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F	too unreliable to be published

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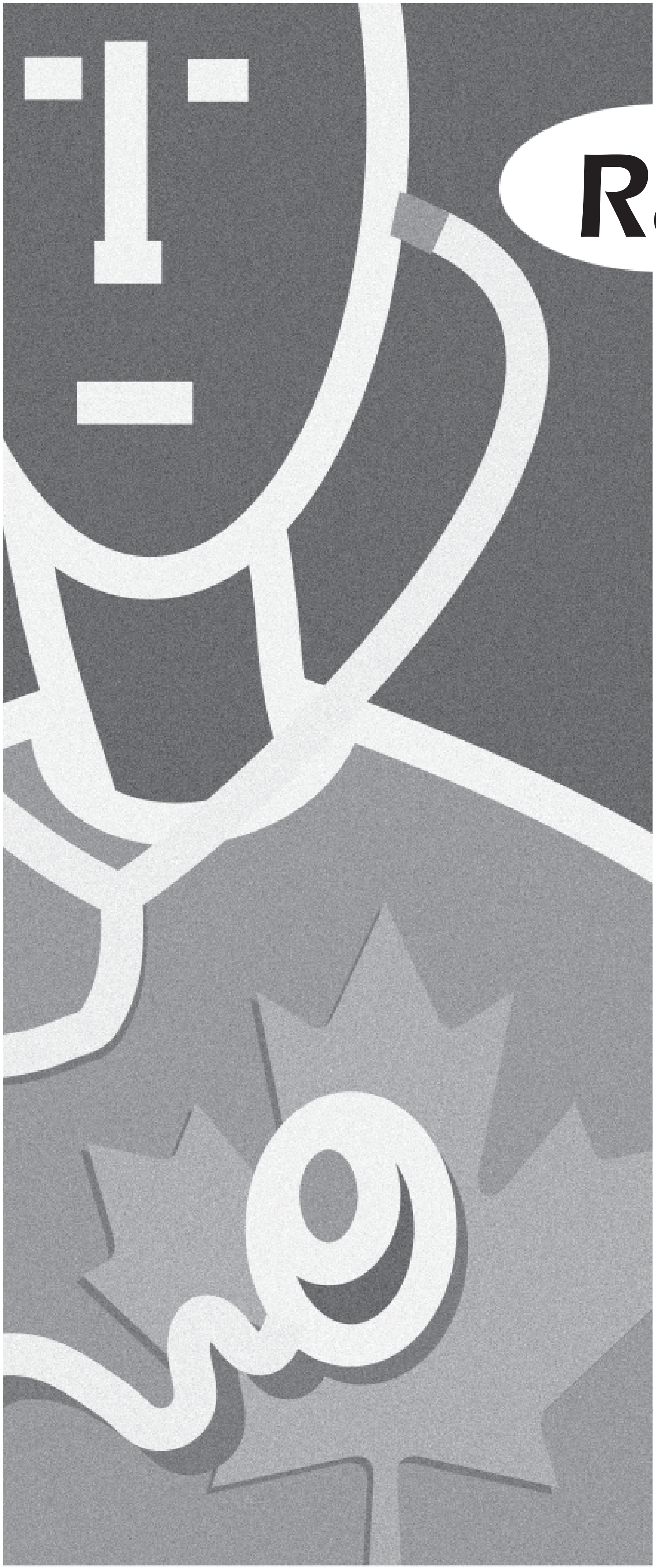
In This Issue

Research Articles

Health Matters



Research Articles

In-depth research and analysis

Infection after cholecystectomy, hysterectomy or appendectomy

Michelle Rotermann

Abstract

Objectives

This article uses patient-linked data to focus on hospitalization with post-operative infection following cholecystectomy, hysterectomy or appendectomy. The average number of hospital days and the costs of readmission are also estimated.

Data source

Data for surgeries in fiscal years 1997/98, 1998/99 and 1999/00 are from the Health Person-Oriented Information Database.

