72.8	
80 to 89	7.7	4.7	10.6	6.2	4.5	8.0	3.8	2.7	5.0	11.8	9.5	14.2	70.5	66.8	74.1	
90 to 100	n/a	n/a	n/a	3.7	0.6	6.8	n/a	n/a	n/a	10.5	n/a	21.5	83.0	72.0	93.9	
Residential area																
urban	7.7	6.9	8.4	4.9	4.4	5.4	2.6	2.2	3.0	6.4	5.8	7.0	78.5	77.4	79.5	
rural	7.9	6.7	9.2	5.8	4.7	6.8	2.0	1.5	2.6	6.3	5.3	7.3	78.0	76.1	79.8	
Education																
< high school	6.9	5.9	8.0	4.8	4.0	5.7	2.5	2.0	3.1	6.3	5.3	7.2	79.5	77.8	81.1	
high school grad.	7.7	6.1	9.3	5.6	4.5	6.7	2.7	1.9	3.4	5.7	4.7	6.6	78.4	76.3	80.6	
post high school	9.1	6.4	11.9	3.7	1.8	5.6	1.9	1.0	2.9	5.2	3.1	7.2	80.1	75.8	84.4	
post high school graduate	8.0	7.0	9.0	5.1	4.4	5.8	2.5	2.0	3.0	6.9	6.0	7.7	77.5	76.1	79.0	
Household income																
low to low medium	6.8	5.6	7.9	4.4	3.7	5.1	2.6	2.0	3.2	7.1	6.1	8.2	79.1	77.5	80.8	
upper medium	7.9	6.8	9.1	4.9	4.1	5.7	2.1	1.6	2.6	7.3	6.3	8.3	77.8	76.1	79.5	
high	9.0	7.5	10.5	5.7	4.7	6.8	2.8	2.0	3.5	5.0	4.0	5.9	77.6	75.4	79.7	
Bowel disease																
yes	11.9	7.8	15.9	5.5	2.8	8.2	3.0	1.2	4.8	10.1	6.5	13.8	69.5	63.8	75.1	
no	7.6	6.9	8.2	5.1	4.5	5.6	2.5	2.2	2.8	6.2	5.7	6.8	78.6	77.7	79.6	
Residential province^c																
Newfoundland & Labrador	3.8	2.7	4.9	2.8	1.7	3.8	2.0	0.8	3.1	6.1	4.6	7.7	85.4	83.2	87.5	
British Columbia	8.1	7.0	9.2	5.1	4.3	5.9	2.1	1.7	2.5	6.4	5.6	7.3	78.4	76.8	79.9	

Rate percentages represent weighted data

^a Number of respondents providing information on FOBT screening and representing 2 089 024 Canadians

^b Respondents categorized according to the last reported date of screening FOBT

FOBT performed for non-screening purposes are excluded

^c Ontario and Saskatchewan provincial rates are not reported because data are not available for all health regions

n/a = not available because non-weighted data cells contained less than 5 individuals (Statistics Canada privacy protection regulation)

TABLE 3
Summary of health regional screening rates of FOBT and endoscopy by province

Province	Health regions n (%)	FOBT range ^b		Endoscopy range ^b	
		past year	never	past 5 years	never
Overall^a	43	2.4 to 21.5	54.3 to 89.2	4.2 to 16.5	81.1 to 94.3
Newfoundland & Labrador	6 (100%)	2.8 to 5.4	83.6 to 89.1	4.8 to 12.0	84.6 to 94.3
Ontario	14 (37.8%)	3.9 to 13.1	62.5 to 85.3	8.2 to 16.5	81.1 to 88.4
Saskatchewan	7 (63.6%)	3.8 to 21.5	54.3 to 85.5	7.5 to 10.8	82.6 to 90.8
British Columbia	16 (100%)	2.4 to 15.1	56.5 to 89.2	4.2 to 13.4	83.4 to 93.8

