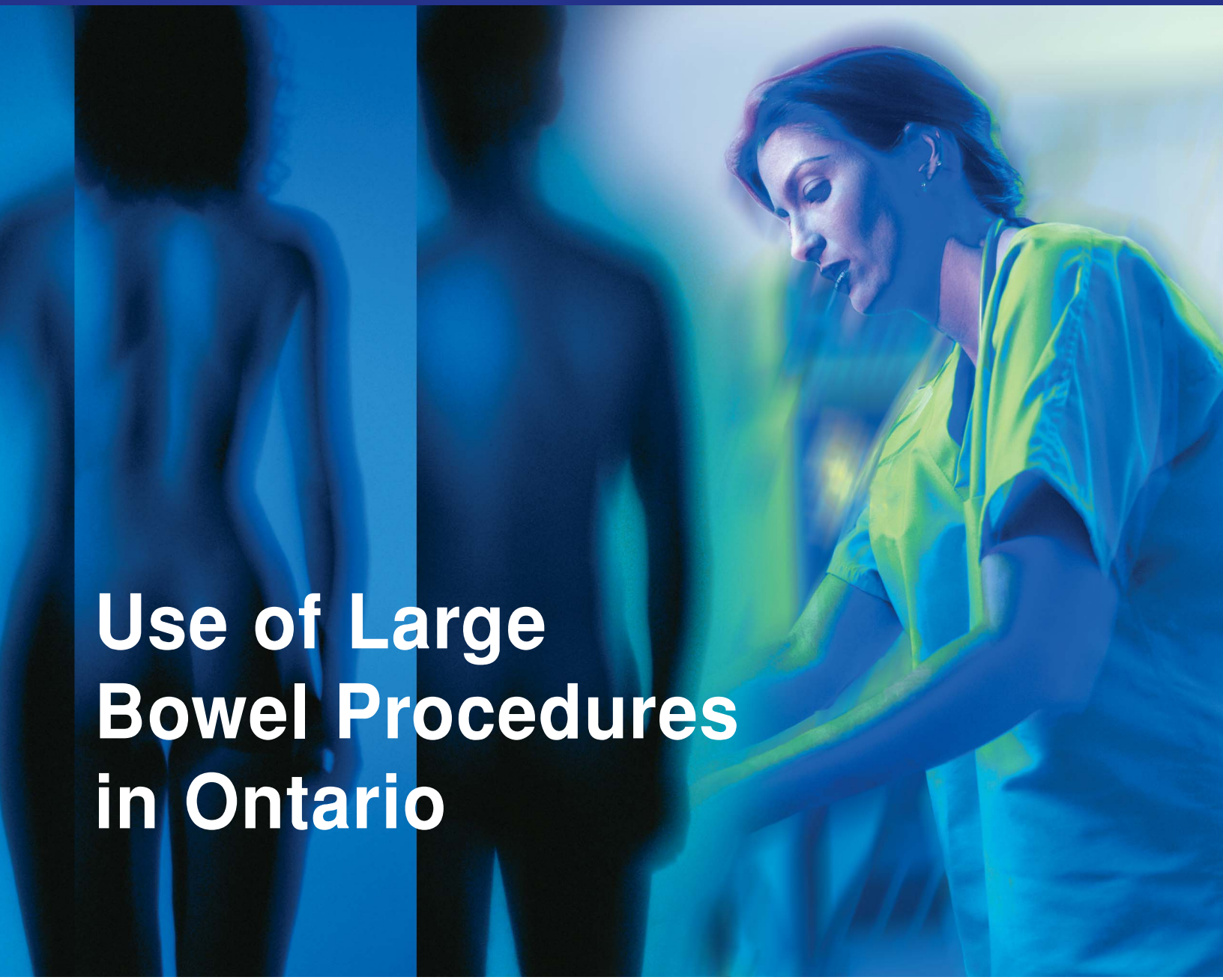

Use of Large Bowel Procedures in Ontario

Research Atlas

FEBRUARY 2004

ICES Institute for Clinical Evaluative Sciences

Use of Large Bowel Procedures in Ontario

An ICES Research Atlas

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Published by Institute for Clinical Evaluative Sciences (ICES)

Canadian Cataloguing in Publication Data

ICES Research Atlas: Use of Large Bowel Procedures in Ontario

Includes bibliographical references and index.
ISBN 0-9730491-6-2

I. Vinden, Christopher M. 1960
II. Schultz, Susan E. 1957
III. Rabeneck, Linda 1948
IV. Institute for Clinical Evaluative Sciences

How to cite the publication:

Vinden C, Schultz S, Rabeneck L. *ICES Research Atlas: Use of Large Bowel Procedures in Ontario*
February 2004

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Acknowledgements

The publication of this research atlas is the result of the cooperative efforts of many individuals in all phases of this project. The authors wish to take this opportunity to acknowledge a number of individuals who contributed to the successful completion of this project.

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Printing

Continental Press, Concord, Ontario

Foreword

ICES – Ontario's resource for informed health care decision-making

ICES is an independent, non-profit organization that conducts research on a broad range of topical issues to enhance the effectiveness of health care for Ontarians. Internationally recognized for its innovative use of population-based health information, ICES research provides evidence to support health policy development and changes to the organization and delivery of health care services.

Unbiased ICES evidence provides fact-based measures of health system performance; a clearer understanding of the shifting health care needs of Ontarians; and a stimulus for discussion of practical solutions to optimize scarce resources.

Key to ICES' research is our ability to link anonymous population-based health information on an individual patient basis, using unique encrypted identifiers that ensure privacy and confidentiality. This allows scientists to obtain a more comprehensive view of specific health care issues than would otherwise be possible. Linked databases reflecting 12 million of 30 million Canadians allow researchers to follow patient populations through diagnosis and treatment, and to evaluate outcomes. Nowhere else in Ontario is there the combined scientific capability and in-house expertise to extract and interpret information from population-based health information databases of such magnitude.

ICES brings together the best and the brightest talent under one roof. Many of our faculty are not only internationally recognized leaders in their fields, but are also practising clinicians who understand the grassroots of health care delivery, making ICES knowledge clinically-focused and useful in changing practice. Other team members have statistical training, epidemiological backgrounds, project management or communications expertise. The variety of skill sets and educational backgrounds ensures a multi-disciplinary approach to issues management and creates a "real-world" mosaic of perspectives that is vital to shaping Ontario's future health care.

ICES collaborates with experts from a diverse network of institutions, government agencies, professional organizations and patient groups to ensure research and policy relevance.

ICES Research Atlas – Use of Large Bowel Procedures in Ontario

ICES research atlases, such as *Use of Large Bowel Procedures in Ontario,* are designed to provide relevant information to providers, planners and policymakers on the effectiveness of the Ontario health care system. Covering a range of system-related and disease-specific topics, research atlases feature geographical breakdowns of regional patterns in health care delivery. Findings, implications and policy recommendations are provided to help guide quality improvement and decision-making in the dynamic climate of health care.

In this atlas, ICES examines colonic evaluation procedure practices and patterns and associated resources to aid current discussion about the feasibility of implementing a population-based colorectal cancer screening program in Ontario. Key measures investigated in this document are:

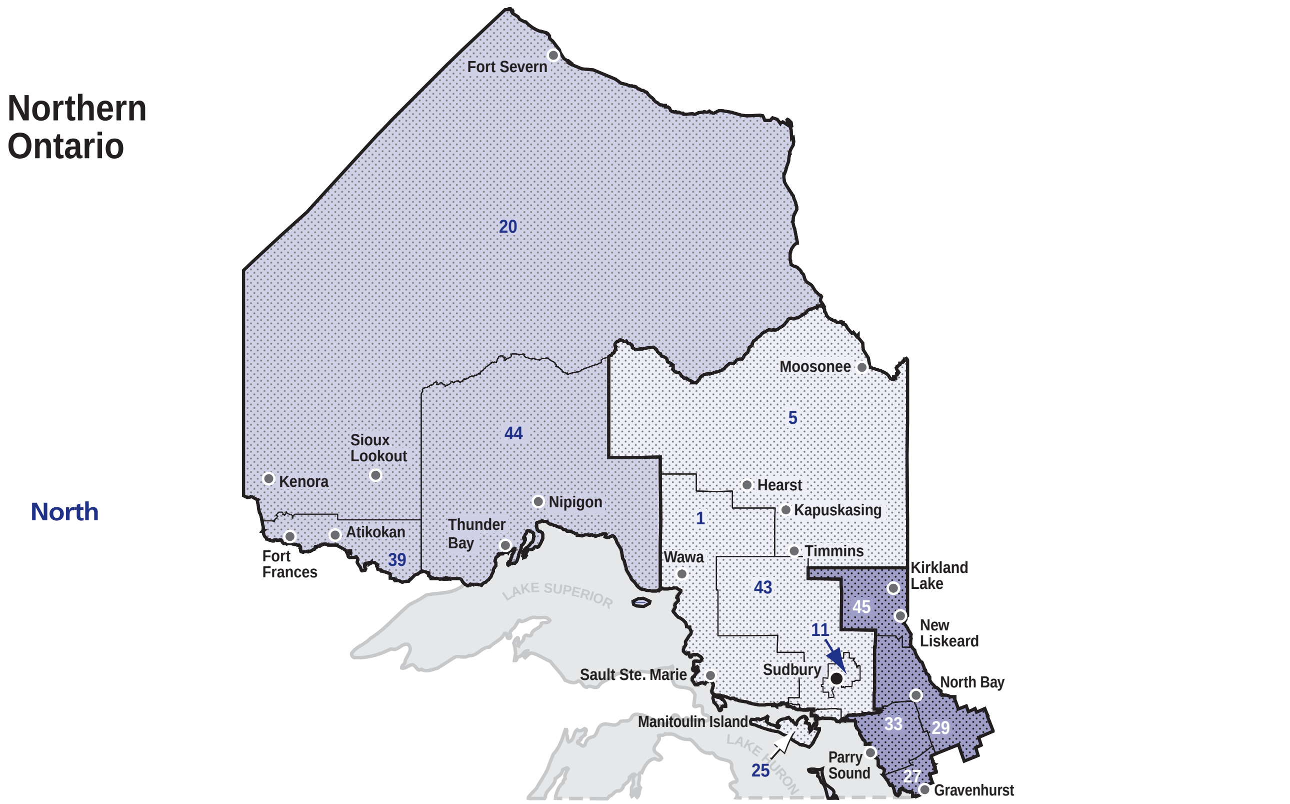
- Colonic evaluation procedure frequencies and rates
- Proportion of the population receiving colonic evaluation procedures
- Geographic variation in utilization of colonic evaluation procedures
- Physician activity levels for colonic evaluation procedures
- Geographic distribution of resources

This report also highlights the policy implications of these findings.

Ontario Health Planning Regions, District Health Councils and Counties

How to Read ICES Maps

Ministry of Health and Long-Term Care (MOHLTC) Regions	District Health Councils (DHCs)	Regions, Counties and Districts (49)
North	Algoma-Cochrane-Manitoulin-Sudbury DHC	Algoma (1), Cochrane (5), Greater Sudbury (11), Manitoulin (25), Sudbury (43)
	Northern Shores DHC	Muskoka (27), Nipissing (29), Parry Sound (33), Timiskaming (45)
	Northwestern Ontario DHC	Kenora (20), Rainy River (39), Thunder Bay (44)
South West	Essex-Kent-Lambton DHC	Chatham-Kent (4), Essex (9), Lambton (21)
	Grey-Bruce-Huron-Perth DHC	Bruce (3), Grey (12), Huron (18), Perth (35)
	Thames Valley DHC	Elgin (8), Middlesex (26), Oxford (32)
Central West	Halton–Peel DHC	Halton (15), Peel (34)
	Waterloo Region–Wellington–Dufferin DHC	Dufferin (6), Waterloo (47), Wellington (48)
Central South	Grand River DHC	Brant (2), Haldimand-Norfolk (13)
	Hamilton DHC	Hamilton (16)
	Niagara DHC	Niagara (28)
Toronto	Toronto DHC	Toronto (46)
Central East	Durham-Haliburton-Kawartha-Pine Ridge DHC	Durham (7), Haliburton (14), Northumberland (30), Peterborough (36), Kawartha Lakes (19)
	Simcoe-York DHC	Simcoe (41), York (49)
East	Champlain DHC	Ottawa (31), Prescott-Russell (37), Renfrew (40), Stormont-Dundas-Glengarry (42)
	Southeastern Ontario DHC	Frontenac (10), Hastings (17), Lanark (22), Leeds-Grenville (23), Lennox-Addington (24), Prince Edward (38)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New Liskeard
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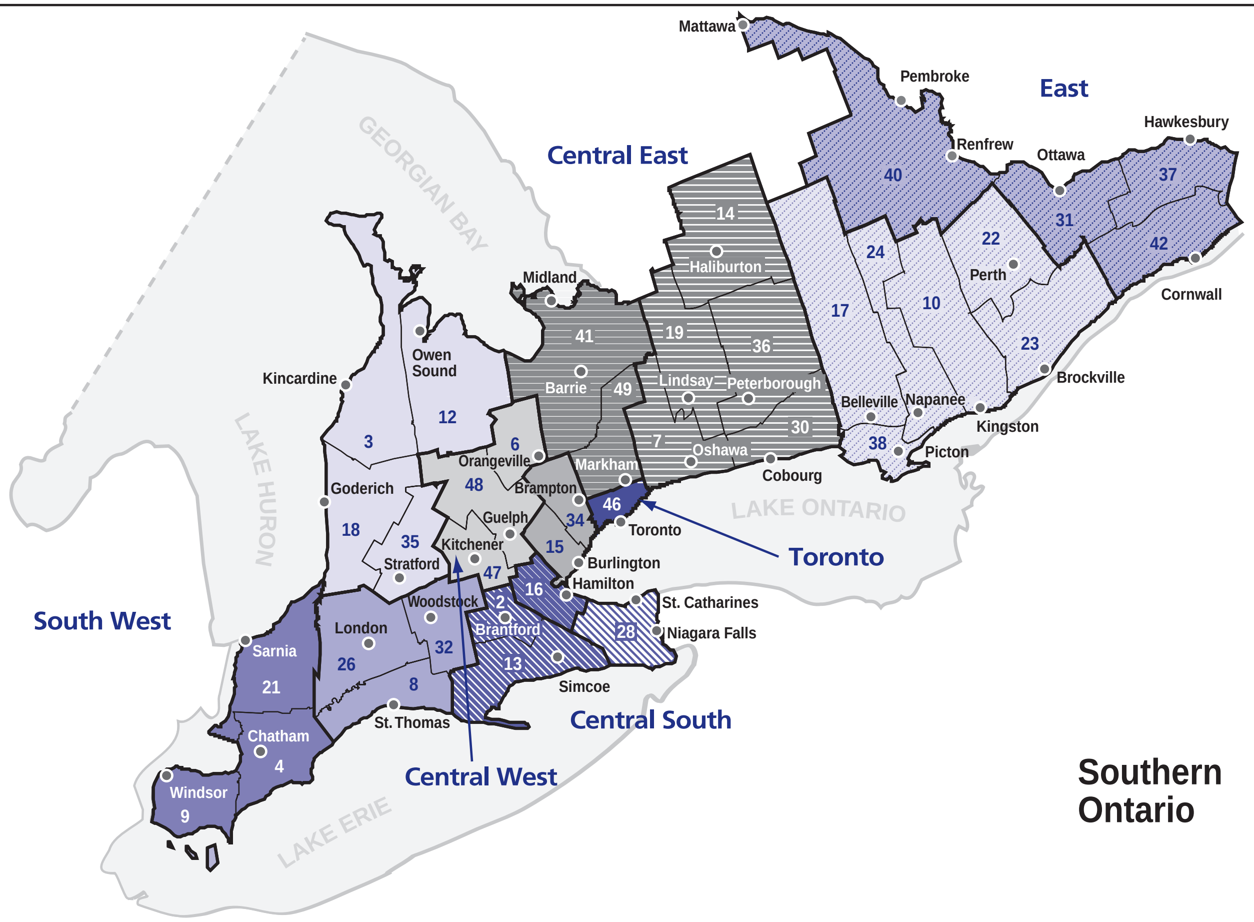
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Peterborough
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Toronto
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Toronto
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Burlington
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Hamilton
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LAKE ERIE
Southern Ontario

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1. Introduction

It is anticipated that over the next decade a number of countries with publicly funded health care systems (e.g. UK, Denmark) will develop population-based colorectal cancer (CRC) screening programs. In Canada, recommendations for such a program have been made at the national level[1] and in Ontario[2]. However, there is concern among health care providers and policymakers about the availability of required resources. This research atlas examines colonic evaluation procedure practice patterns and associated resources to inform current discussion about the feasibility of implementing a population-based CRC screening program in Ontario.

Key Messages

- Colorectal cancer is the leading cause of non-tobacco related deaths from cancer.
- The scientific evidence to support colorectal cancer screening is strong: the Canadian Task Force on Preventive Health Care recommends screening for all men and women 50 years and older using FOBT (fecal occult blood test) or flexible sigmoidoscopy.
- The proportion of the Ontario population 50 years of age and older having at least one type of colonic evaluation procedure remains low, even with the increase in colonoscopy use in the past decade. Efforts must be made to increase screening.
- Access to colonic evaluation procedures varies by county and procedure. Current funding models act as an access barrier to large bowel endoscopic procedures.
- The most promising method for increasing screening uptake is through the implementation of a comprehensive, population-based screening program.

Background

Following lung and breast cancer in women, and lung and prostate cancer in men, CRC is the third most common cancer among Canadians. CRC incidence rates for Canadian men and women are among the highest in the world. In Ontario, CRC is the most common cause of cancer deaths in non-smokers. The lifetime risk of developing CRC is approximately 1 in 17.[3]

Though Ontario's CRC mortality rate has been falling since the early 1970s, the incidence rate began rising in the mid-1990s after a steady decline that began in the mid-1980s (Figure 1).