Analytical techniques

Bivariate tabulations were used to estimate the percentage of patients hospitalized with post-operative infection after cholecystectomy, hysterectomy or appendectomy between 1997/98 and 1999/00. Logistic regression was used to explore associations between infection and patient characteristics, readmission, and peri-operative mortality, while controlling for surgical characteristics.

Main results

Hospitalization with post-operative infection was relatively rare, occurring in 1.4% of cholecystectomy, 2.0% of hysterectomy, and 3.8% of appendectomy patients. The associated costs of readmission for post-operative infection for the three surgeries were estimated at $5.4 to $6.3 million annually. Old age, being male, surgical complexity and approach, and diabetes were associated with hospitalization involving a post-operative infection.

Key words

length of stay, post-operative, patient admission, patient readmission, surgical site

Author

Michelle Rotermann (613-951-3166; Michelle.Rotermann @statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Despite efforts to control infection, advances in surgical techniques, and use of antibiotic prophylactics, no surgery is free of the risk of infection.[1,2] Surgical site, bloodstream, and catheter-associated urinary tract infections, as well as hospital-borne pneumonia, remain important concerns.

Health Canada has estimated that each year between 5% and 10% of all people admitted to hospital contract an infection.[3] With over 2 million Canadians hospitalized annually, potentially 105,000 to 210,000 people may be affected.[4] According to the Community and Hospital Infection Control Association, 8,500 Canadians die each year owing to complications arising from infections acquired in hospital, and the annual related costs to individuals and the health care system exceed $750 million.[5] Patients who acquire infections spend considerably more time in hospital, undergo more testing, and require more medications and medical care than patients who do not develop infections.[6-8]

Methods

Data source

This analysis is based on data from the Health Person-Oriented Information Database, maintained by Statistics Canada. This database contains information on inpatient hospital separations (discharges or deaths) from most acute care and some psychiatric, chronic and rehabilitation hospitals across Canada.[9] Each record contains demographic (for example, postal code, date of birth), non-medical administrative (such as scrambled and unscrambled health insurance number, dates of admission and separation) and clinical information (diagnoses and procedures, for example).[10] This analysis used only data that could be linked; that is, the records with valid identifiers. Annually, approximately 13% of the hospital morbidity records are excluded from the additional processing that enables the files to be analyzed at the person level: 10% because they are records for newborns, and the remaining 3% because the record contains either an invalid identifier or is for a person residing outside the province. A more complete description of the Health Person-Oriented Information Database is available in another publication.[9]

To prepare the data for analysis, hospital separation records for each patient were merged, based on a unique patient identifier, and sorted chronologically. Records of hospital stays for each patient were thus linked, beginning with the admission during which the surgery took place, followed by readmissions within 30 days of surgery. For each patient, data from only the first 20 admissions, beginning in April 1997 and ending in March 2000, were used in the analysis. A total of 382,277 linked records were included, representing 141,766 cholecystectomy, 159,644 hysterectomy, and 80,867 appendectomy patients. Virtually all of these inpatients (99.9%) had had their surgery in an acute care hospital (data not shown).

Cost information is not available for all provinces. The Alberta cost information used in this analysis reflects the average cost of procedures derived from data submitted by nine Alberta hospitals.[11] Cost information for Ontario reflects the average cost of procedures and treatment of diagnoses from data submitted by a subset of 22 specialty, community or teaching hospitals (Ontario Case Costing Initiative).[12-13] The cost data do not necessarily correspond with total provincial averages of hospital-based services.

Analytical techniques

Patients who had had one of the three surgeries—cholecystectomy, hysterectomy or appendectomy—during fiscal years 1997/98 to 1999/00 were grouped by surgery.

Date of surgery was not available; therefore, it was imputed as the day after the date of admission for the surgical stay.

Descriptive analyses were based on tabulations of numbers and percentages. Statistical significance of differences between proportions was tested ($p < 0.05$). The proportions of patients hospitalized with post-operative infection either during the surgical stay or readmission were calculated. The overall rate for hospitalization with post-operative infection was calculated by dividing the number of patients with infection noted on any hospital record within 30 days of surgery by the total number of patients who had the surgery, then multiplying by 100. Readmissions for infection were considered to include only those patients who were re-hospitalized within 30 days with a post-operative infection identified as the "most responsible" diagnosis. Peri-operative death rates (in-hospital death within 30 days of the procedure) were similarly calculated.