^a All health regions/provinces combined

^b Range values are percentages

counterparts, similar to the findings of others.²⁶⁻³⁴ Individuals aged 50 to 59 were less likely to report CRC screening, suggesting a delayed uptake of CRC screening recommendations by either or both physicians and younger patients, since at the time of the survey no CRC screening programs were in place. Furthermore, FOBT and endoscopy screening declined in the 80 to 89 year age group and, for endoscopy, dropped off dramatically in the 90 to 100 year age group. These findings may reflect the cost-effective model proposed for the Canadian population, which recommends to stop screening at age 74.^{3,35}

No meaningful differences were found in CRC screening rates according to urban vs. rural residence, suggesting that variation in screening was not due to availability of health care resources. One might have expected that rural areas would have been disadvantaged in terms of accessibility to sigmoidoscopy and colonoscopy and, consequently, more likely to have employed FOBT, which is readily available. Our finding corroborates that reported by another Canadian similar study that found CRC procedure rates in rural and urban areas.²¹ One possible explanation for the lack of variability between residential areas may rest in regional similarities in physician practice style. Since both FOBT and endoscopy are considered primary screening modalities, physicians who adhere to endoscopy screening may recommend endoscopy regardless of whether facilities are located outside of the patient's residential area.

Rates of FOBT increased moderately between 1 to 2 years ago and the past year, while rates of endoscopy increased almost 6-fold in the past decade. Not only do these trends indicate a steady rise in CRC screening, they may also depict a shift from FOBT to endoscopy for primary CRC screening.^{21,34,36-39} These findings should alert decision- and policy-makers of an impending increased demand for screening endoscopy, since at the present time there are insufficient resources to meet that demand.³⁵

Adherence to endoscopy screening guidelines

A total of 20.6% of respondents were adherent to endoscopy screening guidelines (Table 5). Figure 4 shows that health regional rates of adherence to endoscopy screening guidelines were highest in southeastern British Columbia, southern Alberta, northern Ontario and parts of Newfoundland. Rates of never-use of endoscopy (Figure 5) were highest in British Columbia and parts of Newfoundland. No clear geographical pattern emerged for Saskatchewan, as less than half of provincial health regions were sampled.

Adherence to current CRC screening guidelines

In this study population, 30.1% of respondents were adherent and 69.9% were non-adherent to current CRC screening guidelines (Table 5). Figure 6 shows that non-adherence rates were highest in most health regions of British Columbia and lowest in many health regions of Ontario. Non-adherence rates for Newfoundland and Saskatchewan varied by health region.

Discussion

The overarching goal of this Canadian population-based study was to increase our knowledge of the extent to which Canadians

50 years of age and older undergo CRC screening. Our results indicate that rates of CRC screening by FOBT and endoscopy were low and subject to considerable geographic variation. Provincial screening rates (Newfoundland and British Columbia) revealed that up to 85.4% and 91.4% of residents had never been screened with FOBT and endoscopy, respectively. Health regional screening rates (Saskatchewan and Ontario) were also low, with up to 85.5% and 90.8% of the population having never been screened with FOBT and endoscopy, respectively. The large geographical variation echoes findings from one Alberta-based study²¹ and several US studies that show large regional and state level differences in CRC test use.^{22,23} Geographical variation in use of health preventive services is evident for other types of screening in Canada. Health regional rates of the Papanicolaou (Pap) test in Ontario reportedly vary from 12% to 74%,²⁴ while across Canada provincial rates vary between 70% to 88%.²⁵ Similarly, survey data indicate that Canadian provincial breast cancer screening rates vary from approximately 9% in Nunavut to 67% in New Brunswick.²⁵

CRC screening rates varied by age as well. People 65 years of age and older were screened more often by both FOBT and endoscopy compared to their younger

TABLE 4
Endoscopy screening rates by time interval according to socio-demographic, clinical and geographical characteristics (n^a = 13 949)