In 2003, the most recent year for which estimates are available, it was estimated that there would be 6,800 new cases of CRC in Ontario and 3,000 deaths.

In 2001, Ontario's age-standardized CRC incidence and mortality rates per 100,000 were:

	Men	Women
Incidence	64.4	43.7
Mortality	22.2	14.3

Data source: Cancer Care Ontario, Cancer Incidence, Mortality, Survival and Prevalence in Ontario.

CRC places a significant burden on the health care system. Figure 2 shows the hospital bed days associated with the four most common types of cancer in Ontario in 2001. CRC has by far the highest, with 100,125 bed days. Female breast cancer, by contrast, required less than one-fifth the number of bed-days. It is clear that the societal burden of CRC is considerable in terms of morbidity, mortality, and consumption of increasingly scarce health care resources.

CRC has a long, identifiable and treatable pre-malignant phase that makes it an ideal candidate for a screening program. A number of screening procedures are currently available:

- Fecal occult blood test (FOBT)
- Barium enema
- Sigmoidoscopy
- Colonoscopy

Over the past decade, screening guidelines and recommendations have been evolving in Canada and the United States as new evidence about the relative efficacy and cost-effectiveness of different approaches emerges.[4-8]

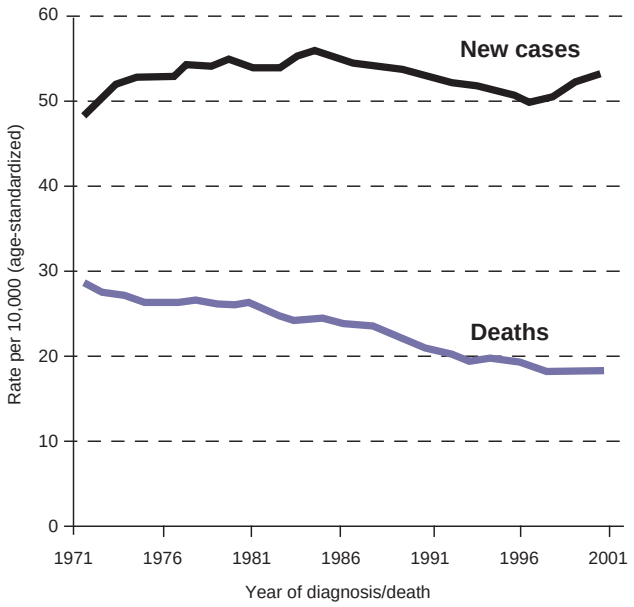
One of the first comprehensive guidelines for CRC screening was published by Winawer et al.[9] and endorsed by a variety of groups including the American Gastroenterological Association, the American Cancer Society and the US Preventive Services Task Force (USPSTF). The authors recently updated their recommendations to take into account evidence published since 1996.[10] The Canadian Task Force on Preventive Health Care (CTFPHC) has published recommendations for CRC screening.[11] These and other recommendations are summarized in Appendix A. There is consensus that all men and women at average risk for CRC should be screened beginning at age 50, although recommendations with respect to screening modalities and frequency differ. Both the CTFPHC and the USPSTF have endorsed FOBT and/or flexible sigmoidoscopy as

the initial screening test.[11,12,13]

With the evolution of more specific guidelines for CRC screening has come increased pressure to develop population-based CRC screening programs in Canada.[14] In 1999, Cancer Care Ontario convened an expert panel to develop recommendations for a CRC screening program in Ontario. The panel recommended the creation of an FOBT-based CRC screening program for average risk individuals between the ages of 50 and 75.[2] In 2002, this recommendation was echoed at the national level by a committee convened by Health Canada.[1]

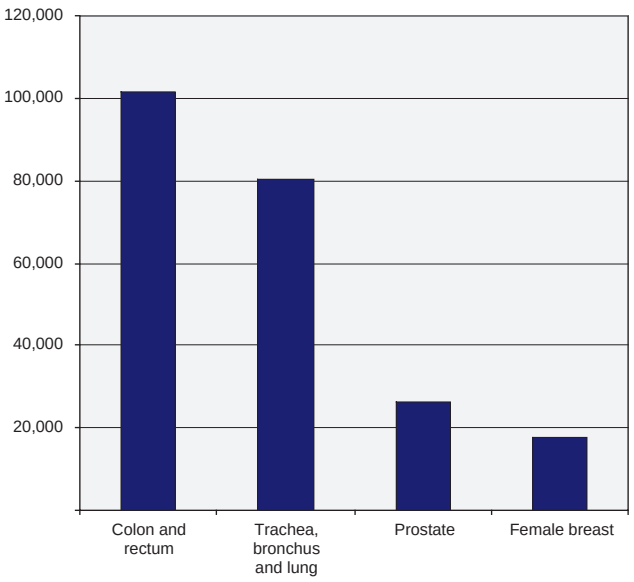
In June 2003, a pilot study to evaluate two implementation models for FOBT was funded by the Ontario Ministry of Health and Long-Term Care (MOHLTC). It is expected that the information on current colonic evaluation procedure practice patterns in this research atlas will contribute to the discussion about the feasibility of establishing a population-based CRC screening program in Ontario.

Figure 1. Colorectal cancer rates in Ontario, 1971-2001



Source: Ontario Cancer Registry

Figure 2. Hospital bed days by type of cancer in Ontario, 2001



Source: Canadian Institute for Health Information

Key Findings

- Half of the more than 359,000 non-FOBT (fecal occult blood test) colonic evaluation procedures performed in Ontario in 2001 were colonoscopies.
- The number of colonoscopies among Ontarians in 2001 was approximately 3-fold that of 1992, and the rate of growth also increased steadily throughout the decade. The year-over-year increase in 1993 was only 8%; in 2001, it was almost 17%.
- There was very little difference by county in the proportion of the population having a colonic evaluation procedure when all procedures were taken together. Rates for individual procedures varied widely from county to county.
- Specialist physicians are currently performing most colonic evaluation procedures: for example, general surgeons and gastroenterologists are primarily performing endoscopic procedures, while radiologists are performing barium enemas.
- There is a relationship between the type of hospital(s) in a county and the colonoscopy procedure rate.
- Relative to total hospital volume, in small hospitals, on average, more colonoscopies are performed than in large teaching hospitals.
- There is a relationship between the supply and activity level of physicians performing colonoscopy and the colonoscopy rate.

2. How the Research was Done

Data Sources

Physicians who bill fee-for-service (FFS) within the Ontario Health Insurance Program (OHIP), which covers all residents, perform the majority of colonic evaluation procedures. Consequently, the OHIP billings database is the primary source of data used in these analyses.

Additional information was added by record linkage to other databases including hospital discharge abstract data from the Canadian Institute of Health Information (CIHI) as well as the Registered Persons Data Base (RPDB) of the MOHLTC.

Physician characteristics (practice location and specialty) were derived from the OHIP Corporate Provider Database (CPDB), the accuracy of which was verified against the Ontario Physician Human Resource Data Centre (OPHRDC) database.

Population data used in the rate calculations are from the 2002 post-censal estimates from Statistics Canada. All rates were standardized to the 1991 Canadian population.

Scope

The colonic evaluation procedures examined in this study included:

- FOBT
- Rigid sigmoidoscopy (RS)
- Flexible sigmoidoscopy (FS)
- Double contrast barium enema (DCBE)
- Single contrast barium enema (SCBE)
- Colonoscopy (CC)

(See Appendix B for procedure detail.)

Billing codes are straightforward for radiological procedures, rigid sigmoidoscopy and FOBT. In contrast, billing for flexible endoscopic procedures (FS and CC) is more complex as it involves a combination of codes. For example, a complete colonoscopy to the terminal ileum (see Appendix B for anatomical term definitions) requires 5 separate codes representing incremental fees billed for each section of the colon reached. (See Appendix C for code list.)

This results in an overlap of the fee codes used for a limited (or incomplete) colonoscopy and a flexible sigmoidoscopy. Many endoscopists bill limited colonoscopy rather than a flexible sigmoidoscopy (same fee) when the intent is to carry out a limited evaluation. They would also bill the same fee codes if they attempted a colonoscopy and were unable to complete it. Unfortunately, the intent of the endoscopist is impossible to discern from the available data. Similarly a combination of the codes representing a procedure that did not reach the cecum could represent either an incomplete colonoscopy or a colonoscopy in someone who has had a proximal colectomy. This latter group is likely over represented in this analysis due to follow-up colonic evaluation procedures performed to detect recurrent cancer.

To deal with these issues, endoscopy up to, but not beyond, the splenic flexure was considered a flexible sigmoidoscopy, while endoscopy to the hepatic flexure and beyond was considered a colonoscopy. To confirm the validity of these definitions, the proportion of completed colonoscopies was calculated. Using this definition of colonoscopy, the completion rate was 91%, in keeping with published figures. This is likely a conservative estimate, as it does not account for individuals who have had previous colonic resections.

Analyses

All analyses were produced using SAS software. The study involved more than 7 million records representing close to 4 million procedures.

To obtain a complete picture of the type and quantity of colorectal evaluation services provided in Ontario, the following rates were determined:

a) The number of colonic evaluation procedures performed for a specific period (usually one year) was calculated per 10,000 in the population. This included repeats when an individual had more than one procedure during the year.

b) The proportion of the population receiving colonic evaluation procedures was measured excluding repeats and counting only one procedure per person per time period.

c) Procedure rates and proportions for Ontario as a whole were calculated for the inclusive calendar years 1992 to 2001.

d) Age-standardized county-level rates and the rates by hospital type were calculated for 2001, the most recent year for which complete data were available.

Compared to the Ontario rate, county rates were grouped as follows:

- More than 25% above
- 10 to 25% above
- Less than 10% above or below
- 10 to 25% below
- More than 25% below.

The study also examined several factors that affect access to colonic evaluation procedures.

Geographic availability of physician services

This was addressed by examining the geographic distribution of physicians performing colonic evaluation procedures across the province. However, because a physician's county of residence is often different from that of the institution in which a procedure is performed, each physician was assigned a "practice county" based on the county of residence of the majority of his or her patients. It is this practice county, rather than the physician's county of residence, on which the geographic distribution of physicians is based.

Active physicians

Because there are many physicians who perform only a few colonic evaluation procedures per year, criteria for being active were set for each procedure. For colonoscopy, a physician was considered active if he or she performed at least 200 colonoscopies in 2001. For all other procedures, some of which are now being used infrequently, the threshold was set at 50 per year, or approximately 1 per week. The relationship between the supply of active physicians and the procedure rate was then examined using linear regression.

Hospital resources

This was examined two ways:

a) Procedure rates were calculated by institution county rather than the patient's county of residence.

b) The 115 hospitals in Ontario where colonoscopies are performed were divided into 4 categories according to size, defined by the hospital's total weighted case volume (see Glossary for explanation).The ratio between the number of colonoscopies performed and the total weighted case volume for each category of hospitals was compared.

Interpretive Cautions

The FOBT rates in this report must be viewed with some caution for the following reasons:

a) OHIP data only include tests conducted in non-hospital labs and do not reflect FOBTs performed in hospitals or hospital outpatient labs.

b) Many FOBTs performed by physicians during office visits using single samples obtained by digital rectal examination are excluded because the procedure is not always billed.

Although the FOBT data are incomplete, rates are included in this study because the test has the strongest scientific evidence for efficacy and, with its endorsement by the CTFPHC, it will likely form the core of any population-based screening program. While the number of FOBTs may be under-reported for a particular year, there is no reason to believe that there has been a change in the degree of under-reporting, so the pattern of FOBT utilization over time should reflect the actual trend.

Several other factors must also be considered. First, it is not possible to ascertain whether a procedure was performed for screening or diagnostic workup. Second, the analysis did not exclude persons with prior CRC or colonic resection. Finally, services provided outside the OHIP fee-for-service system are not adequately captured in the available data. This affects three Ontario counties, which have been consequently excluded from local-level analyses:

- Physicians in Frontenac County, which includes the city of Kingston, operate outside the FFS system and do not shadow-bill, thus no data are available from this area. As well, rates for the surrounding counties may be somewhat underestimated if residents received service in Frontenac County.

- Physicians in Kenora and Rainy River Districts began providing endoscopy in 1999 under an alternative funding arrangement, which affected data for the end of the study period.

3. Health Care Services Funding

While most health care services in Ontario are publicly funded, the means by which these funds are made available can vary according to the procedure, the health care setting, or the geographic location. For example, hospitals are generally funded on a global budget model in which there is only one funding envelope for most costs. Therefore, when the need arises to expand a given service, for example, colonoscopy, the required funding must come from contraction of an existing hospital program.

Although several alternate funding models have been developed over the past decade that would see hospitals compensated per unit of activity,[15] these new models have had only limited implementation, mostly to make minor adjustments to funding levels. Activity volume and cost per unit volume, calculated using Resource Intensity Weights (RIW), are the primary measures of hospital performance. There is a disincentive to perform procedures with no assigned RIW because this incurs costs without an offsetting activity, making the institution appear less efficient.

The MOHLTC has encouraged private sector involvement in some types of diagnostic testing by allowing OHIP to reimburse a technical fee, in addition to the physician's professional fee, to cover the cost of infrastructure when the procedure is performed outside a hospital. As a result, a significant proportion of diagnostic tests such as radiology investigations, vascular testing, pulmonary function testing, cardiac imaging and laboratory testing are provided by the private sector. For endoscopy, the technical fee is inadequate to cover the cost of the infrastructure needed to provide this procedure in non-hospital (ambulatory) settings. (See Discussion for details.)

4. Findings

Colonic Evaluation Procedure Frequencies and Rates

Exhibit 1. Overall and sex-specific number of colonic evaluation procedures by year and procedure type in Ontario, 1992-2001

Year	Sex	Ontario Population 50-74 years of age	Total Number of Procedures by Type – All Ages Included						Total (excluding FOBT)
			Colonoscopy	Flexible Sigmoidoscopy	Rigid Sigmoidoscopy	Double Contrast Barium Enema	Single Contrast Barium Enema	Fecal Occult Blood Test (FOBT)	
1992	Men	1,055,220	31,341	22,032	39,005	33,491	14,941	86,893	140,810
	Women	1,138,450	31,698	27,253	37,788	48,507	21,779	109,563	167,025
	Total	2,193,670	63,039	49,285	76,793	81,998	36,720	196,456	307,835
1993	Men	1,078,430	33,986	22,059	35,190	33,906	12,198	80,854	137,339
	Women	1,163,600	33,990	26,597	33,389	48,617	17,855	98,828	160,448
	Total	2,242,030	67,976	48,656	68,579	82,523	30,053	179,682	297,787
1994	Men	1,102,460	36,895	22,129	32,716	34,928	10,041	76,021	136,709
	Women	1,188,440	37,355	26,557	31,390	49,357	14,667	91,485	159,326
	Total	2,290,900	74,250	48,686	64,106	84,285	24,708	167,506	296,035
1995	Men	1,121,970	39,139	21,866	30,303	35,149	7,884	69,912	134,341
	Women	1,208,690	40,464	26,275	29,054	49,760	11,711	83,745	157,264
	Total	2,330,660	79,603	48,141	59,357	84,909	19,595	153,657	291,605
1996	Men	1,143,610	42,280	21,159	28,638	35,151	6,240	69,279	133,468
	Women	1,231,077	44,657	25,541	27,468	50,308	9,544	80,482	157,518
	Total	2,374,687	86,937	46,700	56,106	85,459	15,784	149,761	290,986
1997	Men	1,180,365	46,969	20,973	27,593	36,669	5,356	75,048	137,560
	Women	1,265,957	50,295	25,180	26,430	52,129	7,928	85,512	161,962
	Total	2,446,322	97,264	46,153	54,023	88,798	13,284	160,560	299,522
1998	Men	1,215,359	52,616	21,014	27,029	39,575	4,650	80,339	144,884
	Women	1,298,603	56,673	25,520	25,146	55,728	6,804	91,364	169,871
	Total	2,513,962	109,289	46,534	52,175	95,303	11,454	171,703	314,755
1999	Men	1,246,190	60,968	20,911	25,378	39,528	4,007	91,701	150,792
	Women	1,328,238	65,683	25,738	23,933	56,509	5,946	103,732	177,809
	Total	2,574,428	126,651	46,649	49,311	96,037	9,953	195,433	328,601
2000	Men	1,277,051	70,895	20,559	24,957	39,294	3,410	103,595	159,115
	Women	1,359,130	76,716	25,494	23,339	56,253	4,879	119,377	186,681
	Total	2,636,181	147,611	46,053	48,296	95,547	8,289	222,972	345,796
2001	Men	1,309,559	82,311	19,450	24,533	37,224	2,576	125,222	166,094
	Women	1,391,866	89,893	24,064	21,970	53,177	4,045	144,574	193,149
	Total	2,701,425	172,204	43,514	46,503	90,401	6,621	269,796	359,243
Total 1992-2001	Men		497,400	212,152	295,342	364,915	71,303	858,864	1,441,112
	Women		527,424	258,219	279,907	520,345	105,158	1,008,662	1,691,053
	Total		1,024,824	470,371	575,249	885,260	176,461	1,867,526	3,132,165

Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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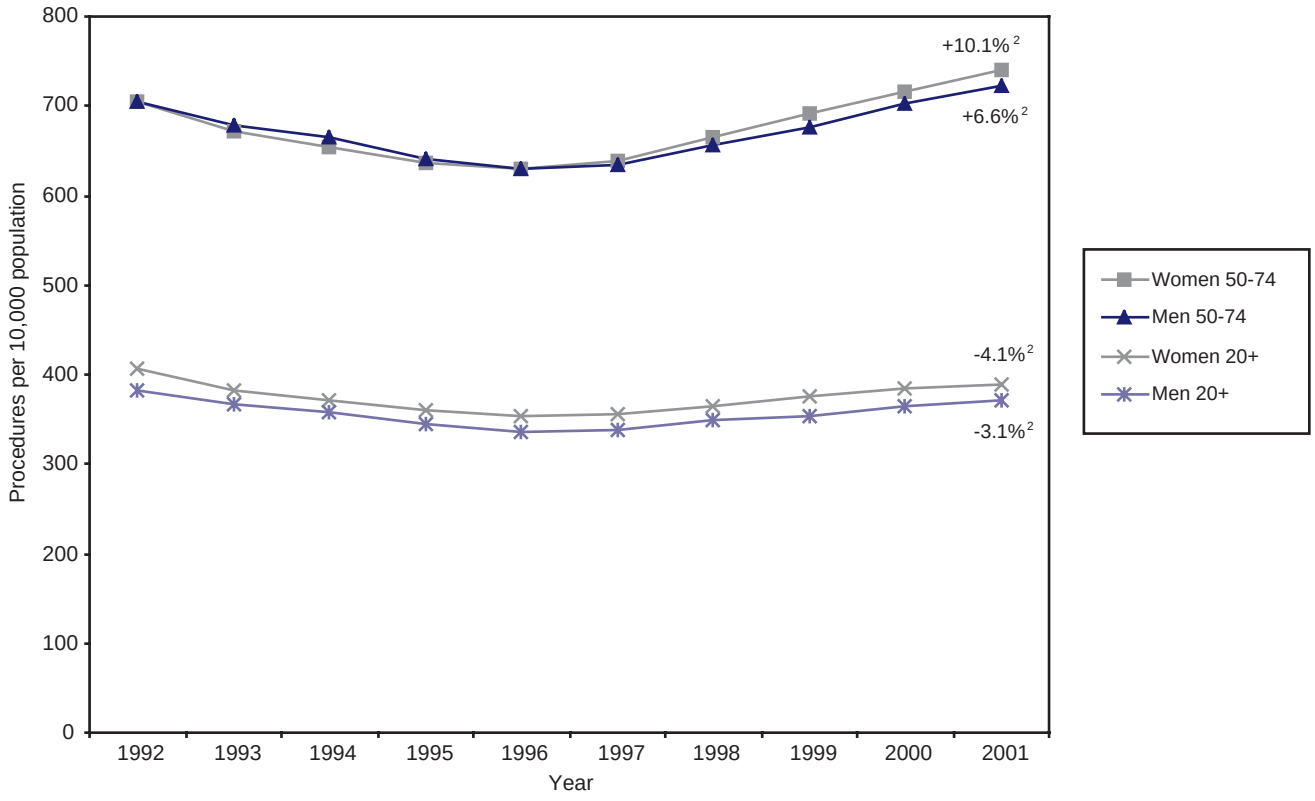
In 1992, there were 307,835 colonic evaluation procedures performed in Ontario, not including FOBTs. By 2001, this number had risen to 359,243, an increase of just under 17%. Nearly all of this increase was for colonoscopy, with the number of colonoscopies nearly tripling from 63,039 in 1992 to 172,204 in 2001.

Some of this increase reflects the aging of the Ontario population as baby boomers moved into their 50s. There is also an evident trend toward more complete evaluation of the colon. In 1992, procedures to visualize the entire colon (barium enema and colonoscopy), comprised only 59% of the total, compared to 75% by 2001.

Exhibit 2. Age- and sex-adjusted utilization rates[1] per 10,000 Ontarians for all colonic evaluation procedures combined (excluding FOBT) by age group and sex, 1992-2001



[1]Rates standardized to the 1991 Canadian Population
[2]Percent change in rate in 2001 compared with 1992
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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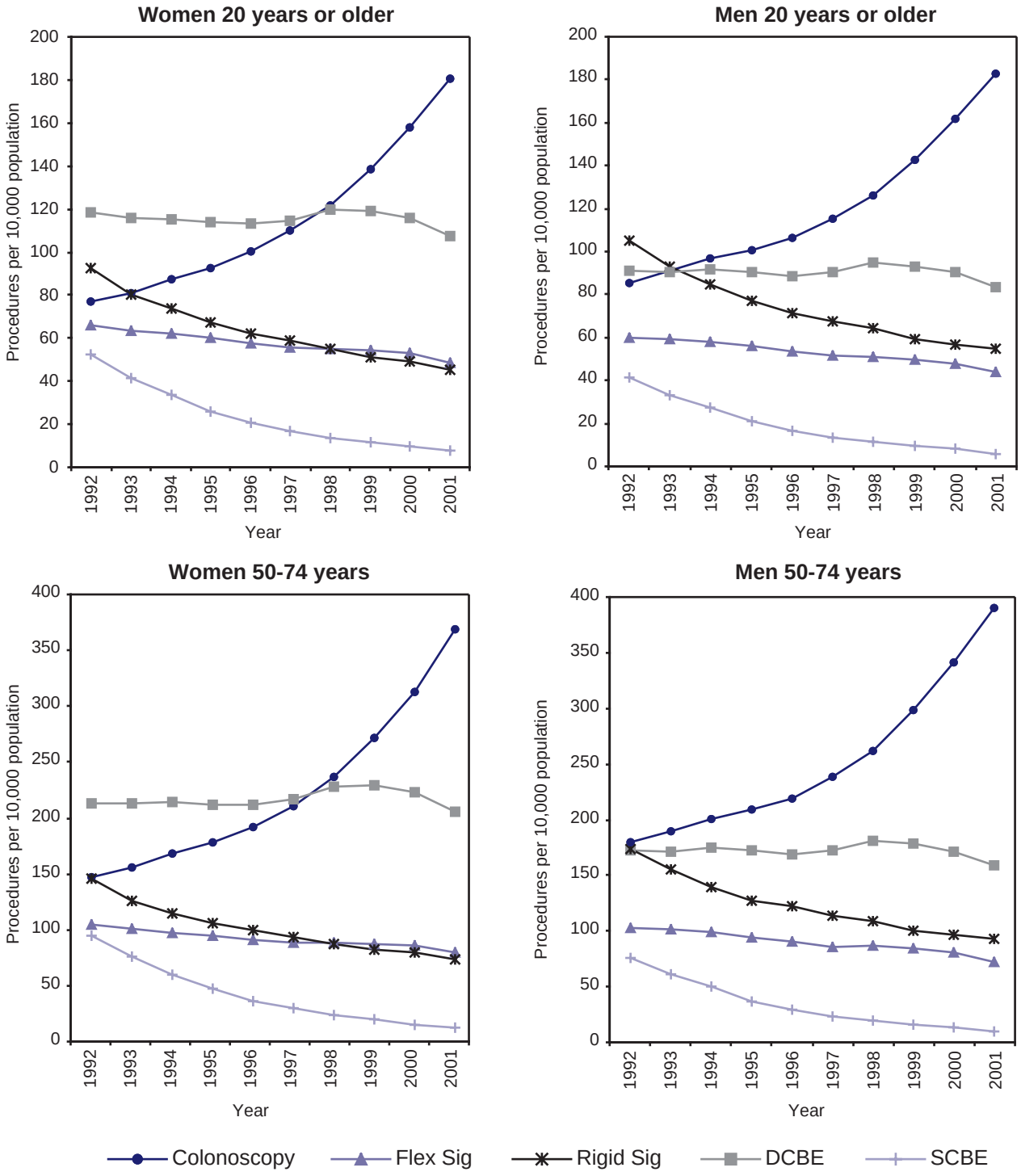
This analysis reflects changes in the overall rate after adjusting for the age-sex structure of the population. For the entire population age 20 years and over, the rate for colonic evaluation procedures declined slightly. When only the screen-eligible ages of 50-74 years were included, the rates declined slightly from 1992 to 1996, after which they increased. Compared to 1992 data, the 2001 rate of colonic evaluation procedures had risen 10.1% for women and 6.6% for men in the screen-eligible age group.

Exhibit 3a. Age- and sex-adjusted colonic evaluation procedure utilization rates[1] per 10,000 Ontarians, by procedure type, age group and sex, 1992-2001



[1]Rates standardized to the 1991 Canadian Population
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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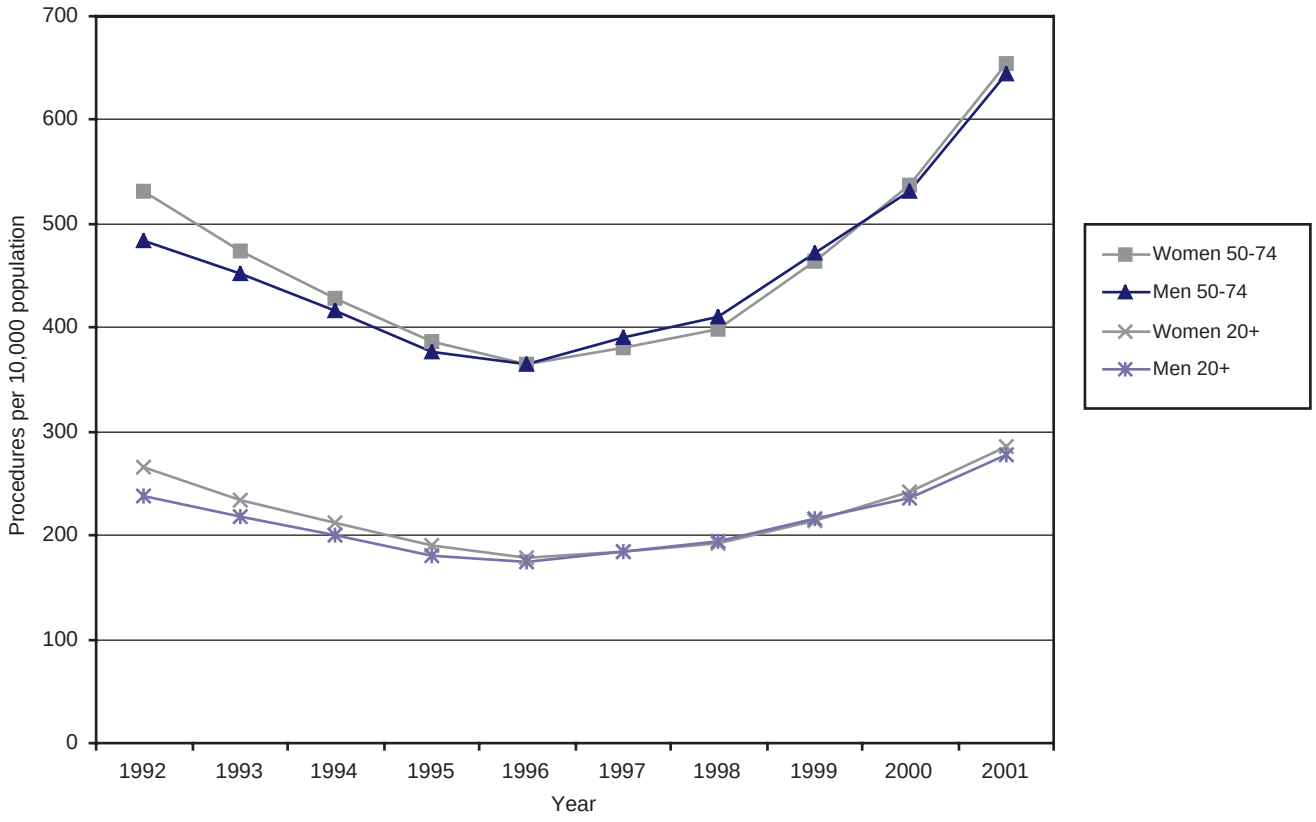
This exhibit shows the trends over time for each type of procedure (excluding FOBT), by sex and age group. In 1992, DCBE was used most frequently for women, while rigid sigmoidoscopy was used most frequently for men, at a rate slightly higher than colonoscopy or DCBE. Over the decade, the colonoscopy rate rose almost exponentially in all groups becoming the most frequently used procedure. Rates for both rigid sigmoidoscopy and SCBE fell sharply (82% in the case of SCBE) and there was a shallow decline in the use of flexible sigmoidoscopy and DCBE.

Exhibit 3b. Age- and sex-adjusted fecal occult blood test (FOBT) utilization rates[1] per 10,000 Ontarians, by age group and sex, 1992-2001



[1]Rates standardized to the 1991 Canadian Population
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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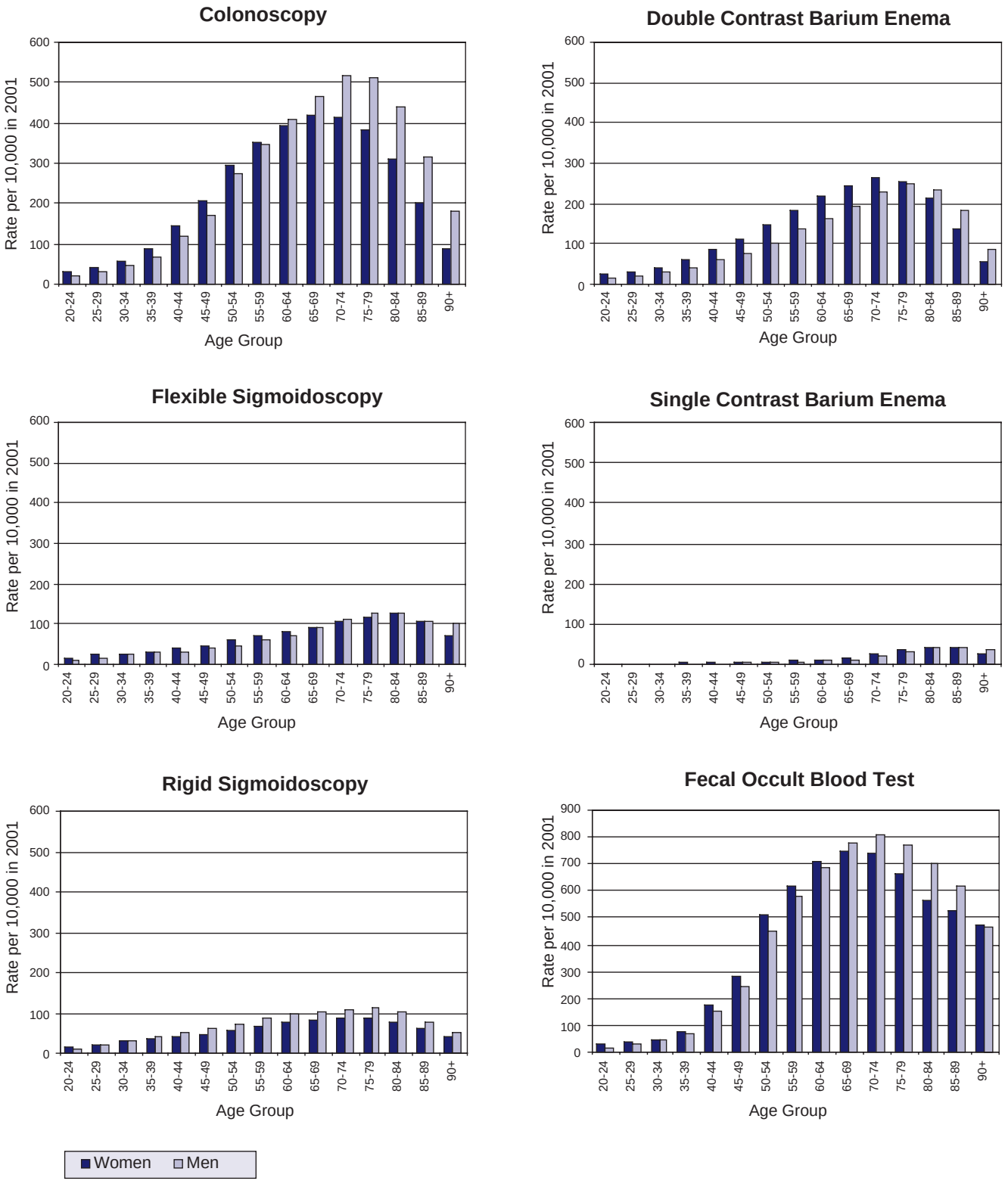
The curve for FOBT is U-shaped with a steep drop in the early to mid-1990s, and then an equally steep rise beginning in 1996.