Separate logistic regression models were fitted for each surgery in order to calculate the odds of hospitalization with a post-operative infection, readmission for post-operative infection, and dying within 30 days of surgery. Selection of control variables was guided by the literature and the availability of data in the Health Person-Oriented Information Database (see *Limitations*).

Average length of readmission was calculated separately for each surgical group by summing the number of days of hospitalizations for which the "most responsible" diagnosis was a post-operative infection, and dividing by the number of patients who were readmitted. When the date indicated that a subsequent stay began before or on the same day as the preceding stay ended, the overlapping day was double-counted. Such overlaps are rare and do not substantially change the length-of-stay calculations. They also likely reflect instances where patients were discharged, then readmitted on the same day. On average, 4% of each of the three surgical cohorts had overlapping and/or concurrent admissions associated with the surgical stay (data not shown).

Peri-operative mortality was defined as a discharge condition of "dead" within 30 days of the imputed surgery date. If a patient died out of hospital, the death could not be included.

The burden of post-operative infection on the health care system was measured by calculating the mean number of days of hospitalization for patients who were readmitted for treatment of a post-operative infection (defined as an admission for which post-operative infection accounted for the major portion of the stay) within 30 days of the surgery. The average length of readmission was obtained by summing the days of subsequent hospitalizations within 30 days of surgery.

This article examines hospitalization for post-operative infection in patients who underwent one of three common surgical procedures during the 1997/98, 1998/99 or 1999/00 fiscal year: cholecystectomy (gall bladder removal), hysterectomy (removal of the uterus) and appendectomy (removal of the appendix). Associations between patient characteristics and post-operative infection are investigated, as are surgical approach and complexity (see *Definitions*).

The Health Person-Oriented Information Database structures hospital morbidity data so that each patient's hospital admissions could be linked using a unique identifier (see *Methods* and *Limitations*). In addition to the number of hospitalizations, the average total length and the estimated costs of re-hospitalization for post-operative infection were calculated. Using linked data provides a more accurate assessment of the burden post-operative infections place on the health care system. Without such records, a substantial proportion of the post-operative infections observed in this study would have been missed.

Patient-linked hospitalization data do not capture all post-operative infections. Many such infections are treated in outpatient clinics or physicians' offices and thus do not appear in hospital records. It is likely that only the most serious ones result in a patient being readmitted to hospital.

Hospitalization uncommon

Hospitalization with post-operative infection was relatively rare among cholecystectomy, hysterectomy and appendectomy patients (see *Definitions*). Of the 382,277 in-patients who had one of these surgeries in 1997/98, 1998/99 or 1999/00, just 2.2% (8,323) developed an infection that was noted during the initial surgical stay and/or subsequent admission(s) to hospital within 30 days of the surgery (Table 1).

The percentage of patients hospitalized with a post-operative infection varied by surgery. Infection was significantly less likely after cholecystectomy (1.4%) or hysterectomy (2.0%) than after appendectomy (3.8%). These figures are comparable with findings from other studies.[2,14-16]

Risk of post-operative infection

The risk of post-operative infection is influenced by patient characteristics such as sex, age, pre-existing infection (peritonitis, for example), presence of other conditions, and by surgical approach and complexity. Information about other factors that may affect a patient's risk of developing an infection—weight, nutritional and smoking habits, use of prophylactic antibiotics, and so on—was not available in the data used for this analysis (see *Limitations*).