Characteristic	Last reported endoscopy screening ^b											
	0 to 5 years			6 to 10 years			10+ years			never		
	Rate	95% CI		Rate	95% CI		Rate	95% CI		Rate	95% CI	
OVERALL	8.8	8.2	9.5	1.5	1.2	1.8	1.0	0.8	1.2	88.7	88.0	89.4
Sex												
male	9.0	8.0	10.0	1.3	0.9	1.7	1.1	0.7	1.5	88.7	87.6	89.7
female	8.7	7.8	9.6	1.7	1.3	2.1	0.9	0.7	1.2	88.7	87.7	89.7
Age (years)												
50 to 64	8.1	7.3	9.0	1.1	0.8	1.5	0.6	0.4	0.9	90.1	89.2	91.0
65+	10.0	8.9	11.0	2.0	1.6	2.5	1.6	1.2	2.0	86.5	85.3	87.6
50 to 59	7.3	6.4	8.3	1.0	0.7	1.4	0.5	0.3	0.8	91.1	90.1	92.2
60 to 69	10.4	9.2	11.6	1.8	1.2	2.4	1.0	0.6	1.4	86.9	85.6	88.2
70 to 79	10.3	8.8	11.8	2.1	1.6	2.7	1.7	0.9	2.4	86.0	84.3	87.7
80 to 89	9.7	6.6	12.8	1.6	0.7	2.5	2.1	1.3	3.0	86.6	83.4	89.8
90 to 100	2.7	n/a	5.7	n/a	n/a	n/a	n/a	n/a	n/a	94.6	90.5	98.8
Residential area												
urban	9.0	8.2	9.8	1.5	1.2	1.8	0.9	0.7	1.1	88.6	87.7	89.4
rural	8.2	7.1	9.4	1.4	0.9	1.9	1.2	0.6	1.9	89.1	87.8	90.4
Education												
< high school	8.2	7.1	9.2	1.6	1.1	2.0	1.0	0.6	1.4	89.3	88.1	90.6
high school grad.	8.4	6.8	10.0	1.3	0.7	1.9	1.0	0.5	1.4	89.3	87.6	91.1
post high school	10.8	7.6	13.9	2.6	0.5	4.7	1.7	n/a	3.7	84.9	81.3	88.6
post high school grad.	9.3	8.2	10.4	1.4	1.0	1.8	0.9	0.7	1.2	88.4	87.2	89.5
Household income												
low to low medium	8.8	7.5	10.2	1.6	1.1	2.0	1.2	0.8	1.7	88.4	87.0	89.8
upper medium	8.5	7.4	9.6	1.7	1.2	2.1	1.1	0.6	1.6	88.7	87.5	90.0
high	9.1	7.7	10.4	1.5	0.8	2.2	0.7	0.4	1.0	88.7	87.2	90.2
Bowel disease												
yes	23.2	16.5	29.9	4.1	1.6	6.6	n/a	n/a	n/a	71.0	63.7	78.2
no	8.6	7.9	9.2	1.4	1.2	1.7	1.0	0.8	1.2	89.0	88.3	89.7
Residential province^c												
Newfoundland & Labrador	9.0	7.3	10.8	1.7	0.7	2.7	1.2	0.5	2.0	88.1	86.1	90.0
British Columbia	6.5	5.7	7.4	1.2	0.8	1.6	0.8	0.5	1.2	91.4	90.5	92.4

Percentages represent weighted data

^a Number of respondents providing information on endoscopy screening and representing 2 029 620 Canadians

Rates are based on valid responses (excludes missing values)

^b Respondents categorized according to the last reported date of screening endoscopy (sigmoidoscopy or colonoscopy)

Endoscopies performed for non-screening purposes are excluded

^c Ontario and Saskatchewan provincial rates are not reported because data are not available for all health regions

n/a = not available because non-weighted data cells contained less than 5 individuals (Statistics Canada privacy protection regulation)

TABLE 5
Frequency of the three adherence outcomes

Outcome	n	% ^a
Adherence to FOBT screening guidelines^b		
yes	356 535	15.1
no	2 005 605	84.9
Adherence to endoscopy screening guidelines^c		
yes	490 128	20.6
no	1 890 047	79.4
Adherence to current CRC screening guidelines^d		
yes	720 899	30.1
no ^e	1 673 225	69.9