Exhibits 4a. Age/sex-specific colonic evaluation procedure utilization rates per 10,000 Ontarians, by procedure type, 2001



Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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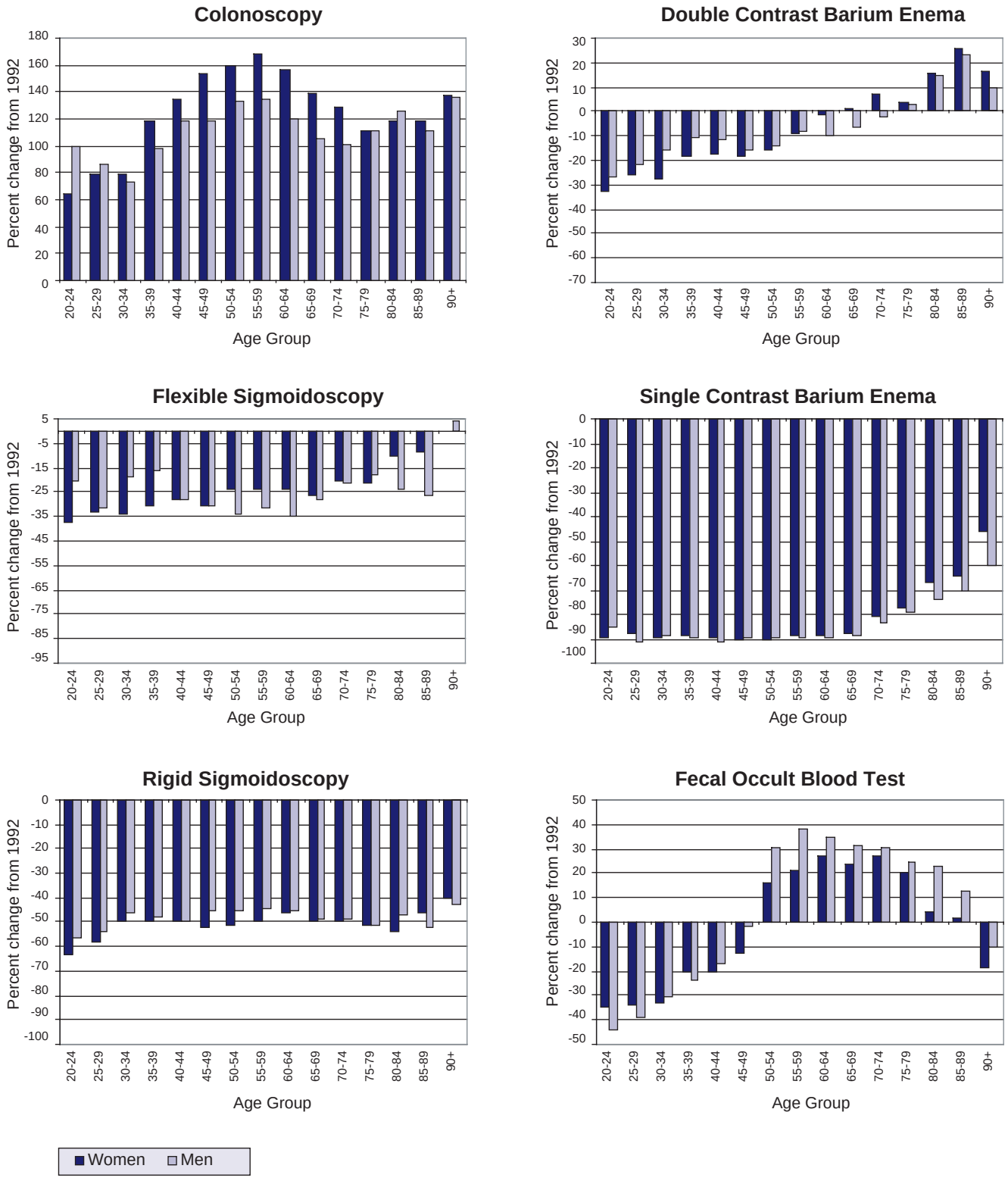
Looking at age/sex-specific procedure rates by 5-year age groups, the rates increase with age until about age 74, after which they decline.

Exhibit 4b. Percent change in age/sex-specific procedure utilization rates per 10,000 Ontarians in 2001 compared with 1992, by procedure type



Data source: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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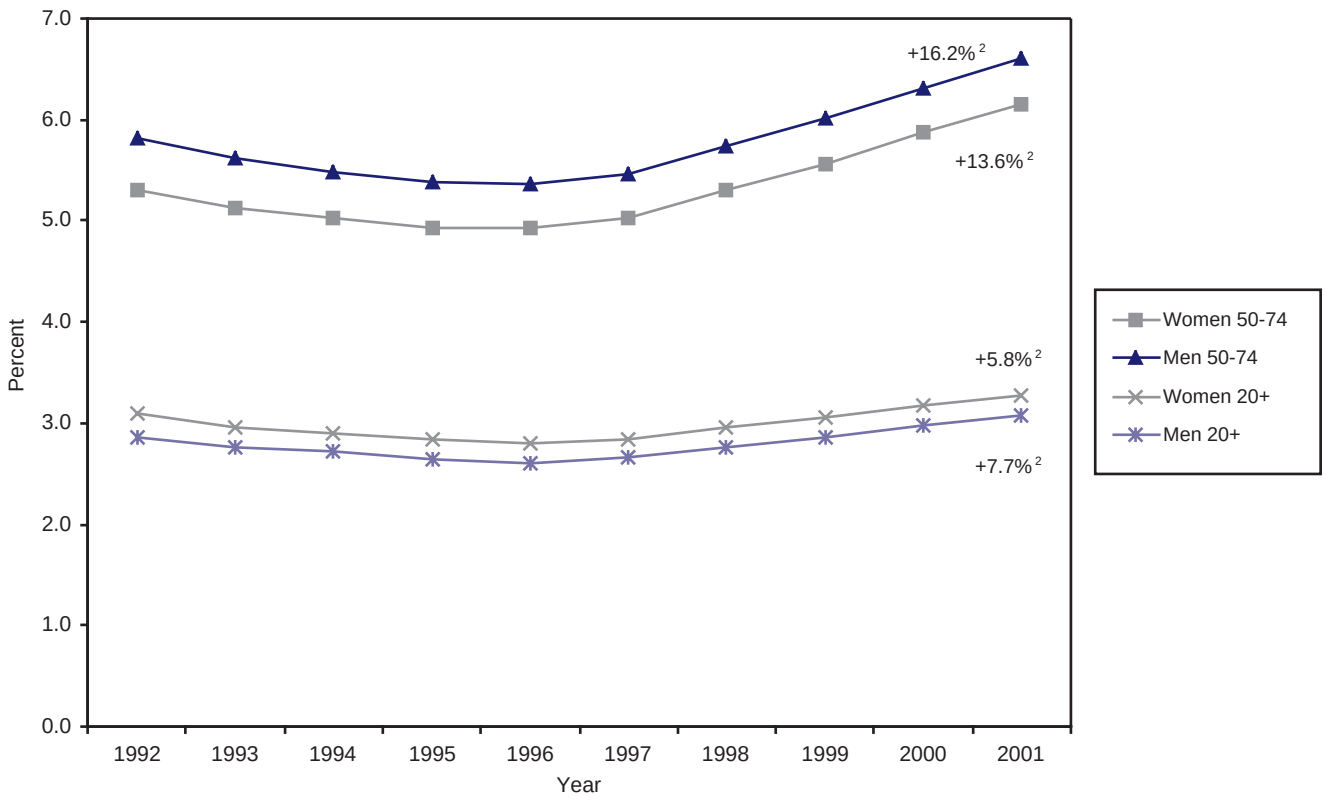
Comparing the percent change in 2001 versus 1992, for every age group, the increase in colonoscopy rates is striking, at times in excess of 100%, with a somewhat larger increase for women than men in the middle years. For sigmoidoscopy (both types) and SCBE, the rates are lower in 2001 compared with 1992 in nearly every age group.

Proportion of the Population Receiving Colonic Evaluation Procedures

Exhibit 5. Age- and sex-adjusted proportion[1] of the Ontario population having any colonic evaluation procedure (excluding FOBT), by age group and sex, 1992-2001



[1]Proportion standardized to the 1991 Canadian Population
[2]Percent change in proportion in 2001 compared with 1992
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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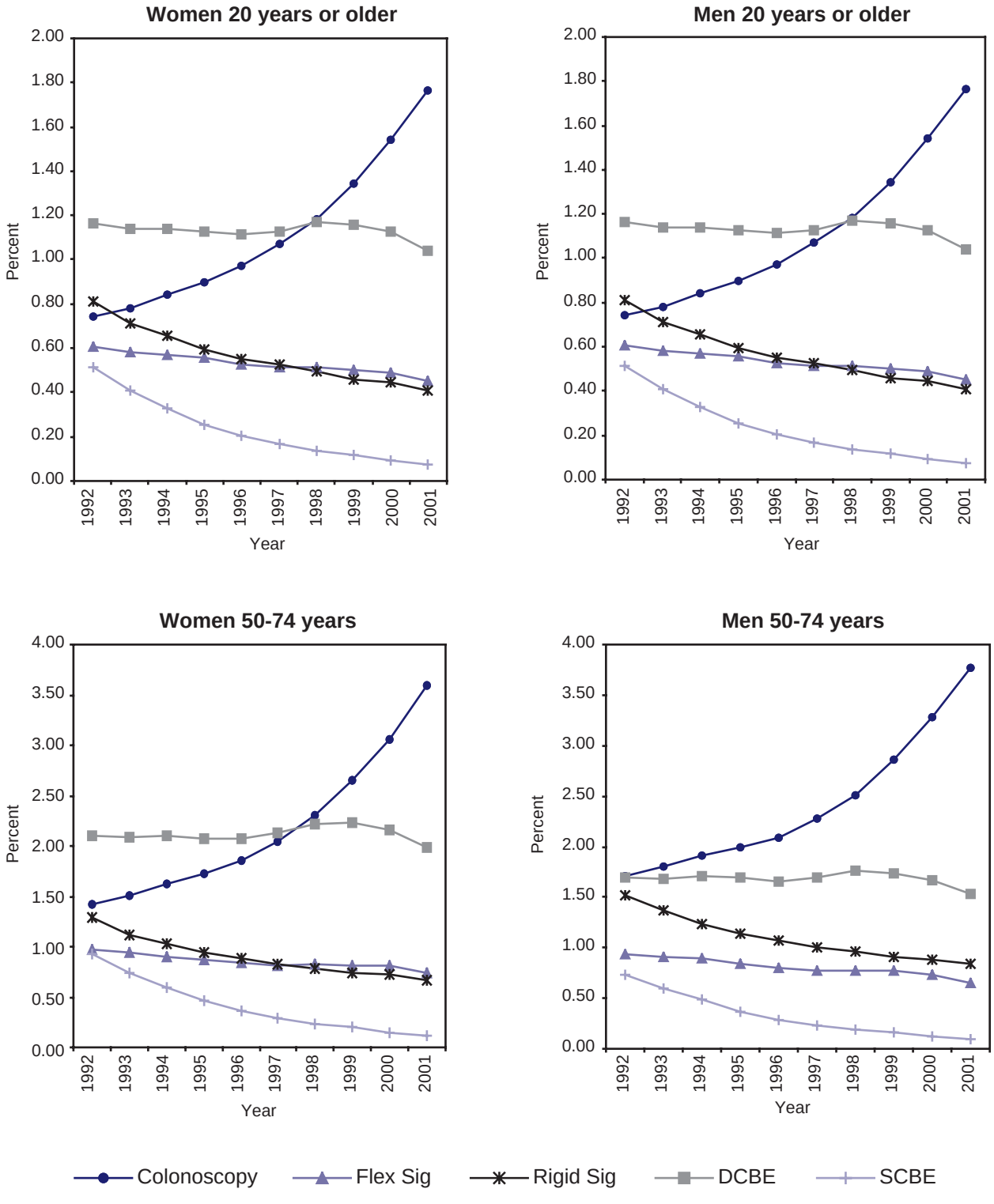
Between 1992 and 2001, the proportion of the population between the ages of 50 and 74 years having any colonic evaluation procedure rose approximately 16.2% for men and 13.6% for women. It is interesting to note that for all age-sex groups the increases in Exhibit 5 are greater than those in Exhibit 2, indicating a decline in the number of procedures per person.

Exhibit 6a. Age- and sex-adjusted proportion[1] of Ontarians having each type of colonic evaluation procedure (excluding FOBT), by age group and sex, 1992 to 2001



[1]Proportions standardized to the 1991 Canadian population
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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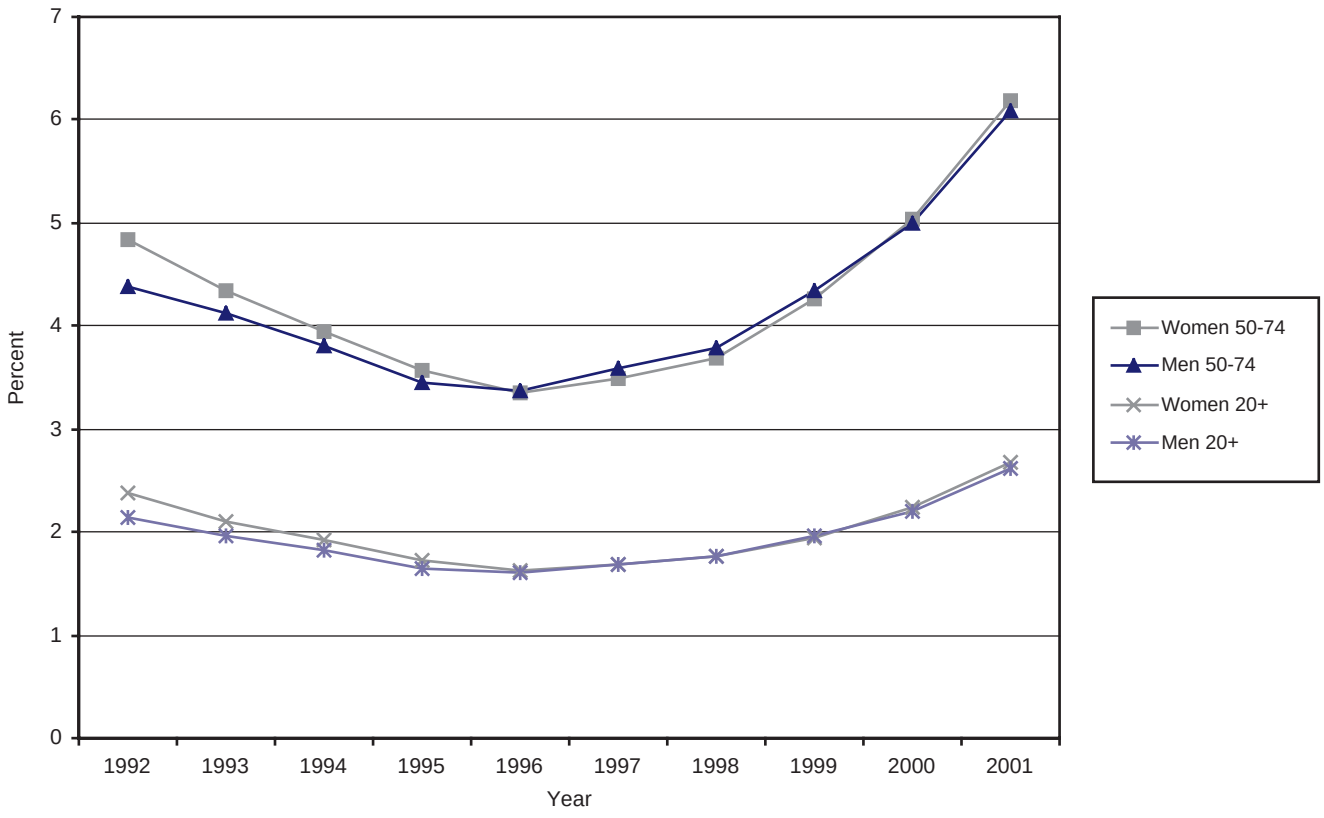
This exhibit shows that the proportion of the population having a colonoscopy began to rise dramatically in the mid-1990s so that by 2001 between 3.5% and 4.0% of the screen-eligible age group had the procedure.

Exhibit 6b. Age- and sex-adjusted proportion[1] of Ontarians having a fecal occult blood test (FOBT), by age group and sex, 1992-2001



[1]Proportions standardized to the 1991 Canadian population
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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There is general agreement that FOBT should be carried out annually or biennially.[11-13] This analysis indicates that use of FOBT in Ontario is very low. Even if FOBT rates were underestimated by 50%, the actual proportion of the screen-eligible age group receiving the test would still have only reached about 12% in 2001.

Geographic Variation in Utilization of Colonic Evaluation Procedures

Exhibit 7. Age- and sex-adjusted colonic evaluation procedure utilization rates[1] (excluding FOBT) per 10,000 Ontarians 50 to 74 years of age, by province, region and county, 2001

LEGEND

- More than 25% above Ontario rate
- 10-25% above Ontario rate
- Less than 10% above or below Ontario rate
- 10-25% below Ontario rate
- More than 25% below Ontario rate

Region and County	Type of Procedure					
	All Procedures Combined (excl. FOBT)	Colonoscopy	Flexible Sigmoidoscopy	Rigid Sigmoidoscopy	DCBE	SCBE
Ontario	744.92	385.72	77.68	84.99	186.01	10.87
East	665.3*	286.8*	89.8*	60.1*	221.6*	6.9*
Ottawa	698.4*	254.8*	105.0*	88.9	242.2*	7.6*
Prescott-Russell	604.8*	340.6*	58.4*	26.6*	172.5	6.6
Stormont-Dundas-Glengarry	746.2	410.0*	99.0*	37.4*	184.5	15.4
Renfrew	612.3*	233.4*	87.7	28.7*	260.2*	2.4*
Frontenac	Not Included					
Lennox-Addington	459.6*	208.4*	45.9*	27.4*	174.0	***
Hastings	682.3*	367.3	102.7*	17*	191.0	4.3*
Prince Edward	611.6*	348.4	52.1*	14.4*	192.4	***
Leeds-Grenville	546.8*	277.8*	37.6*	37.8*	189.9	3.6*
Lanark	662.4*	291.4*	64.4	60.3*	240.1*	6.3
Central East	755.0	439.2*	74.0	79.8*	155.1*	6.9*
Durham	844.0*	501.9*	69.7*	105.1*	151.1*	16.2*
Haliburton	653.8*	430.1	69.8	39.9*	111.0*	***
Northumberland	638.7*	395.1	68.6	42.5*	127.7*	4.7*
Kawartha Lakes	714.9	396.9	95.3*	48.4*	168.7	5.6*
Peterborough	666.7*	323.6*	92.9*	92.0	155.1*	3.2*
Simcoe	725.0	455.4*	66.9*	41.6*	158.2*	2.8*
York	760.8*	428.0*	74.0	93.3*	160.5*	4.9*
Toronto						
Toronto	853.0*	426.9*	84.0*	159.6*	172.9*	9.6
Central West	725.0*	373.0*	80.6	75.9*	179.4*	16.1*
Dufferin	733.5	257.7*	156.3*	52.8*	259.7*	7.0
Wellington	688.0*	462.8*	68.8	25.0*	125.2*	6.2*
Waterloo	708.7*	380.3	71.9	44.8*	200.4*	11.3
Halton	823.1*	426.0*	90.6*	91.8	208.7*	6.0*
Peel	694.4*	331.3*	78.5	95.5*	163.4*	25.8*

This analysis shows the variation in colonic evaluation procedure rates among Ontario counties for 2001. When all procedures (excluding FOBT) are grouped together, the rates for 4 of the 7 regions and nearly half of the 49 counties fell within +/- 10% of the Ontario rate. Sixteen counties had rates below the provincial average, all but one of which were in the southern part of the province.