Female cholecystectomy patients outnumbered their male counterparts by more than 2 to 1, but men were twice as likely to be hospitalized with a post-operative infection, a finding previously noted in research on gall bladder and other surgery patients.[17-21] Post-operative infection was also more common among male than female appendectomy patients (Table 2). Research has indicated that testosterone has a depressive effect on the body's

Table 1
Hospitalization with post-operative infection within 30 days of cholecystectomy, hysterectomy or appendectomy, Canada excluding territories, 1997/98 to 1999/00

	Total		Cholecystectomy		Hysterectomy		Appendectomy	
	Number	%	Number	%	Number	%	Number	%
Total	382,277	100.0	141,766	100.0	159,644	100.0	80,867	100.0
Post-operative infection within 30 days of surgery (noted during surgical admission and/or upon readmission)	8,323	2.2	1,961	1.4*	3,254	2.0	3,108	3.8
Post-operative infection noted upon readmission and coded as condition most responsible for hospital stay†	3,554	0.9	593	0.4	1,540	1.0	1,421	1.8

***Data source**: Health Person-Oriented Information Database, 1997/98 to 1999/00*
† 219 of these patients also had an infection diagnosed during their surgical admission.
** Significantly different from rates of infection following hysterectomy and appendectomy ($p < 0.05$)*

Limitations

This analysis is based on inpatient hospitalization information only. Data on outpatient/day surgery procedures, which comprise an unknown proportion of the total, are not included in this analysis. Tabulations of hospitalization with post-operative infection based on information from the Health Person-Oriented Information Database do not reflect the extent of post-operative infection. Only patients whose discharge summaries contained an ICD-9 code of 998.5 within 30 days of the surgery were included in the analysis. Post-operative infections that later developed in patients who were not readmitted were not documented in hospital records, so they could not be counted in this analysis.

The accuracy of the diagnosis of post-operative infection has not been validated, and the specificity and sensitivity of the coding is unknown. Hospitals in jurisdictions where funding is based on discharge abstract data may have a greater incentive to report more diagnoses and/or more post-operative infections. The completeness of reporting may also be influenced by the availability of health records resources, and provincial and/or individual hospital data-capture guidelines. For example, some hospitals may identify a diagnosis based on a laboratory test alone. Coding of post-operative infection may also be influenced by a hospital's participation in nosocomial infection surveillance programs and/or other types of coding practices specific to individual hospitals.[22]

A recent reabstraction study showed that approximately 7% of the principal procedures and 13% of the most responsible diagnoses are not coded accurately. However, common and relatively uncomplicated procedures, such as the three surgical procedures examined in this analysis, are easier to identify and are likely more accurately coded.[23]

The principal procedure from each record was used to select patients for this study. Records with multiple procedures were not excluded from the analysis because the majority of other procedures on each record relate to the principal procedure. In over 99% of all patients, the principal procedure was equivalent to the first procedure field (as expected); 47% of these records noted additional procedures. The Health Person-Oriented Information Database is made up of administrative data primarily designed for billing purposes. It is likely that some of the variation in the number of procedures on each record reflects differing levels of coding specificity or procedure itemization within and among hospitals.

Information on several patient and hospital characteristics that may influence post-operative infection risk was not available in the Health Person-Oriented Information Database; for example, patients' weight, nutritional and smoking habits, immunity status, current immuno-suppression therapy, length of pre-operative stay, severity of pre-operative conditions, presence of distant infection, use of prophylactic antibiotics, emergency versus elective appendectomy, type of wound closure, and effectiveness of infection control practices and programs at each hospital.[24-26] Incomplete reporting of a patient's co-morbid conditions may also limit interpretation of the risk factors for post-operative infections.

The accuracy of the cost estimates for readmissions owing to infection is unknown. The estimates pertain only to patients who were readmitted for infection. But many other patients received treatment for post-operative infection during surgical admission and readmissions, although it may not have been the chief factor that extended the hospital stay and/or necessitated the readmission. Estimated differences between the average accumulated lengths of stay of patients who were and were not treated for infection suggest that costs to treat patients with post-operative infection associated with the three surgeries could range from $18 million to $21.2 million annually (data not shown).