All numbers are weighted

Includes procedures for all indications

^a Based on valid responses (excludes missing values)

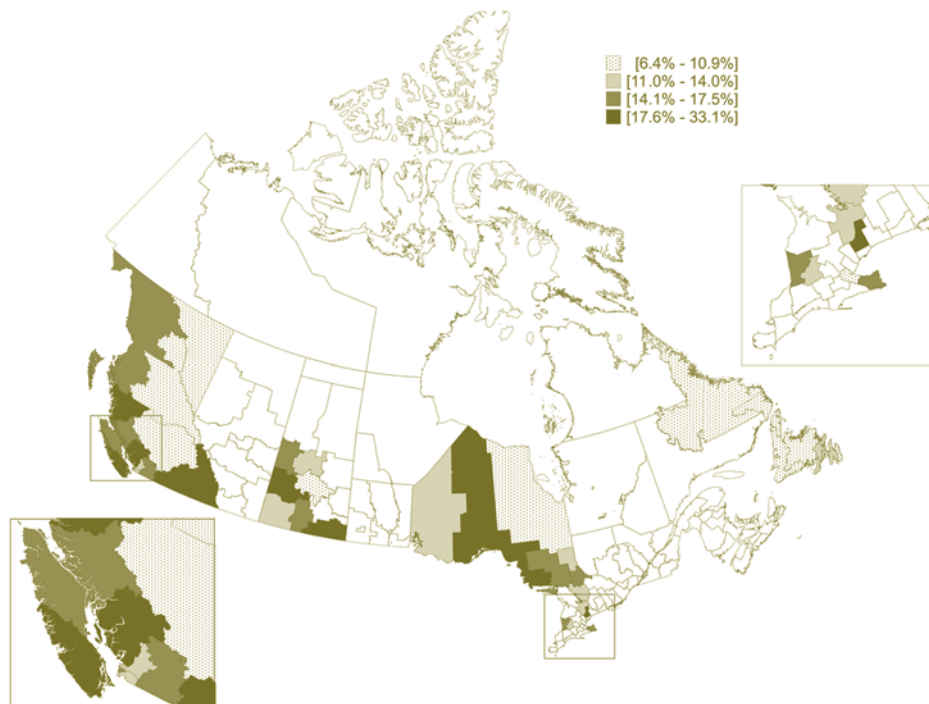
^b Reported use in the past 2 years for 16 545 respondents (1.3% missing values)

^c Reported use in the past 10 years for 16 648 respondents (0.6% missing values)

^d Reported use of FOBT in the past 2 years or endoscopy in the past 10 years for 16 747 respondents