Looking at the rates for each procedure separately, some areas, such as Cochrane, Lambton and Huron, had relatively high rates of colonoscopy, with rates more than 45% higher than Ontario as a whole. The lowest rates for colonoscopy were in eastern Ontario.

The flexible sigmoidoscopy rate was highest in Dufferin, where it was nearly twice the Ontario rate.

Rigid sigmoidoscopy showed the greatest variation in rates, ranging from fewer than 15 procedures per 10,000 in Perth, to about 160 per 10,000 in Toronto. More than half of the counties had rigid sigmoidoscopy rates of less than 50 per 10,000.

LEGEND

- More than 25% above Ontario rate
- 10-25% above Ontario rate
- Less than 10% above or below Ontario rate
- 10-25% below Ontario rate
- More than 25% below Ontario rate

Region and County	Type of Procedure					
	All Procedures Combined (excl. FOBT)	Colonoscopy	Flexible Sigmoidoscopy	Rigid Sigmoidoscopy	DCBE	SCBE
Ontario	744.92	385.72	77.68	84.99	186.01	10.87
Central South	635.7*	322.9*	60.6*	71.5*	165.0*	15.6*
Brant	556.9*	342.8*	99.0*	14.3*	94.3*	6.5*
Haldimand-Norfolk	789.0*	303.1*	70.6	130.0*	280.1*	5.3*
Hamilton	596.9*	319.7*	57.6*	81.2*	133.7*	4.8*
Niagara	659.2*	326.1*	51.6*	61.8*	188.1	31.6*
South West	716.2*	366.4*	78.9	42.1*	219.5*	9.3*
Grey	696.4*	380.6	82.3	43.2*	176.2	14.1
Bruce	757.2	493.9*	65.9	35.0*	152.7*	9.6
Huron	880.8*	588.8*	82.5*	14.6*	175.1	19.7*
Perth	618.1*	412.0	94.4*	10.7*	100.5*	***
Elgin	966.3*	278.0*	102.2*	139.9*	433.1*	13.2
Middlesex	626.7*	259.8*	82.5*	60.7*	213.9*	9.8
Oxford	666.3*	262.6*	120.3*	17.9*	261.3*	4.3*
Essex	718.5*	334.9*	79.7	24.2*	272.6*	7.1*
Chatham-Kent	708.2	440.2*	55.4*	40.8*	169.9	1.9*
Lambton	811.4*	576.4*	40.6*	31.2*	147.6*	15.6*
North	791.2*	463.1*	62.7*	38.5*	212.0*	14.9*
Algoma	633.7*	391.0	25.4*	17.5*	193.8	6.0*
Cochrane	917.2*	641.6*	64.5	26.3*	178.5	6.3
Manitoulin	798.8	536.1*	67.1	21.8*	168.2	***
Greater Sudbury	952.1*	562.9*	72.9	35.5*	269.9*	10.9
Sudbury	841.6*	480.2*	64.4	30.3*	238.3*	28.5*
Muskoka	693.9*	447.8*	94.5*	20.4*	119.5*	11.7
Nipissing	830.7*	347.5*	55.1*	82.9	334.6*	10.7
Parry Sound	784.1	454.3*	91.0	40.6*	196.7	***
Timiskaming	734.8	389.0	37.2*	83.1	210.8	14.6
Thunder Bay	727.3	413.8*	70.5	41.6*	160.8*	40.6*
Kenora	Not Included					
Rainy River	Not Included					

*Indicates that the rate differs significantly from the Ontario rate, p<.05
***rate not reportable due to small cell size
[1]Rates standardized to the 1991 Canadian Population
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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Exhibit 8. Age- and sex-adjusted proportion of the Ontario population 50 to 74 years of age having a colonic evaluation procedure (excluding FOBT) at least once between 1992 and 2001, by province, region and county

LEGEND

- More than 25% above Ontario rate
- 10-25% above Ontario rate
- Less than 10% above or below Ontario rate
- 10-25% below Ontario rate
- More than 25% below Ontario rate

Region and County	Type of Procedure					
	Any Procedure	Colonoscopy	Flexible Sigmoidoscopy	Rigid Sigmoidoscopy	DCBE	SCBE
Ontario	32.2	15.7	6.9	6.9	16.7	3.4
East	31.8*	12.2*	8.5*	5.3*	19.7*	3.1*
Ottawa	32.7*	10.6*	9.5*	7.2*	20.5*	3.2*
Prescott-Russell	29.4*	11.8*	6.9	3.3*	19.1*	3.0*
Stormont-Dundas-Glengarry	32.3	15.8	8.6*	3.7*	18.6*	2.6*
Renfrew	29.6*	10.0*	7.7*	3.8*	21.6*	2.9*
Frontenac	not included					
Lennox-Addington	26.9*	9.4*	6.1*	3.6*	17.7*	2.6*
Hastings	31.9	15.9	8.8*	2.1*	16.6	5.7*
Prince Edward	30.4*	14.4*	6.8	2.1*	20.1*	2.2*
Leeds-Grenville	30.8*	13.9*	6.8	3.6*	19.5*	1.6*
Lanark	32.5	15.5	6.4*	5.8*	20.1*	1.8*
Central East	32.5*	17.8*	6.8*	6.7*	16.3*	3.3*
Durham	34.6*	21.0*	6.0*	8.8*	14.3*	6.1*
Haliburton	30.8	16.0	6.0*	7.1	15.8	3.7
Northumberland	32.6	18.3*	8.0*	4.3*	14.2*	4.7*
Kawartha Lakes	33.6*	15.7	10.0*	5.0*	21.0*	1.8*
Peterborough	29.7*	13.1*	6.6	6.6*	14.8*	6.7*
Simcoe	31.4*	17.5*	6.5*	3.5*	18.1*	1.2*
York	32.1	17.2*	6.8	7.8*	16.7	1.5*
Central West	31.6*	15.2*	7.0	6.9	17.1*	3.0*
Dufferin	30.2*	11.5*	12.4*	3.5*	20.4*	0.7*
Wellington	31.2*	19.2*	7.7*	4.2*	14.7*	2.4*
Waterloo	31.8	14.3*	6.5*	5.7*	20.1*	2.2*
Halton	34.1*	16.6*	7.4*	8.1*	20.0*	0.9*
Peel	30.3*	14.4*	6.5*	7.6*	14.4*	4.8*
Toronto						
Toronto	33.7*	16.3*	7.4*	10.7*	14.6*	3.5*
Central South	29.4*	15.5*	4.9*	5.9*	14.4*	2.5*
Brant	26.8*	15.3	8.0*	1.8*	13.1*	1.0*
Haldimand-Norfolk	31.9	11.6*	6.2*	10.7*	21.7*	1.0*
Hamilton	27.6*	15.6	4.5*	6.6*	12.6*	0.6*
Niagara	31.3*	16.3*	4.4*	5.2*	14.9*	5.2*

The most significant information here is the variation in the proportion receiving colonoscopy, which ranges from about 40% below the Ontario average in Lennox-Addington and Renfrew, to about 50% greater in Lambton.

Over the entire period from 1992 to 2001, just over 32% of Ontarians ages 50 to 74 years had at least one procedure, excluding FOBT. Overall, from 1992 to 2001, 15.7% of the screen-eligible age group had at least one colonoscopy, 6.9% had at least one flexible sigmoidoscopy and 6.9% had at least one rigid sigmoidoscopy. Approximately 30% of those who had a colonoscopy during the 10-year study period had more than one (data not shown).

LEGEND

- More than 25% above Ontario rate
- 10-25% above Ontario rate
- Less than 10% above or below Ontario rate
- 10-25% below Ontario rate
- More than 25% below Ontario rate

Region and County	Type of Procedure					
	Any Procedure	Colonoscopy	Flexible Sigmoidoscopy	Rigid Sigmoidoscopy	DCBE	SCBE
Ontario	32.2	15.7	6.9	6.9	16.7	3.4
South West	31.5*	14.9*	7.0	4.8*	17.2*	4.7*
Grey	29.6*	14.6*	6.9	5.6*	17.2	2.9*
Bruce	29.3*	16.1	6.2*	5.5*	13.6*	5.7*
Huron	34.3*	20.0*	8.4*	3.4*	11.7*	8.9*
Perth	31.2*	19.0*	9.0*	2.3*	11.3*	2.9*
Elgin	31.5	10.3*	5.5*	15.1*	19.1*	8.3*
Middlesex	29.4*	10.0*	7.1	6.7*	17.5*	5.2*
Oxford	30.8*	10.2*	10.2*	2.9*	21.6*	2.6*
Essex	33.1*	15.4*	7.6*	3.1*	20.0*	4.3*
Chatham-Kent	31.0*	18.7*	4.4*	3.3*	17.0	1.0*
Lambton	35.7*	24.2*	5.3*	2.2*	13.0*	6.3*
North	33.9*	18.2*	5.7*	4.4*	19.6*	3.6*
Algoma	29.7*	18.8*	2.6*	1.8*	16.5	2.4*
Cochrane	36.9*	22.8*	5.2*	3.9*	21.3*	1.1*
Manitoulin	31.5	18.7*	4.5*	3.9*	12.6*	9.2*
Greater Sudbury	38.5*	20.9*	7.2	5.2*	23.8*	4.8*
Sudbury	34.9*	19.0*	5.4*	4.3*	18.1*	7.6*
Muskoka	31.0*	18.4*	8.9*	1.9*	15.6*	1.7*
Nipissing	35.8*	13.8*	3.6*	7.9*	24.1*	4.8*
Parry Sound	35.2*	18.3*	8.1*	4.4*	20.0*	2.0*
Timiskaming	30.8*	14.4*	3.3*	8.7*	20.5*	0.9*
Thunder Bay	31.5*	15.2*	7.3*	4.0*	16.4	5.0*
Kenora	not included					
Rainy River	not included					

*Indicates that the rate differs significantly from the Ontario rate, p<.05
[1]Rates standardized to the 1991 Canadian Population
Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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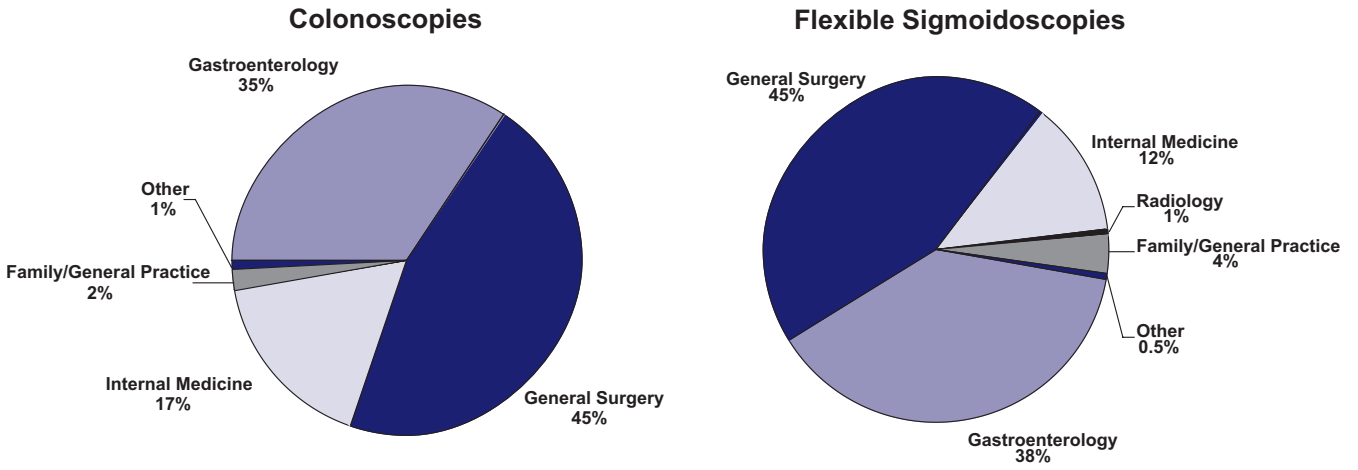
Physician Activity Levels for Colonic Evaluation Procedures

Exhibit 9. Percent distribution of colonoscopies and flexible sigmoidoscopies by physician specialty in Ontario, 2001



Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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In 2001, general surgeons, followed by gastroenterologists and internists, performed the greatest proportions of colonoscopies at 45%, 35% and 17%, respectively.

For flexible sigmoidoscopy, the situation is nearly identical, the main difference being a slightly higher proportion performed by gastroenterologists and somewhat lower by internists.

Rigid sigmoidoscopies were performed as follows (data not shown):
- General surgeons, 63%
- Family physicians, 19%
- Gastroenterologists, 9%
- Internists performed, 7%
- Physicians in other specialties 2%.

The results for barium enema have not been shown, as radiologists performed over 90% of procedures.

Exhibit 10. Activity levels of physicians performing colonic evaluation procedures in Ontario, 2001

Procedure	Total[1] number of procedures performed in 2001	Total number of physicians that performed at least one procedure in 2001	Physicians classified as active[2] in 2001		Percent of physicians performing 50% of procedures	Percent that performed fewer than 5 procedures in 2001
			Number	Percent		
Colonoscopy	172,200	633	349	55.1	22.6	7.3
Flexible Sigmoidoscopy	43,502	707	274	38.8	14.4	13.7
Rigid Sigmoidoscopy	46,503	1021	156	15.3	3.4	44.9
Double Contrast Barium Enema	90,401	633	449	70.9	18.6	7.7
Single Contrast Barium Enema	6,605	469	31	6.6	6.0	45.4

[1]Totals differ slightly from Exhibit 1 due to the exclusion of some procedures because of missing physician data.
[2]Active is defined as 200 or more procedures a year for colonoscopy and 50 or more a year for each of the other procedures.
Data sources: Ontario Health Insurance Plan

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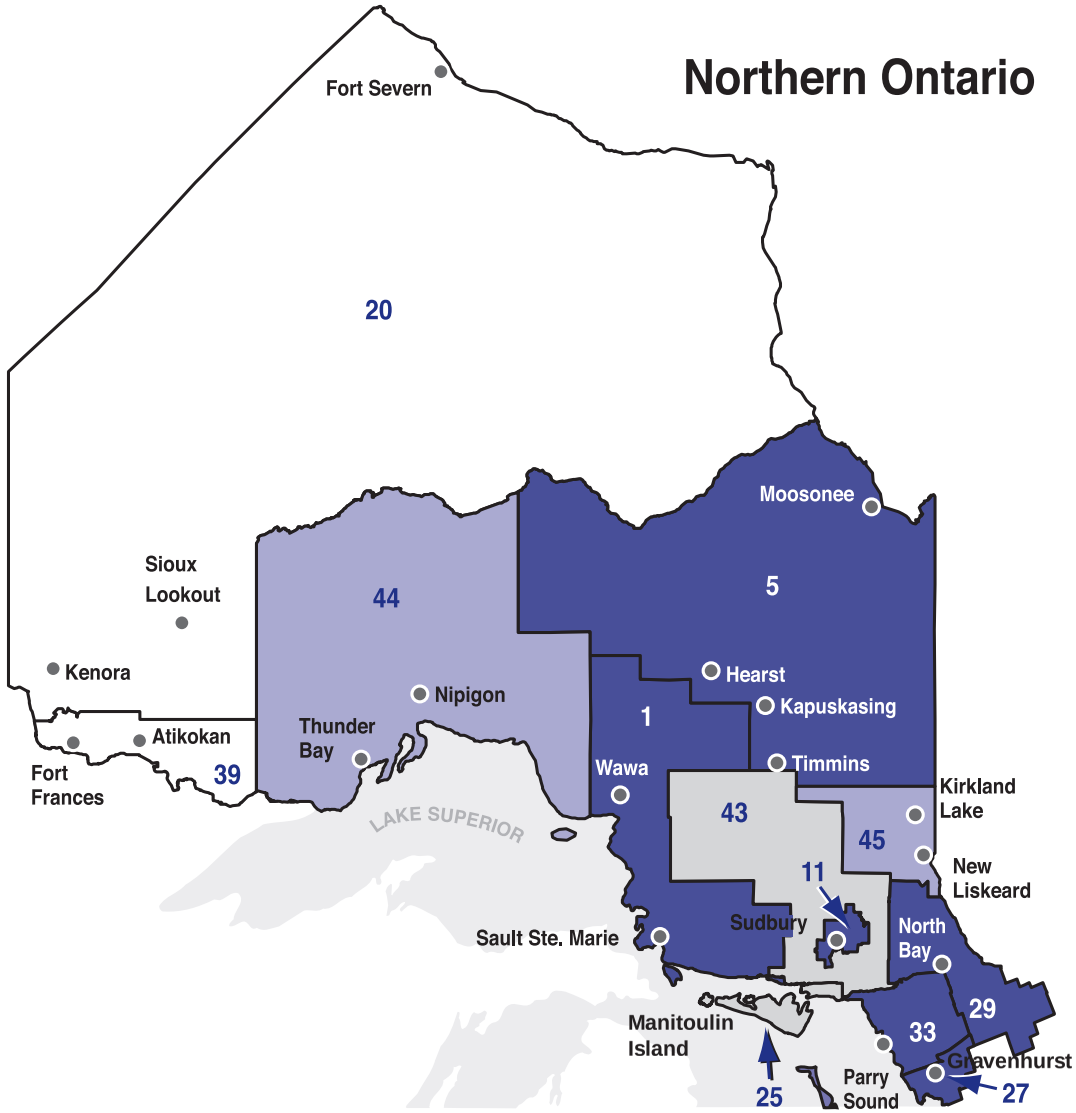
The number of procedures performed by the 633 physicians doing colonoscopy during the year ranged from a low of 1 to a high of 1,487 (data not shown). An active colonoscopist is defined as having performed at least 200 procedures in 2001; 349 (55.1%) would be considered active. In contrast, the proportion of physicians considered active for flexible sigmoidoscopy is 38.8%, and for rigid sigmoidoscopy, only 15.3%, despite a lower threshold of 50 procedures. The difference in activity levels is explained by noting that in 2001, 22.6% of colonoscopists performed 50% of colonoscopies, while 14.4% of physicians performed 50% of flexible sigmoidoscopies.