An important body of research focuses on the relationship between the number of surgeries performed at a particular institution and patient outcomes. In general, patients who undergo a specific procedure in hospitals where a high volume of that procedure is performed have better outcomes than those treated in lower-volume hospitals.[27-30] It is not possible to ascertain surgical volume by hospital with available documentation because the definition of "hospital" is inconsistent within and across provinces and between data years. For instance, "hospital" is variously defined as an individual hospital or a corporation comprising more than one hospital, due to the amalgamation of several individual hospitals, or a ward within a hospital. Therefore, the effect of surgical volume on the risk of post-operative infection or mortality could not be assessed in this analysis.

Because the date of surgery is not provided on the Health Person-Oriented Information Database, it was imputed as the day after the admission date. The validity of the imputed surgery date is unknown.

The data used in this study capture only deaths that occurred in hospital. Other patients may have died because of complications associated with post-operative infections, but because these deaths did not occur in hospital, they could not be included.

ability to fight infection.[18,19] It has also been suggested that estrogen may account for women's higher level of immunity.[18,19]

Of course, additional factors may contribute to men's elevated risk of developing an infection after surgery. For example, compared with women, higher proportions of men in all but the youngest age groups smoke daily,[31] and smoking has been shown to impede healing and immune responses.[32]

Table 2
Distribution of surgery and percentage with post-operative infection within 30 days of cholecystectomy, hysterectomy or appendectomy, by selected characteristics, Canada excluding territories, 1997/98 to 1999/00

	Cholecystectomy		Hysterectomy		Appendectomy	
	Total	Hospitalized with infection	Total	Hospitalized with infection	Total	Hospitalized with infection
	%		%		%	
Total	100.0	...	100.0	...	100.0	...
Sex						
Men	30.0	2.2*	...	...	55.2	4.4*
Women†	70.0	1.0	100.0	2.0	44.8	3.1
Age group						
≤ 29†	12.8	0.5	3.3	3.0	56.9	3.0
30-39	15.4	0.6*	24.4	2.2*	17.6	3.6*
40-49	17.6	0.8*	40.3	2.0*	12.0	4.9*
50-59	19.0	1.3*	16.0	1.8*	6.8	5.8*
60-69	16.9	1.9*	8.6	1.7*	3.7	7.6*
70+	18.4	2.9*	7.5	2.1*	3.0	7.2*
Surgical approach						
Open	16.6	4.3*	...	...	...	...
Laparoscopic†	83.4	0.8	...	...	...	...
Abdominal	...	...	68.7	2.3*	...	...
Vaginal†	...	...	31.4	1.6	...	...
Surgical complexity						
High	...	...	0.9	3.4*	...	...
Low†	...	...	99.1	2.0	...	...
Appendix						
Ruptured/Peritonitis/ Peritoneal abscess	...	...	...	...	28.2	8.0*
No record of rupture/peritonitis/ peritoneal abscess†	...	...	...	...	71.9	2.2
Diabetes						
Yes	5.3	2.9*	4.7	4.0*	1.5	10.1*
No†	94.7	1.3	95.3	2.0	98.5	3.7

Data source: Health Person-Oriented Information Database, 1997/98 to 1999/00
† Reference group
··· Not applicable
* Significantly different from reference group ($p < 0.05$)

For people who had a cholecystectomy or appendectomy, post-operative infection was more frequent among the older patients. Previous research indicates that advanced age is a major risk factor for post-operative infection, partly because seniors are far more likely to have other conditions that may delay healing.[33-35]

The relationship between age and risk of infection was generally reversed for hysterectomy patients, meaning that women younger than 30 were more likely than older women to be hospitalized for an infection. Whenever possible, young women, and those with one or no children, are treated to preserve their childbearing capacity.[36] It is therefore reasonable to assume that the conditions necessitating hysterectomy in young women are relatively serious, and these women are consequently at higher risk of post-operative infection. Information about other factors that might predispose a patient to infection, such as complications encountered during the operation, tumour size, underlying diagnoses or length of surgery, is not available in the Health Person-Oriented Information Database (see *Limitations*).