^e Includes 1.3% of respondents classified according to only one procedure

FIGURE 2.
Health regional rates of adherence to FOBT screening guidelines*



*Utilization of FOBT in the past 2 years

FIGURE 3
Health regional rates of never-use of FOBT

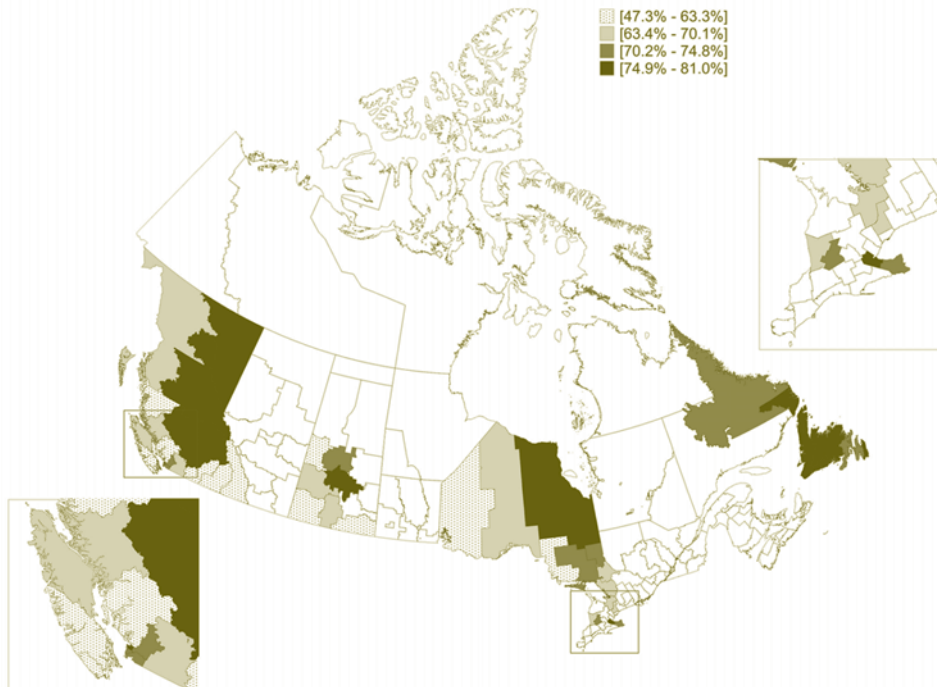
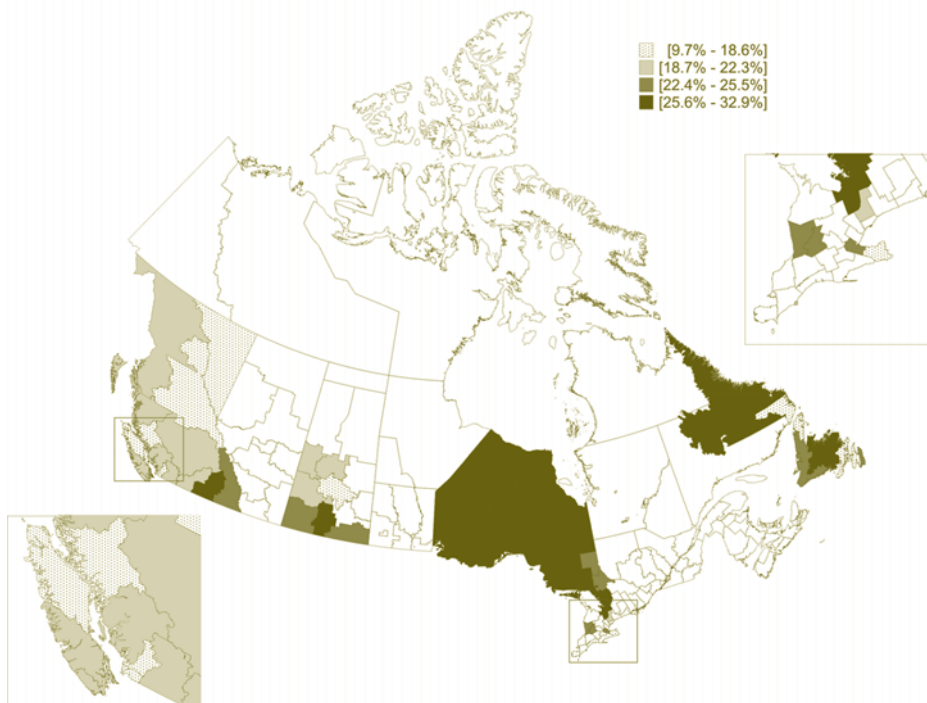