Exhibits 11 and 12 focus on the geographic distribution of active endoscopists performing colonoscopy (200 or more procedures per year) and flexible sigmoidoscopy (50 or more procedures per year). Across Ontario, the numbers of active endoscopists doing colonoscopy and flexible sigmoidoscopy per 100,000 population age 20 and over were approximately 4 and 3, respectively.

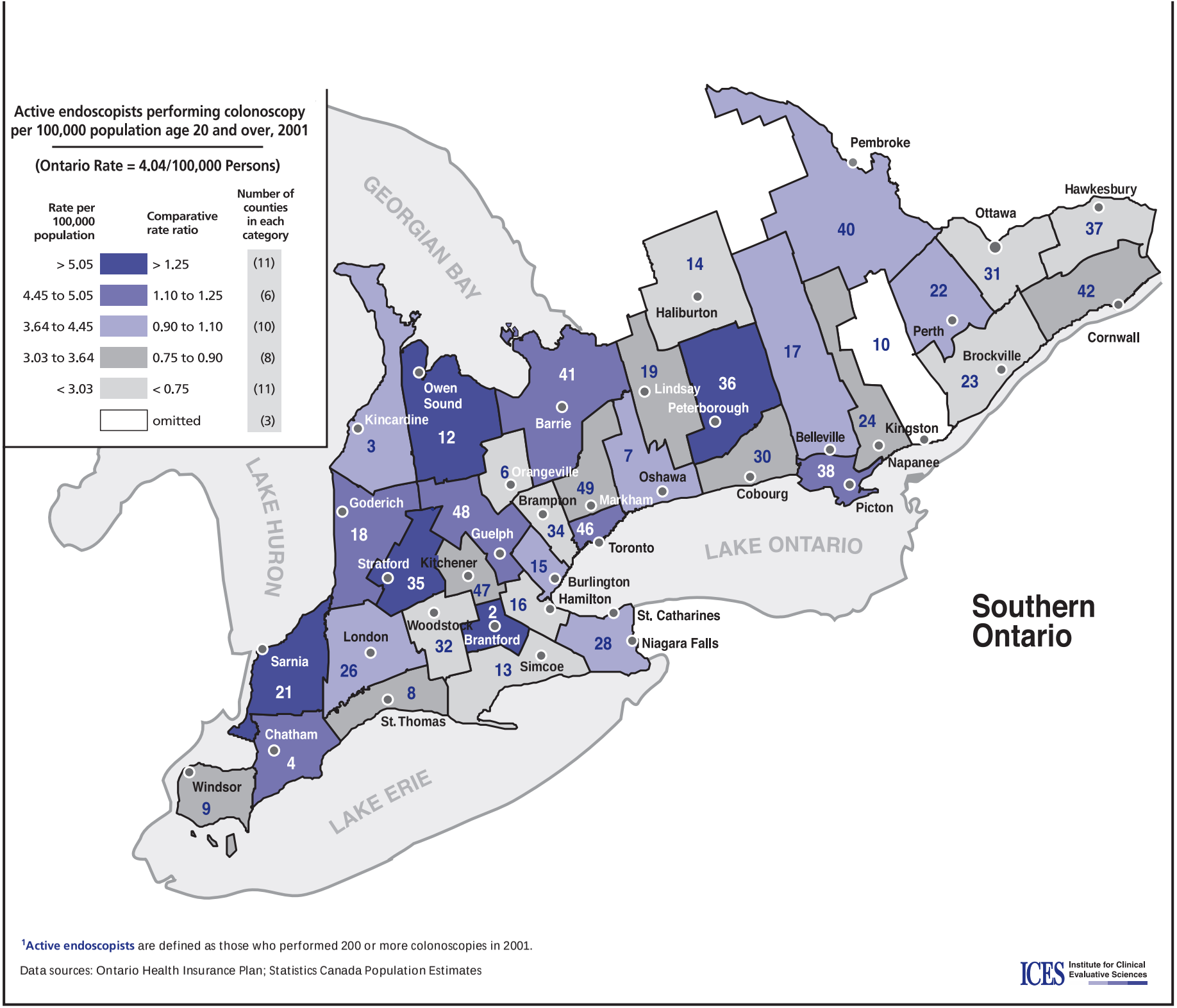
Among counties that had one or more active endoscopist doing colonoscopies, the endoscopist: population ratio ranged from a high of almost 10 per 100,000 in Muskoka, to a low of 1.3 in Leeds and Grenville. Dufferin had 11.2 active endoscopists doing flexible sigmoidoscopy per 100,000, the highest in the province. Nine counties had fewer than 2 active endoscopists doing flexible sigmoidoscopy per 100,000. Seven counties had no active endoscopists doing flexible sigmoidoscopy and 3 had no active endoscopists performing either endoscopic procedure.

Exhibit 11. Number of active[1] endoscopists performing colonoscopy per 100,000 population age 20 and over, by Ontario county, 2001



Ontario Counties

1	Algoma	26	Middlesex
2	Brant	27	Muskoka
3	Bruce	28	Niagara
4	Chatham-Kent	29	Nipissing
5	Cochrane	30	Northumberland
6	Dufferin	31	Ottawa
7	Durham	32	Oxford
8	Elgin	33	Parry Sound
9	Essex	34	Peel
10	Frontenac	35	Perth
11	Greater Sudbury	36	Peterborough
12	Grey	37	Prescott-Russell
13	Haldimand-Norfolk	38	Prince Edward
14	Haliburton	39	Rainy River
15	Halton	40	Renfrew
16	Hamilton	41	Simcoe
17	Hastings	42	Stormont-Dundas-Glengarry
18	Huron	43	Sudbury
19	Kawartha Lakes	44	Thunder Bay
20	Kenora	45	Timiskaming
21	Lambton	46	Toronto
22	Lanark	47	Waterloo
23	Leeds-Grenville	48	Wellington
24	Lennox-Addington	49	York
25	Manitoulin		



[1]**Active endoscopists** are defined as those who performed 200 or more colonoscopies in 2001.

Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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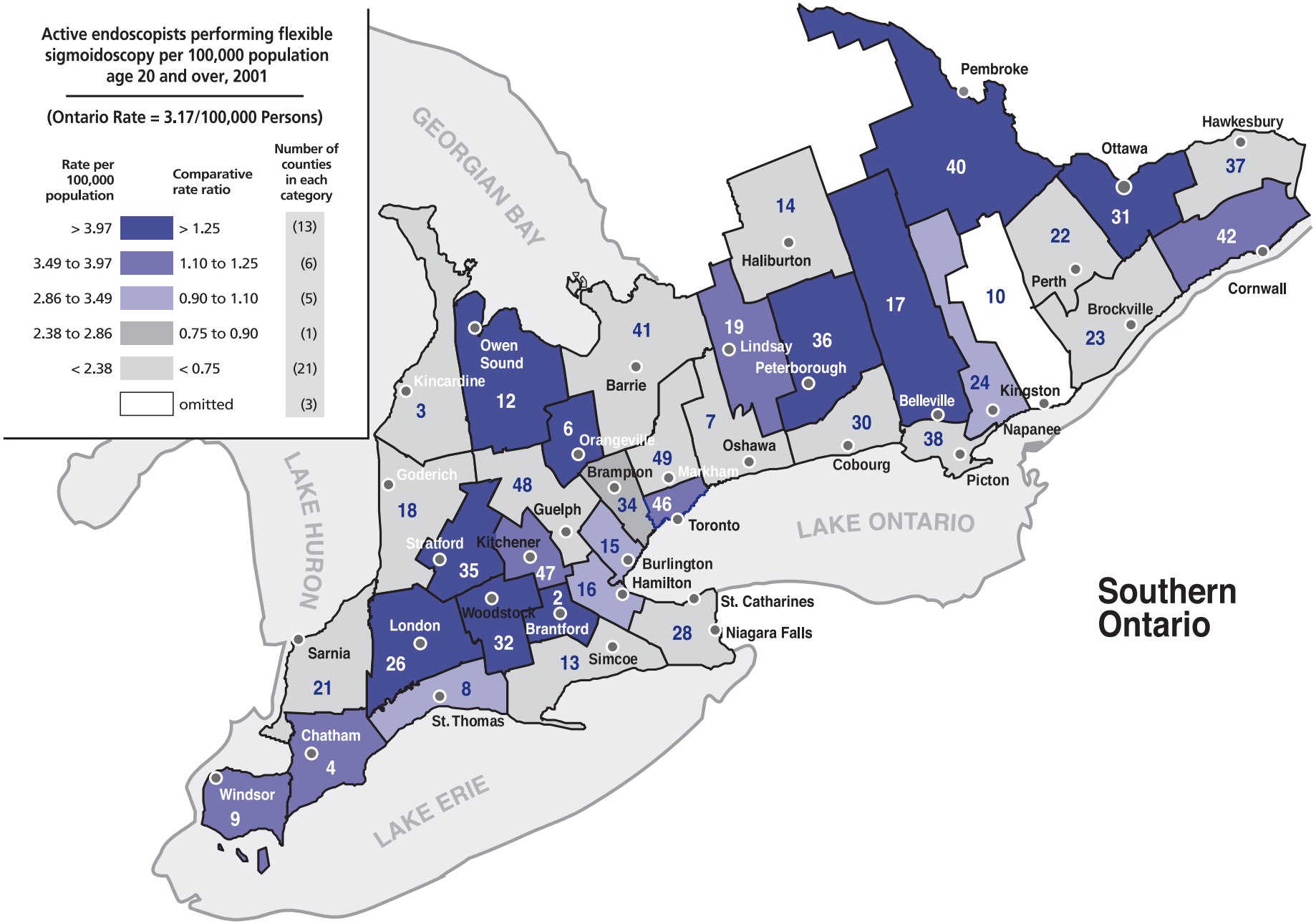
Exhibit 12. Number of active[1] endoscopists performing flexible sigmoidoscopy per 100,000 population age 20 and over, by Ontario county, 2001

Ontario Counties

1	Algoma	26	Middlesex
2	Brant	27	Muskoka
3	Bruce	28	Niagara
4	Chatham-Kent	29	Nipissing
5	Cochrane	30	Northumberland
6	Dufferin	31	Ottawa
7	Durham	32	Oxford
8	Elgin	33	Parry Sound
9	Essex	34	Peel
10	Frontenac	35	Perth
11	Greater Sudbury	36	Peterborough
12	Grey	37	Prescott-Russell
13	Haldimand-Norfolk	38	Prince Edward
14	Haliburton	39	Rainy River
15	Halton	40	Renfrew
16	Hamilton	41	Simcoe
17	Hastings	42	Stormont-Dundas-Glengarry
18	Huron	43	Sudbury
19	Kawartha Lakes	44	Thunder Bay
20	Kenora	45	Timiskaming
21	Lambton	46	Toronto
22	Lanark	47	Waterloo
23	Leeds-Grenville	48	Wellington
24	Lennox-Addington	49	York
25	Manitoulin		



[1]**Active endoscopists** are defined as those who performed 50 or more flexible sigmoidoscopies in 2001.

Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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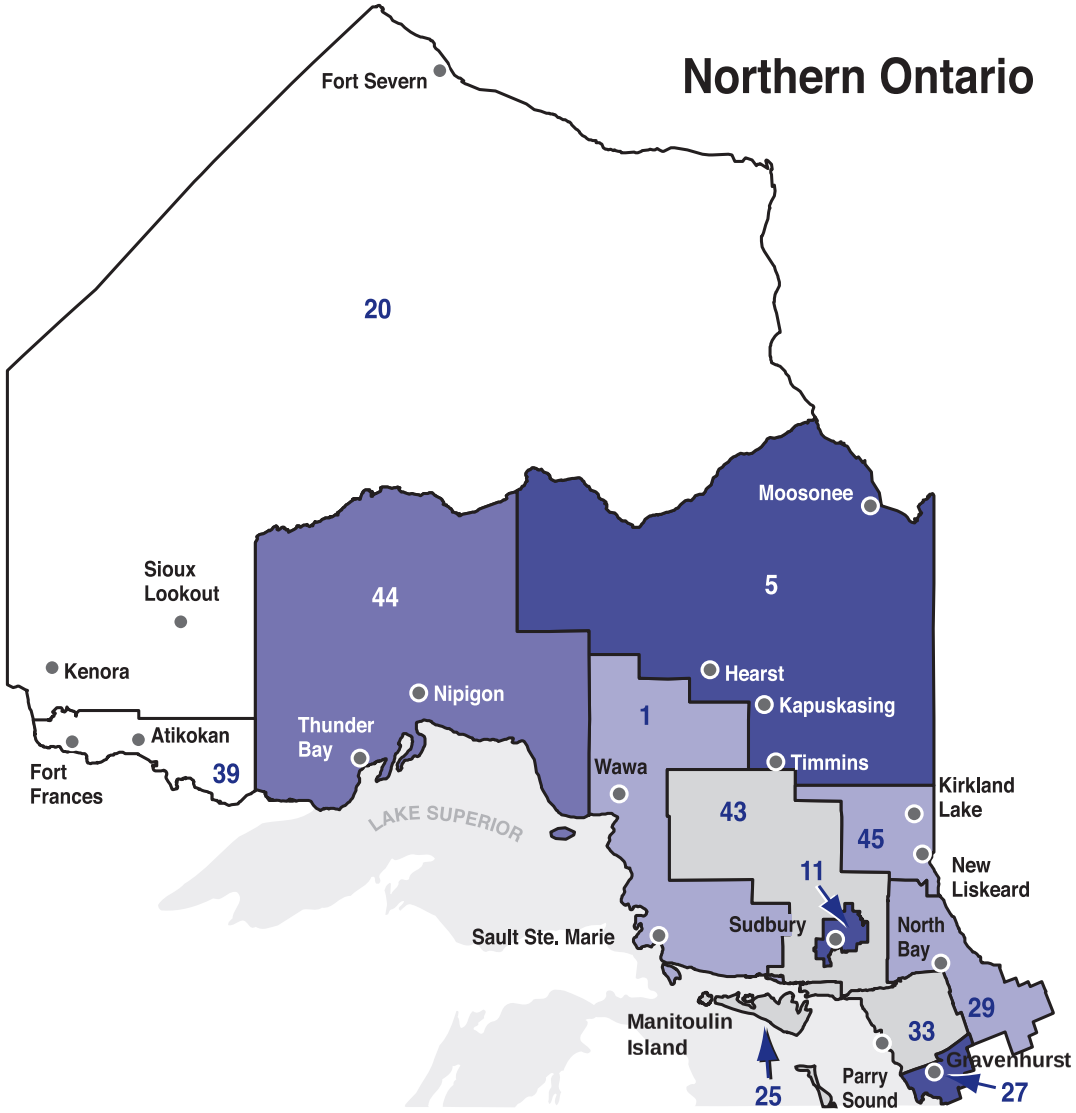
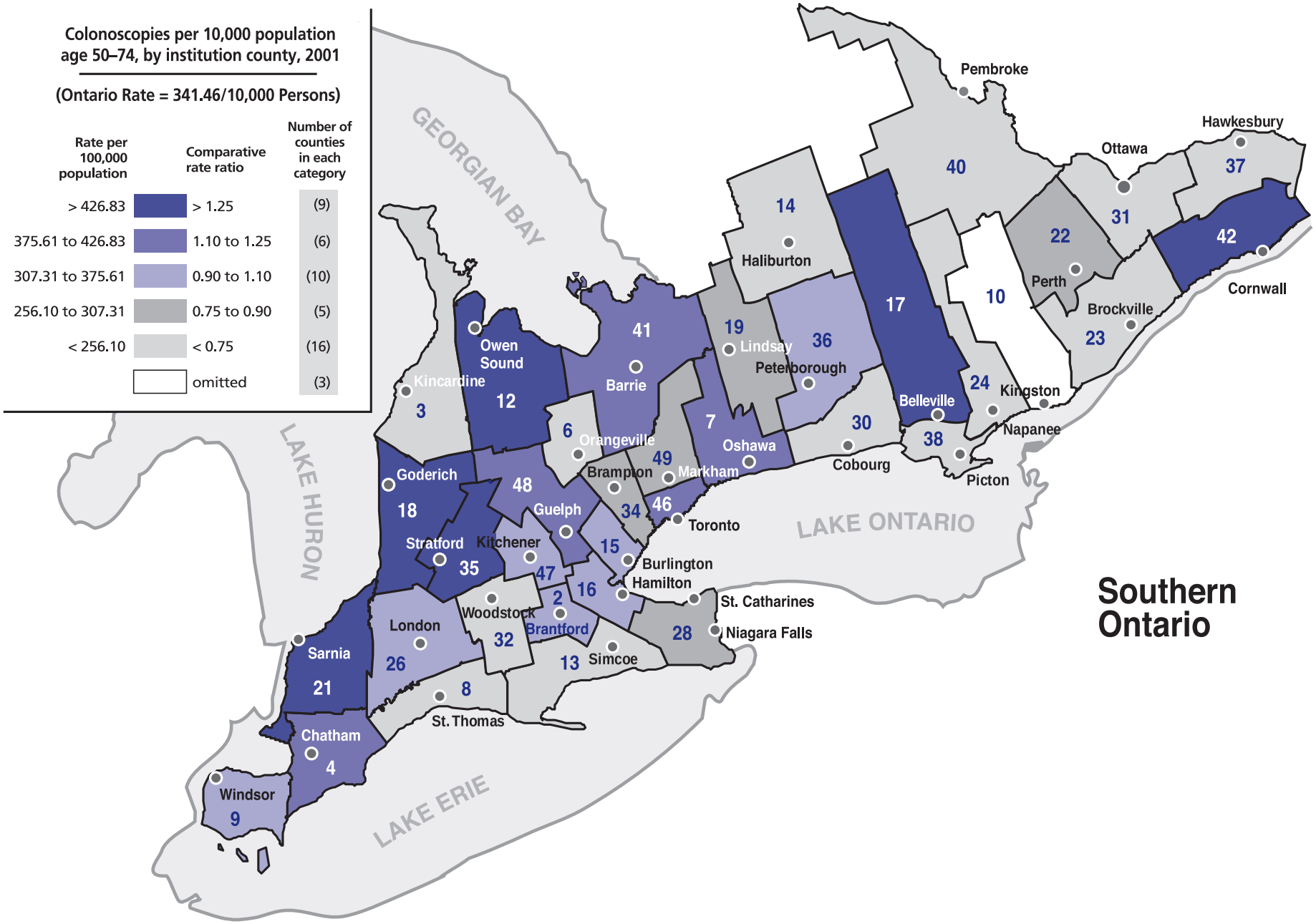
This analysis examined colonoscopy rates by the county of the institution in which they were performed. Greater Sudbury had the highest rate at nearly 700 colonoscopies per 10,000. Interestingly, some of the other areas with high rates are primarily rural counties such as Muskoka, Perth and Cochrane. An explanation for this variation may be the type of hospital in a given community (see Exhibit 15).