Differences by surgical approach

The percentage of hospitalizations with post-operative infection varied by surgical procedure and complexity, and by underlying disease. Cholecystectomy patients who had open versus laparoscopic surgery, hysterectomy patients who had an abdominal procedure, appendectomy patients who already had an infection when they had surgery, and patients with diabetes were all over-represented among those hospitalized with post-operative infections (Table 2).

For cholecystectomy patients, surgical approach was strongly associated with post-operative infection (Table 3). Those who underwent an open cholecystectomy had over 4 times the odds of being hospitalized with an infection post-operatively, compared with patients whose surgery was performed laparoscopically, even when risk factors such as age, sex and diabetes were taken into account.

Definitions

In accordance with the *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures* (CCP),[37] cholecystectomy, hysterectomy and appendectomy were defined based on the surgical codes in the principal procedure field of the hospital morbidity record. This field represents the "most significant" procedure performed during a patient's hospital stay; that is, the one having the greatest impact on the length of stay and/or use of hospital resources.[38] The CCP codes for open cholecystectomy were 63.11, 63.12 and 63.13; for the laparoscopic procedure, the code was 63.14. Codes 80.2, 80.3 and 80.5 indicate abdominal hysterectomy; 80.4 and 80.6, vaginal. The CCP code for appendectomy was 59.0.

Post-operative infection refers to abscess or septicemia that occurred after surgery and that was diagnosed and documented in hospital records either during the patient's original hospitalization or during readmission with 30 days of surgery. The *International Classification of Diseases, Ninth Revision* (ICD-9)[39] code 998.5 in any of the diagnostic fields (records contained a maximum of 16) was used to identify patients hospitalized with such an infection within 30 days of the surgery (including the surgical hospitalization or readmissions).

Because the *date of surgery* was not available, it was defined as the day following the date of admission to hospital for surgery.

Each patient was followed for 30 days from the imputed date of surgery. A *30-day follow-up* period is considered sufficient time for a post-operative infection to develop and is consistent with the Centers for Disease Control and Prevention's (CDC) National Nosocomial Infection Surveillance (NNIS) system surveillance criteria.[24,40]

A variable reflecting *surgical complexity* was based on information from Appendix H.4 of the Canadian Institute for Health Information's *Case Mix Group (CMG) Directory*.[41] According to this document, procedures requiring at least seven days of in-hospital care were considered to have a high level of complexity. This includes radical hysterectomy, which is the removal of the uterus, fallopian tubes, parametrium (the tissue at the side of the uterus), the upper third of the vagina, and the pelvic lymph nodes via an abdominal incision or the vagina.[42]

Patients were classified as having *diabetes* if, during the surgical hospitalization, a diagnosis of diabetes mellitus (ICD-9 code 250) was noted in any of the 16 diagnostic or "most responsible" diagnosis fields.

Six *age groups* (29 or younger, 30 to 39, 40 to 49, 50 to 59, 60 to 69, and 70 or older) were used for most of the analysis. These groups were combined as 60 or younger and over age 60 to examine in-hospital deaths within 30 days of surgery.

Two categories were used to consider the pathological state of the *appendix*. Patients were considered to have a ruptured appendix and/or peritonitis and/or peritoneal abscess if a diagnosis of 540.0 or 540.1 appeared in any of the 16 diagnostic fields of the surgical hospitalization record.

Readmission refers to patients who had another admission to hospital within 30 days of the imputed surgery date, with a record showing post-operative infection as the diagnosis "most responsible" for the repeat stay.

Estimated costs of readmission were included in the cost-per-day values. Costs may be direct, such as those incurred by the hospital department providing service to the patient (salaries, supplies and equipment, for example) or indirect, meaning those incurred by departments not providing services to patients, such as administrative services (admitting and registration, health records, finance, etc.).

The *average total cost of readmission* was calculated by multiplying the estimated daily costs of hospital care by the *average length of hospital stay* for readmissions where the most responsible diagnosis was post-operative infection.

Cost per day of hospitalization was calculated for the Ontario data by dividing the average total cost per case by the average length of stay. Alberta provides information on cost per day of hospitalization directly (see *Limitations*).