FIGURE 4
Health regional rates of adherence to endoscopy screening guidelines*



*Utilization of sigmoidoscopy or colonoscopy in the past 10 years

FIGURE 5
Health regional rates of never-use of endoscopy

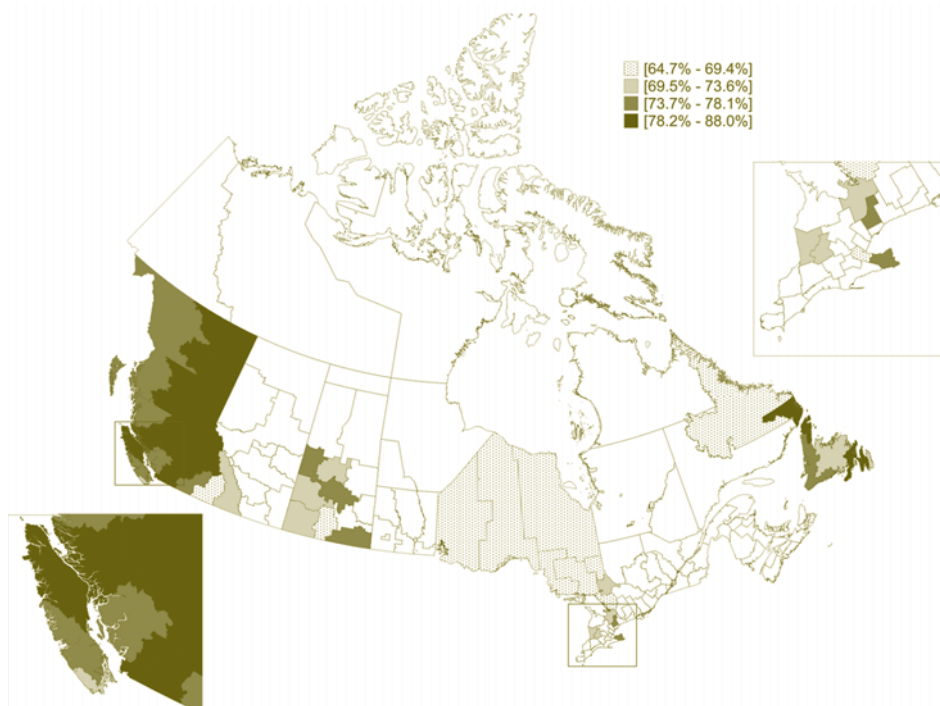
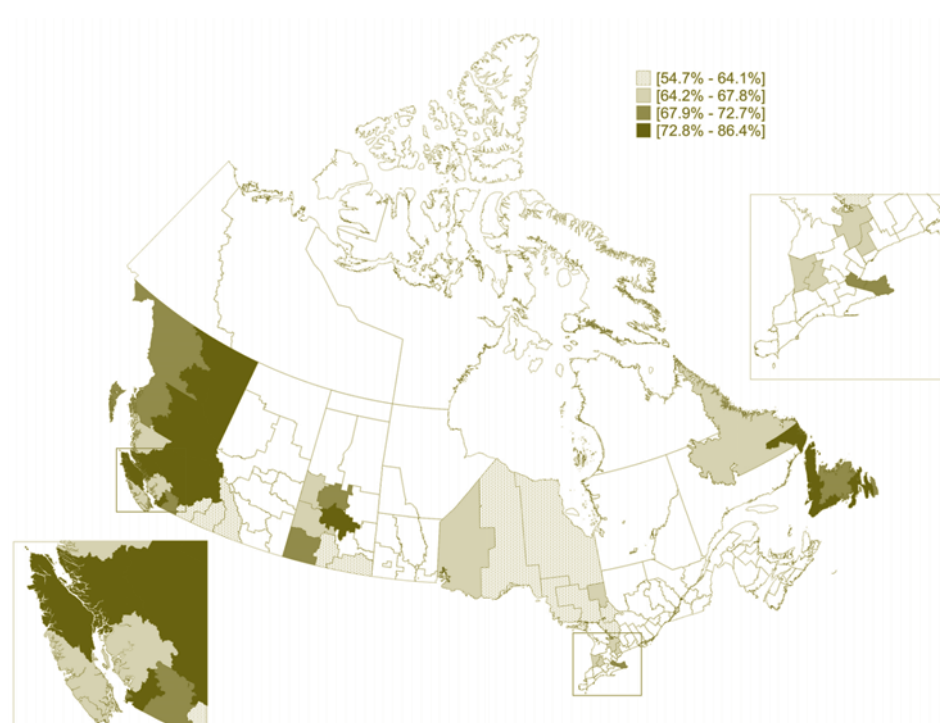


FIGURE 6
Health regional rates of non-adherence to current colorectal-cancer screening guidelines*