Exhibit 13. Colonoscopies per 10,000 population age 50–74 years, by institution county,[1] Ontario, 2001



Ontario Counties

1	Algoma	26	Middlesex
2	Brant	27	Muskoka
3	Bruce	28	Niagara
4	Chatham-Kent	29	Nipissing
5	Cochrane	30	Northumberland
6	Dufferin	31	Ottawa
7	Durham	32	Oxford
8	Elgin	33	Parry Sound
9	Essex	34	Peel
10	Frontenac	35	Perth
11	Greater Sudbury	36	Peterborough
12	Grey	37	Prescott-Russell
13	Haldimand-Norfolk	38	Prince Edward
14	Haliburton	39	Rainy River
15	Halton	40	Renfrew
16	Hamilton	41	Simcoe
17	Hastings	42	Stormont-Dundas-Glengarry
18	Huron	43	Sudbury
19	Kawartha Lakes	44	Thunder Bay
20	Kenora	45	Timiskaming
21	Lambton	46	Toronto
22	Lanark	47	Waterloo
23	Leeds-Grenville	48	Wellington
24	Lennox-Addington	49	York
25	Manitoulin		



[1]The rates in this exhibit differ from those in Exhibit 8 and 9 in that they are based on the county of the institution in which the procedure was performed rather than the county of residence of the individual having the procedure.

Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates; Canadian Institute for Health Information

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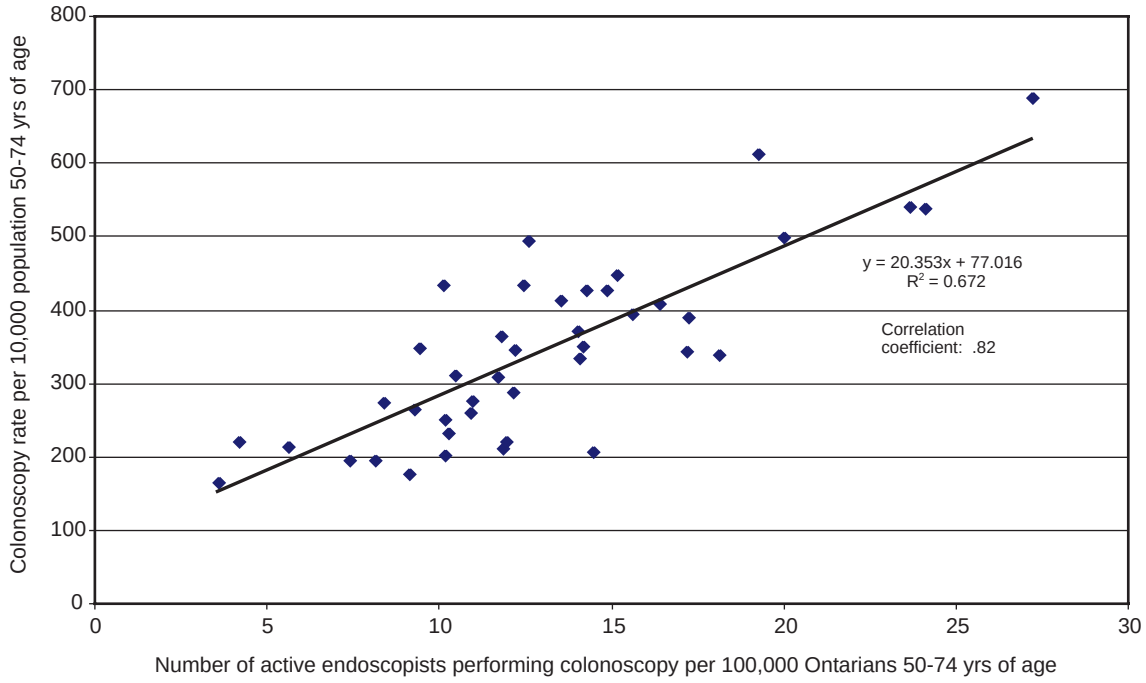
Exhibit 14. Correlation between the number of active endoscopists performing colonoscopy (200 or more procedures per year) and colonoscopy rate by institution county in Ontario, 2001



Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates

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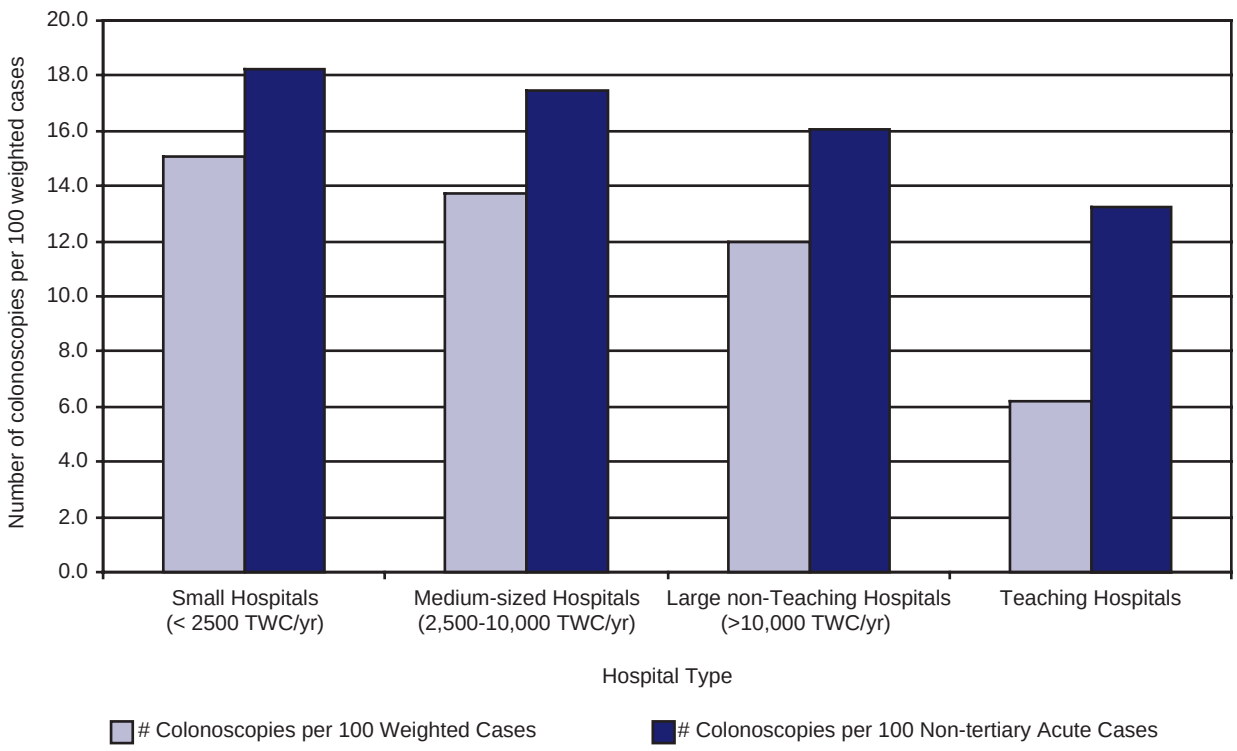
The availability of active endoscopists has a definite impact on procedure rates. In this graph, the colonoscopy rate per 10,000 Ontarians age 50 to 74 has been plotted against the number of active endoscopists performing colonoscopy per 100,000 Ontarians in this age group for all counties that had at least one active endoscopist. An estimated 67% of the variance in county procedure rates can be directly attributed to the number of active endoscopists.

Exhibit 15. Ratio of colonoscopy volume to total hospital volume[1] by hospital type in Ontario, 2001



[1]Hospital volume is measured in Total Weighted Cases (TWC). Each case is assigned a resource intensity weight (RIW) that estimates the hospital resources required, based on the severity and complexity of the condition and length of stay. The total of all RIWs is the total volume for that hospital.

Data sources: Ontario Health Insurance Plan; Statistics Canada Population Estimates: OHA-MOHLTC Joint Policy and Planning Commitee

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This exhibit indicates that the ratio of colonoscopy volume to total hospital volume decreases as the size of the hospital increases (see Glossary for explanation of hospital volume measurements). In small hospitals, the ratio was approximately 14 colonoscopies per 100 weighted cases, compared with 6 per 100 in teaching hospitals. Based on these rates, in a small hospital with a volume of 2500 total weighted cases per year, about 350 colonoscopies would be performed.

When all hospital weighted cases are included, colonoscopies were performed at more than twice the rate in small hospitals compared with teaching hospitals. When tertiary and chronic cases are excluded, there is still an inverse gradient between colonoscopy volume and hospital size, with the rate in small hospitals almost 30% higher than in teaching hospitals.

Looking at it another way, in 2001, the 67 smallest hospitals in Ontario had a combined total weighted case volume of 175,989. This is almost identical to combined total weighted case volume of 176,634 for the province's two largest hospitals, the Hamilton Health Sciences Centre and the University Health Network in Toronto. However, the small hospitals together performed 25,163 colonoscopies, while only 9,050 were performed in the two largest teaching hospitals. This finding has important implications for access to colonoscopy.

5. Discussion and Conclusions

Trends in Colonic Evaluation Procedures

From 1992 to 2001, the rate for all colonic evaluation procedures combined in Ontario, excluding FOBT, followed a shallow U-shaped curve, declining in the mid-90s and rising sharply in the second half of the study period. Because colonic evaluation procedures, especially colonoscopy, are performed as follow-up after a positive FOBT, it is likely that this pattern of overall procedure rates is partly linked to the dramatic decline and subsequent increase in FOBT rates over the same period.

The changing FOBT utilization pattern reflects changing opinions about its efficacy. For example, in 1994 the CTFPHC stated that it could not support or reject FOBT in the periodic health exam because of concerns about the test's high false positive rate.[16] Because there are other causes of gastrointestinal bleeding and FOBT is not specific for cancer, skepticism persists. In addition, FOBT has a relatively low sensitivity for curable CRC and for adenomas (polyps), which rarely bleed.[2] Nonetheless, subsequent to the published results of several well conducted large-scale randomized controlled trials showing a reduction in CRC mortality through the use of FOBT,[5,7,17] US guidelines recommended the use of FOBT for initial screening.[9] This likely explains the rise in FOBT rates that occurred at the end of the decade.

With respect to non-FOBT colonic evaluation procedures, there are two important trends. The first is a substitution effect, with colonoscopy replacing other procedures in many areas of the province, likely the result of patient and physician preference. Patients may prefer colonoscopy because the test is performed under sedation, though the pre-test bowel preparation is somewhat uncomfortable. As well, the procedure evaluates the total colon, unlike flexible sigmoidoscopy.

Physicians may prefer colonoscopy as it provides the following advantages:

- Permits visualization of the entire colon;
- Polyp detection is more complete when compared with barium enema[18]; and
- Detected polyps can be removed immediately.

The other evident trend in colonic evaluation is the increase in colonoscopy over and above what can be explained by the substitution effect. Several factors appear to be responsible:

- Growing awareness of the importance of CRC screening;
- Entry of baby boom generation into the screen-eligible 50 and older age group;
- Demand for screening where colonoscopy is available;
- Increased screening by other methods leads to an increase in the rate of polyp detection, resulting in a rise in the number of subsequent colonoscopies needed for follow-up.

Trends in Flexible Sigmoidoscopy

In contrast to the increased usage of colonoscopy, flexible sigmoidoscopy rates have decreased over time. One of the barriers to using flexible sigmoidoscopy as a screening modality is the funding model at the hospital and physician level. OHIP provides a technical fee of $21.80, yet the actual cost of providing the service outside the hospital setting is several times higher. The equipment cost of a basic video endoscopy system is estimated at about $150,000, comprising a video camera, two sigmoidoscopes, a suction source and a scope washer that meets environmental disinfection standards. Additional costs include personnel, maintenance and repair. The equipment costs are even greater for colonoscopy, which, despite its greater complexity, has the same technical fee of $21.80.

There is an additional barrier at the hospital level for flexible sigmoidoscopy, which is that it has not been assigned a Resource Intensity Weight (1 RIW = approximately $3000). Thus, as explained in Section 3, performing it in a hospital would result in an incurred cost without an offsetting activity, reducing the hospital's apparent efficiency. Colonoscopy, by comparison, has an RIW of .09, which means that the cost allocated by the hospital for each procedure is estimated at approximately $270, a figure 12 times higher than the technical fee OHIP pays outside the hospital setting.

Although flexible sigmoidoscopy is easier to perform than colonoscopy and can be readily done by appropriately trained primary care physicians and nurses,[19] the number of active physicians doing flexible sigmoidoscopy across the province is fewer than the number of active physicians doing colonoscopy. Opportunity exists to increase utilization of this office-based screening procedure, provided the barriers outlined above are addressed.

Access to Colorectal Cancer Screening

Access is an important issue for preventive services such as CRC screening. In the case of colonoscopy, access depends on the supply of physicians to perform the procedure as well as availability of necessary facilities and technical support. Living in rural or remote parts of the province does not appear to present a barrier to accessing colonic evaluation procedures, especially colonoscopy. In fact, the highest rates of colonoscopy are

found in Cochrane District and Lambton County, which have the highest active endoscopist: population ratios in the province and are served by small or non-teaching hospitals where more colonoscopies per Total Weighted Cases are performed compared with larger teaching hospitals. The tendency to perform fewer colonoscopies at larger teaching hospitals presents a challenge to increasing CRC screening rates in communities served almost exclusively by them.

The reasons for the inverse relationship between colonoscopy procedure rates and the size of the hospital are not clear-cut. The authors believe the principal reason is the competition for allocation of limited hospital resources. The process is more complex in larger teaching centres because there are more potential programs to support than in smaller hospitals. There is little doubt that CRC screening must compete with high-tech and cutting edge medical technologies for limited resources in larger teaching hospitals.

Implications for Policy

In 1999, Cancer Care Ontario's expert panel recommended that Ontario should develop and introduce a program of colorectal cancer screening for average risk individuals.[2] Recommendations included:

- Targeting individuals 50 to 74 years of age;
- Using FOBT as the initial screening modality;
- Following up any abnormal FOBT result with colonoscopy or DCBE plus flexible sigmoidoscopy based on the preference of the patient and provider;
- Expanding to include the option of direct visualization of the entire colon using colonoscopy or DCBE plus flexible sigmoidoscopy as the initial screening modality.

One alternative to population-based FOBT CRC screening is a model based on more than one screening modality. The Canadian Task Force on Preventive Health Care endorses FOBT and flexible sigmoidoscopy. While in other countries non-physicians commonly perform flexible sigmoidoscopy in office settings, this rarely occurs in Canada, due, at least in part, to current barriers. Thus, a major opportunity exists to expand access to CRC screening using office-based flexible sigmoidoscopy.

A population-based screening program would require several key components including screening invitations, data capture, and tracking of resource use and outcomes. A set of quality control indicators would also be needed, especially for endoscopic procedures. Barriers to access to endoscopy would need to be addressed. Tracking health care resource use and outcomes could be done passively using existing administrative databases.

The benefits of CRC screening in asymptomatic men and women age 50 years and older have been clearly demonstrated in the published literature. The incidence and mortality rates for colorectal cancer in Canada are among the highest in the world. In 2003, it was estimated that 6,800 men and women in Ontario would be diagnosed with CRC and 3,000 will die from the disease.[20]

Using the Population Health Model (POHEM) developed by Statistics Canada, the National Committee on Colorectal Cancer Screening[1] estimated that a national biennial FOBT-based screening program could reduce CRC mortality by 16.7% over ten years, preventing 7,740 deaths Canada-wide. Gains would be even greater with annual screening. The cost per life-year gained was estimated, using POHEM, at approximately $11,907, a figure well within the range of other accepted health care interventions.[9]

The extent of CRC screening in Ontario is very low compared with other countries. An Ontario cohort study that followed approximately one million men and women age 50 to 59 from 1995 to 2000 showed that only 20.5% had at least one large bowel procedure (including FOBT) for any indication.[21] A recent US report indicates that in 2001, an estimated 44.6% of adults age 50 and over had at least one FOBT and 23.5% had the test in the previous 12 months. With respect to endoscopy, 47.3% reported having had a colonoscopy or sigmoidoscopy and 43.4% had the procedure within the last ten years.[22]

One of the key concerns expressed during discussions on the development of an Ontario CRC screening program is lack of resources, particularly with respect to colonoscopy. It is true that a population-based screening program will increase the demand for colonoscopy, particularly for the follow-up of positive initial screens, although the magnitude of this increase will vary with compliance rates and other factors. Appendix D provides an estimate of the impact on demand for resources in terms of the projected number of colonoscopies that would be performed during the first year of a population-based FOBT screening program in individuals age 50 to 74. The projected number of colonoscopies (25,100) represents approximately 15% of the total number of colonoscopies performed in Ontario in 2001. Therefore, the additional need for colonoscopies is well within the scale of the current trend in annual increases.