Annual additional hospital costs of post-operative infection for each surgery were calculated by multiplying the average total length of readmission for post-operative infection by the cost per day by the number of readmitted infected patients. Because three years of data were used, the total costs were divided by three to obtain the *average annual cost of readmissions for infection*.

Case mix groups are defined using a system that classifies hospital patients and makes it possible to group them into a manageable number of categories, depending on clinical similarity.[43,44] Often more than one case mix group (CMG) corresponded to the *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures* codes denoting each surgery.[37] The CMG or *International Classification of Diseases, Ninth revision, clinical modification* (ICD-9-CM) code associated with the lowest cost per day was used to estimate the cost of readmission for each surgery. For the Ontario portion of the hysterectomy costing, the costs corresponding to the ICD-9-CM codes were used. Costs associated with hysterectomy performed in Alberta were available only by CMG. For the Alberta hysterectomy cost estimate, the costs associated with CMG 577 (major gynecological procedures for ovarian or adnexal malignancy) for 2000/01 were used. Data from 1999/00 and associated with ICD-9-CM for abdominal hysterectomy were used to estimate Ontario costs for hysterectomy.

Laparoscopic cholecystectomy limits exposure to bacteria, because only small incisions are made in the abdominal wall.[45-48] The time required to perform laparoscopic surgery also tends to be shorter.[49] Of course, patients are selected for laparoscopic surgery based on a pre-operative assessment of various factors, some of which relate to their risk of surgical and post-operative complications. Patients at lower risk of complications, including infection, likely comprised a larger proportion of those who underwent laparoscopic cholecystectomy, so it is not surprising that this technique was associated with lower odds of infection. With only a limited number of variables available (see *Limitations*), it is likely that some of the observed difference associated with surgical approach is due to other pre-surgical differences in patient risk.[50]

For hysterectomy patients, a protective association emerged between vaginal approach, compared with abdominal, and post-operative infection. Vaginal hysterectomy tends to be associated with fewer complications than the abdominal surgery.[51] The condition necessitating an abdominal rather than a vaginal approach may also pre-dispose the patient to infection.[52,53] Infection may also be less likely in women who undergo vaginal hysterectomy, as there is no external incision.

Complexity associated with infection

Surgical complexity was strongly associated with post-operative infection among hysterectomy patients. (Information on complexity was relevant only for hysterectomy because it was the only surgery for which complexity varied) (see *Definitions*). Women who had a more invasive or "radical"

Table 3
Adjusted odds ratios for hospitalization with post-operative infection within 30 days of cholecystectomy, hysterectomy or appendectomy in relation to selected characteristics, Canada excluding territories, 1997/98 to 1999/00

	Cholecystectomy		Hysterectomy		Appendectomy	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex						
Men	1.4*	1.3, 1.6	...	...	1.4*	1.3, 1.5
Women†	1.0	...	...	...	1.0	...
Age group						
≤ 29†	1.0	...	1.0	...	1.0	...
30-39	1.2	0.9, 1.6	0.7*	0.6, 0.8	1.2*	1.1, 1.3
40-49	1.2	1.0, 1.6	0.6*	0.5, 0.8	1.4*	1.3, 1.6
50-59	1.9*	1.5, 2.4	0.5*	0.5, 0.7	1.5*	1.3, 1.7
60-69	2.5*	2.0, 3.2	0.5*	0.4, 0.7	1.8*	1.5, 2.0
70+	3.3*	2.6, 4.1	0.7*	0.5, 0.8	1.5*	1.3, 1.8
Surgical approach						
Open	4.2*	3.8, 4.6	...	...	...	...
Laparoscopic†	1.0	...	...	...	...	...
Abdominal	...	...	1.5*	1.3, 1.6	...	...
Vaginal†	...	...	1.0	...	...	...
Surgical complexity						
High	...	...	1.6*	1.2, 2.1	...	...
Low†	...	...	1.0	...	...	...
Appendix						
Ruptured/Peritonitis/Peritoneal abscess	...	...	...	...	3.5*	3.2, 3.7
No record of rupture/peritonitis/ peritoneal abscess†	...	...	...	...	1.0	...
Diabetes						
Yes	1.4*	1.2, 1.6	2.1*	1.8, 2.5	1.9*	1.6, 2.3
No†	1.0	...	1.0	...	1.0	...