*Non-use of FOBT in the past 2 years and endoscopy in the past 10 years

In Canada in 2003, 78.4% and 88.7% of respondents had never been screened by either FOBT or endoscopy, respectively. These findings mirror those of US population-based studies that found that up to 65% of individuals had never received either of these exams^{7,11,36} and of one Canadian study that reported that up to 77% had never been screened for CRC.¹⁴ Likewise, in a 6-year follow-up study of Ontario beneficiaries, nearly 80% of CRC screen-eligible individuals aged 50 to 59 years did not receive any large bowel evaluation.¹² Not only do our findings point to the gross underuse of CRC screening, they also convey the message that CRC screening rates are considerably lower than those for either breast or cervical cancer.^{8,37,40} In 2003, the proportion of screen-eligible women who underwent guideline-recommended screening was 79% for Pap test and 61% for mammography, the latter increasing from 53% in 2001.²⁵ The rise in breast-cancer screening rates may be explained by the increasing number of enrollees in provincially organized breast-cancer screening programs, which have been adopted by all Canadian provinces.⁴¹ Multimodal endeavors that proved effective for improving breast-cancer screening rates may be effective at boosting rates of CRC screening. Undoubtedly, providing CRC screening within the context of an organized program may prove to be advantageous by promoting awareness of CRC screening, especially in the younger age group, and monitoring guideline-recommended CRC screening in average-risk Canadians.

Several limitations and strengths are important to consider when interpreting our findings. Endoscopy screening rates may have been overestimated if respondents with bowel disease indicated a screening procedure: since inflammatory bowel disease is a risk factor for the development of CRC, affected individuals are advised to undergo surveillance colonoscopy at more frequent time intervals compared to those considered at average-risk. However, this would not have meaningfully affected the rates of screening because less than 1% of the study population would have been misclassified (3.6% of respondents with

bowel disease, of which 23% had a screening endoscopy in the past 5 years). Adherence to endoscopy screening guidelines may have been overestimated if individuals who underwent sigmoidoscopy beyond the recommended 5 years were included. Adherence to current CRC screening guidelines may have been underestimated as 1.3% of respondents were classified as non-adherent based on only one procedure. CRC screening rates may have been slightly underestimated as some of the 50-year-old respondents who reported not being screened at survey time may have been screened before the end of their 50th year. Given the large variability by geographic location, results are likely not generalizable to Canadian provinces for which CRC screening data were not available.

Determining the extent to which CRC screening is performed nationally is methodologically challenging. Whereas administrative database studies cannot distinguish screening exams from those that are performed for other indications, surveys such as the CCHS Cycle 2.1 include responses that permit the determining of the indication for undergoing the procedure. In contrast, surveys that rely on self-report may be problematic for distinguishing sigmoidoscopy from colonoscopy. However, good sensitivity and specificity for self-reported use are found when the two procedures are grouped together,^{42,43} as was done in the CCHS.

Study strengths include 1) defining adherence to current CRC screening guidelines according to both FOBT and endoscopy, which provides a snapshot of the proportion of the population that has undergone CRC screening; and 2) determining outcomes in a population where over 96% are at average-risk for the development of CRC. Finally, rates by geographical location are likely to remain stable over short time intervals given that only 4.1% of Canadians aged 45 and over move out of province each year.⁴⁴ Because this study used data from 2003 and awareness of CRC screening has increased substantially in the last few years, current CRC screening rates are likely higher than those reported.

Conclusion

In summary, most average-risk respondents had never been screened for CRC by either FOBT or endoscopy, with close to 70% being non-adherent to current screening guidelines. Higher rates of non-adherence to CRC screening guidelines in those aged 50 to 59 suggest delayed uptake of CRC screening recommendations by physicians and younger, average-risk Canadians. It is unclear why screening rates were lower in most regions of British Columbia. Greater use of endoscopy compared to FOBT suggests that it may be used increasingly as a primary CRC screening strategy. The absence of an urban vs. rural difference suggests that a lack of resources in rural areas is not impeding CRC screening. The very low screening rates found in this study coupled with the evidence that CRC screening can reduce incidence of and mortality from CRC suggest that multimodal efforts are needed to increase Canadians' awareness and use of CRC screening.

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