Questions remain with respect to hospital resources. Finding additional hospital resources in communities served primarily by teaching hospitals is likely to be very difficult, where the primary focus is tertiary care and complex case management rather than preventive services. A compelling alternative is to

create freestanding CRC screening clinics in which physicians and non-physicians would perform endoscopic procedures.

Conclusions

Published evidence supports the benefits of CRC screening – screening reduces mortality from colorectal cancer. The Canadian Task Force on Preventive Health Care recommends screening of men and women beginning at age 50. Our findings indicate good news as well as opportunity for improvement. The good news is that the proportion of the target population age 50 to 74 years receiving some form of colonic evaluation has been increasing steadily since the mid-1990s. This is particularly true for colonoscopy. Despite these increases, the overall proportion of the population that has received a colonic evaluation procedure remains very low.

While the overall colonic evaluation rate for all procedures combined does not vary much across the province, the mix of procedures being used varies substantially from county to county. The findings of this study also raise questions about barriers to expanding CRC screening, especially in some of the larger urban centres. If the goal is to reduce the societal burden of CRC in terms of mortality, morbidity and health care costs, the best way to achieve this is through screening. A centrally organized, population-based screening program is the most effective and efficient way to increase screening rates and deal with current variations in access. Such a program has already been recommended.[2]

6. Policy Options and Recommendations

1. Establish an organized screening program.

The most promising method to increase the proportion of people screened for colorectal cancer (CRC) is the implementation of a population-based screening program including the following:

- Public awareness campaign
- Invitations for screening
- Use of quality Indicators
- Monitoring resource use and outcomes

Benefits: The most important advantage would be a significant reduction in mortality from CRC. There is also the potential to reduce health care costs from CRC, which would somewhat offset the cost of screening. Existing administrative databases could be used for monitoring of resource use and outcomes.

Challenge: Mounting such a program requires a commitment on the part of policymakers to ensure that all necessary components and infrastructure are in place and adequately resourced.

2. Investigate the feasibility of flexible sigmoidoscopy by non-physicians.

Establish a committee or task force to examine the feasibility of office-based flexible sigmoidoscopy conducted by family physicians and non-physicians, especially nurse-endoscopists (including credentialing, training, and reimbursement) as part of an organized screening program.

Benefits: Flexible sigmoidoscopy is endorsed by the Canadian Task Force on Preventive Health Care as an initial screening test for CRC in average risk men and women 50 years and older. Rates of use have fallen over time and there is an opportunity to reintroduce this procedure (which is safer than colonoscopy and does not require conscious sedation) and can readily be performed by non-physicians in office settings.

Challenge: The diagnostic workup of those with a positive flexible sigmoidoscopy will require access to timely colonoscopy (see #4).

3. Continuously assess quality and outcomes.

Implement changes in the current system to improve monitoring of CRC screening activity and CRC outcomes, for example to distinguish between tests for screening and those done for diagnostic workup. One way to accomplish this is to use separate fee codes (OHIP) or flags (CIHI) for procedures performed purely for screening. Shadow billing of hospital-based laboratory testing would facilitate monitoring of FOBT compliance rates, and can also be used to capture the activity of non-fee-for-service physicians. Other changes needed to improve monitoring of outcomes are adding CRC stage information to the Ontario Cancer Registry (OCR); and linking the OCR to other administrative databases.

Benefits: Such improvements would facilitate monitoring and tracking of CRC screening and outcomes in Ontario.

Challenge: Changes in billing codes are difficult to introduce and result in some discontinuity with past data. As well, there may be some delay in adopting fee code changes. Adding CRC stage information to the Ontario Cancer Registry will require additional resources.

4. Establish a new funding model for endoscopy.

Consider new models to fund the delivery of colonoscopy and flexible sigmoidoscopy, including freestanding ambulatory health facilities. This must include a reappraisal of the current technical fee available for both procedures.

Benefits: When non-colonoscopic methods are used as the initial screening test, patients with positive tests will require total examination of the colon, preferably using colonoscopy. Access to colonoscopy is constrained because most procedures are done in hospitals and funding is therefore dependent on the hospital's global budget. Thus, the development of freestanding ambulatory health facilities to deliver endoscopic services will allow timely access to these procedures.

Challenge: An increased technical fee would require increased funding.

Given that colorectal cancer represents a large preventable burden of disease, it is advised that consideration be given to moving on these four recommendations simultaneously.

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Appendices

Appendix A. CRC Screening Guidelines for Average Risk Individuals

Organization	Year Published	Screening Recommendations	Reference
American Gastroenterological Association, American College of Gastroenterology, American Cancer Society, American Society of Colon and Rectal Surgeons, et. al	1997	Colorectal cancer screening should be offered to all men and women at average risk beginning at age 50. The following screening options are recommended with the choice to be made by patient and physician: • Annual Fecal Occult Blood Testing (FOBT), with positive FOBT followed up with a visualization of the entire colon using colonoscopy or double contrast barium enema (DCBE) with flexible sigmoidoscopy. • Flexible sigmoidoscopy every 5 years, with biopsy of small (<1 cm) polyps and follow-up colonoscopy in the event of adenomatous polyps, cancer or any large polyp (>1cm). • Combined annual FOBT and flexible sigmoidoscopy every 5 years. • DCBE every 5-10 years, with abnormal findings followed up by colonoscopy. • Colonoscopy every 10 years.	Winawer, SJ et al., Colorectal Cancer Screening: Clinical Guidelines and Rationale. *Gastroenterology* 1997; 112:594-642.
Ontario Expert Panel on Colorectal Cancer Screening	1999	A two-phase colorectal cancer screening program should be developed and implemented for average risk individuals age 50 years or older with: • The initial program using FOBT as the primary modality, with timely follow-up of positive FOBT with colonoscopy or DCBE and flexible sigmoidoscopy; and • Eventual expansion to provide visualization of the entire colon using colonoscopy or DCBE as a primary modality.	Colorectal Cancer Screening. Final Report of the Ontario Expert Panel, April 1999.
Canadian Task Force on Preventive Health Care (CTFPHC)	2001	The CTFPHC found evidence to recommend the following: • Annual or biennial FOBT • Flexible sigmoidoscopy Concluded that the evidence was insufficient to make recommendations for or against colonoscopy.	Colorectal Cancer Screening: Recommendation statement from the Canadian Task Force on Preventive Health Care. *Canadian Medical Association Journal* 2001; 165(2):206-208.
National Committee on Colorectal Cancer Screening: an expert panel	2002	Colorectal cancer screening should be made available to Canadians within a structured environment to maximize benefit and minimize risk, as follows: • Screening offered to target population age 50 to 74 years, using unrehydrated Hemoccult II FOBT or equivalent as the entry test. • Screening should be done at least every 2 years, recognizing that annual screening would reduce mortality further, but requires more resources. • Positive tests should be followed up with colonoscopy, with options of barium enema and flexible sigmoidoscopy where appropriate.	Available on the Health Canada web site: http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/ncccs-cndcc/ccsrec_e.html
US Preventive Services Task Force (USPSTF)	2002	All men and women should be screened beginning at age 50 to reduce mortality from colorectal cancer. It found: • Good evidence to support periodic FOBT. • Fair evidence to support the use of flexible sigmoidoscopy. • Indirect (but no direct) evidence of the efficacy of colonoscopy from its integral role in FOBT trials, as well as extrapolation from other research. • No direct evidence that DCBE reduces mortality, but does provide an alternative means of visualizing the colon.	US Preventive Services Task Force. Screening for Colorectal Cancer: Recommendation and Rationale, *Annals of Internal Medicine* 2002; 137(2):129-131.
American Gastroenterological Association	2003	In light of new evidence, revisions to its 1997 recommendations are as follows: • No rehydration of FOBT. • Colonoscopy rather than DCBE is recommended for follow-up of positive FOBT. • Screening using DCBE should be done every 5 years.	Winawer, SJ et al., Colorectal Cancer Screening and Surveillance: Clinical Guidelines and Rationale – Update Based on New Evidence. *Gastroenterology* 2003; 124:544-560.

Appendix B. Anatomical Terms and Colonic Evaluation Procedures

The human large intestine, comprised of the colon and rectum, is about 150 cm long and extends from the terminal ileum (the end of the small intestine) to the anus. The diagram illustrates the various anatomical features of the colon mentioned in this report. The terms proximal and distal colon are used relative to the terminal ileum. Thus, the proximal colon is the part closest to the terminal ileum, while the distal colon is farthest away.

This report examines rates for a number of colonic evaluation procedures. The following is a brief description of each procedure and its sensitivity for detecting cancer (from Winawer et al., 1997 unless otherwise stated).

Fecal Occult Blood Testing (FOBT)

The patient completes this test for blood in the stool at home by collecting two samples from each of three spontaneously passed stools. The samples are distributed on cards containing guaiac reagent, and returned to a lab for analysis. Estimates of annual FOBT testing sensitivity for cancer detection range from 30-50%.[23]

It is common for physicians to screen for CRC using a single FOBT performed on a stool specimen obtained by digital rectal examination (DRE), though this practice is somewhat controversial because of a lack of strong evidence to support its use.

Sigmoidoscopy

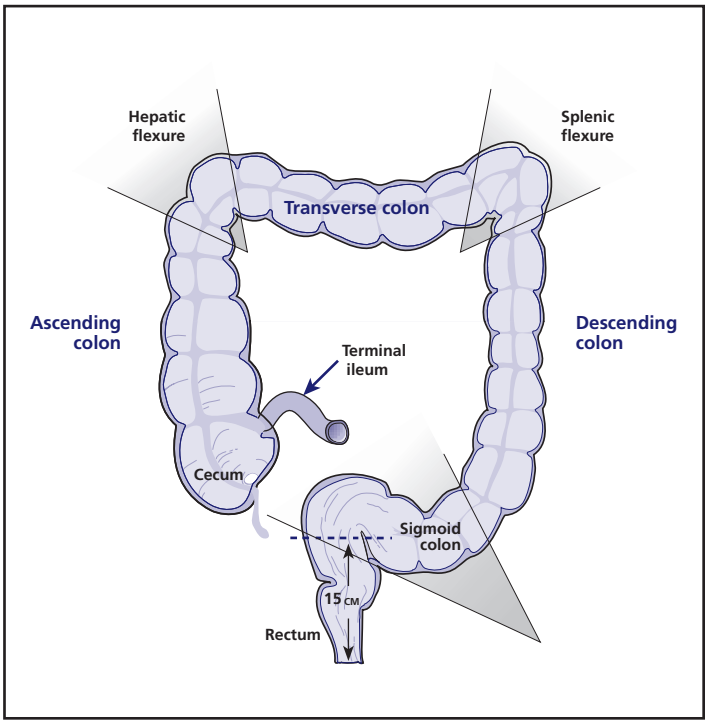
The 25 cm rigid scope has largely been replaced by the 60 cm flexible scope, which allows more of the bowel to be examined, and provides clearer visualization of the mucosa and improved patient comfort. Rigid sigmoidoscopy has not been included in screening guidelines published to date.

The proportion of cancers detected varies with the length of the scope. The 60 cm scope, which can reach up to the sigmoid colon, detects approximately 40%-60% of cancers in the rectum and distal colon.

Colonoscopy

Colonoscopy, which allows visualization of the entire rectum and colon, requires preparation of the bowel using laxatives and/or enemas or oral cathartic solutions. The patient is usually sedated but conscious during the procedure.

In addition to detecting polyps and cancers, colonoscopy also allows for removal of lesions during the procedure. It is the most sensitive of all procedures, detecting over 90% of polyps larger than 1 cm and 75% of those less than 5 mm in size.



Barium Enema

Like colonoscopy, barium enema also allows visualization of the entire colon. The procedure can be performed as a single contrast study using barium alone, or as a double contrast study by instilling air into the colon after removal of the barium, permitting visualization of lesions outlined by the retained barium.

Most barium enemas performed are of the double contrast type, and sensitivity is estimated at 50% for polyps 1 cm or larger.[18]

Appendix C. OHIP Fee Codes Utilized in Study Analyses

All analyses in this research atlas were conducted using OHIP billing data. Straightforward single billing codes are used for radiological procedures, rigid sigmoidoscopy and FOBT, whereas flexible endoscopic procedures require a combination of codes.

A full colonoscopy to the terminal ileum requires 5 separate billing codes as incremental fees apply to each section of the colon reached.

Z535 – Sigmoidoscopy of rectum (rigid sigmoidoscopy)
Z580 – Endoscopy (using 60 cm flexible endoscope)
Z555 – Endoscopy of sigmoid to descending colon
E740 – To splenic flexure (flexible sigmoidoscopy)
E741 – To hepatic flexure (colonoscopy)
E747 – To cecum (colonoscopy)
E705 – Into terminal ileum (colonoscopy)
X112 – Diagnostic Radiology Colon – barium enema including survey film (SCBE)
X113 – Diagnostic Radiology Colon – air contrast, primary/secondary, including survey films (DCBE)

Appendix D. How Many Colonoscopies?

A	B	C	D	E	F	G	H
Sex	Estimated number in screen-eligible age group in 2004[a]	Proportion expected to visit a family physician in 2004[b]	Proportion who will have an FOBT screening test[c]	Proportion of FOBT tests that will require follow-up colonoscopy[d]	Overall % of screen-eligible who will require colonoscopy (C x D x E)	Number of colonoscopies required as follow-up from FOBT (B x F)	Proportion of those having colonoscopy who will be found to have polyps or cancer[e]
Men	1,411,032	83%	50%	2%	.83%	11,712	35%
Women	1,504,276	89%	50%	2%	.89%	13,388	35%
Total	2,915,308					25,100	

[a] From 2002 population forecasts provided by Statistics Canada.
[b] Based on the 1996 Ontario Health Survey, published in the Report on the Health Status of the Residents of Ontario. [24]
[c] A very optimistic estimate for the first year of a screening program. The Ontario Expert Panel set an eventual target of 70%.
[d] Based on Towler B et al.[25]
[e] Based on Lieberman et al.[6]

Central to discussions regarding the development of an Ontario colorectal cancer (CRC) screening program is the issue of resources, particularly with respect to colonoscopy. It is difficult to predict precisely what impact a CRC screening program will have on colonoscopy demand because of the range of factors involved.

Recent population projections of Statistics Canada estimate that approximately 2.9 million Ontarians will comprise the screen-eligible age group of 50 to 74 years in 2004. Using information from a variety of sources, the table provides an estimate of the number of colonoscopies that would immediately result from the establishment of a population-based FOBT screening program targeting this age group. It is important to recognize that persons found to have polyps will require ongoing colonoscopic surveillance to detect new polyps at an interval of 3 – 5 years.

There are two important messages to be taken from this table. First, the immediate impact of an FOBT screening program on demand for colonoscopy will likely be relatively modest. Second, several variables will influence impact. For example, if there is general enthusiasm for screening from physicians and patients, the proportion of those screened could be higher than 50%. The use of other modalities, such as flexible sigmoidoscopy, as the initial screening test could also affect demand for colonoscopy.

Since the mid-1990s, the health care system as a whole has been absorbing exponential growth in colonoscopy use. This illustration does not suggest that an FOBT-based screening program will result in increased demand beyond the scale of historical growth patterns in recent years. Research is required to determine the causes of regional variations in colonoscopy rates, specifically waiting times, an issue that has not been addressed in this research atlas.

Glossary

Hospital Volume Measurement

Hospital activity is measured by Resource Intensity Weights (RIWs), units that represent an estimate of the total hospital resources required by a patient. This permits comparison of the relative costs of treating different types of patients,[15] with 1 RIW unit equal to a cost of approximately $3000.

For example, a liver transplant requires more resources than gallbladder surgery. Thus, the RIW for a liver transplant can be as high as 25.66, indicating that the total cost to the hospital of treating a liver transplant patient was approximately $77,000. In comparison, a laparoscopic cholecystectomy in a young, healthy patient has an RIW of 0.74, or just over $2200.

Weighting cases also allows for comparisons of activity across hospitals that differ widely in patient mix. The sum of all RIWs for a particular hospital is a measure of its overall volume, commonly referred to as "total weighted case volume".[26]

In this research atlas, the number of colonoscopies performed in each hospital was compared to the hospital's overall volume in two ways:

1. The first approach included all cases in the hospital volume figure.

2. The second approach compared the number of colonoscopies to the portion of a hospital's volume that could be considered "community care" (non-tertiary acute care), which excludes cases classified as chronic or tertiary. The reason for this is that not all Ontario hospitals are equipped to provide tertiary care, thus designated tertiary care centres often treat patients from a broad geographic area. Tertiary care is defined as hospital care involving complex treatment, often including a wide range of expensive specialized services and equipment.[15]

More information about these measures, their definition, utilization and development can be found at www.cihi.ca or www.jppc.org.

Ontario Joint Policy and Planning Committee (JPPC)

The mandate of the Ontario Joint Policy and Planning Committee, a partnership between the Ontario Ministry of Health and Long-Term Care (MOHLTC) and the Ontario Hospital Association (OHA), is to recommend and facilitate hospital reform in Ontario. One of its principal objectives is to propose hospital funding that promotes effectiveness, efficiency and equity among hospitals.

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