Data source: Health Person-Oriented Information Database, 1997/98 to 1999/00
† Reference group
... Not applicable
** Significantly different from reference group (p < 0.05)*

procedure were more likely to be diagnosed with an infection after surgery, compared with those who had a less complex operation (Table 3). Surgeries involving extensive tissue removal usually indicate more pervasive illness and generally poor overall health.[54,55] More complex hysterectomies may also be more difficult and time-consuming to perform.[56] The link between surgical duration and risk of post-operative infection is not fully understood; nevertheless, longer operations may increase the risk of a surgical site becoming infected.[45,49,56]

As expected, diabetes was associated with hospitalized post-operative infection in cholecystectomy, hysterectomy and appendectomy patients. Other studies have also found an increased risk of acquiring a post-operative infection among people with diabetes.[57-59] In addition to vascular disorders, diabetes is related to obesity, another risk factor for post-operative infection.[33,60-62]

Repeat admissions

Not surprisingly, diagnosis of post-operative infection during the original surgical admission substantially increased the odds of a patient being readmitted for infection within 30 days—a finding that emerged for each of the three surgeries (Appendix Table A).

More hospital days

Together, cholecystectomy, hysterectomy, and appendectomy patients spent an average of about 4 days in hospital (Table 4). But the average number of hospital days for patients with post-operative infection greatly exceeded that for those with no documented infection. For patients diagnosed with infection, total time in hospital, including readmission within the 30-day follow-up period, ranged from about 10½ days for those who had had a hysterectomy or an appendectomy to about 18½ days for those who underwent a cholecystectomy.

Factors other than infection influence time in hospital. For patients diagnosed with a post-operative infection during the initial surgical stay, it is not known how much of that time was because of the infection. When the patient is readmitted and the hospital record identifies a post-operative infection as the diagnosis most responsible for the hospitalization, there is greater certainty about attributing the time to infection. Hysterectomy and appendectomy patients were in hospital, on average, about 5½ additional days for their infections. Cholecystectomy patients required 8 additional days of hospital treatment.

Post-operative infections costly

The average number of days patients with post-operative infection spent in hospital exceeded those for uninfected patients by 2.5 to 5 times (Table 4). It is not possible to determine how much additional time in hospital was due to post-operative infection, and how much was caused by other factors. Nonetheless, when readmissions were restricted to those for which post-operative infection accounted for the major portion (the "most responsible" diagnosis) of the stay, the extra days required by cholecystectomy, hysterectomy and appendectomy patients were estimated to have cost the health care system an additional $5.4 to $6.3 million annually (Table 5). This is likely a conservative estimate, as it

Table 4

Average number of hospital days for cholecystectomy, hysterectomy and appendectomy patients, by post-operative infection status, Canada excluding territories, 1997/98 to 1999/00

	Number of patients	Average number of hospital days†	Average length of readmission‡ (days)
Cholecystectomy	141,766	4.0	...
Uninfected	139,805	3.8	...
Infected	1,961	18.3	...
Readmitted†	593	13.4	8.3
Hysterectomy	159,644	4.3	...
Uninfected	156,390	4.2	...
Infected	3,254	10.6	...
Readmitted†	1,540	9.8	5.5
Appendectomy	80,867	3.8	...
Uninfected	77,759	3.5	...
Infected	3,108	10.5	...
Readmitted†	1,421	10.3	5.6

Data source: Health Person-Oriented Information Database, 1997/98 to 1999/00
... Not applicable
† Includes surgical stay and readmissions within 30 days of surgery.
‡ "Most responsible diagnosis" = post-operative infection

Table 5
Estimated costs of readmission with post-operative infection† after cholecystectomy, hysterectomy or appendectomy, based on cost data from Alberta and Ontario

	Cholecystectomy	Hysterectomy	Appendectomy
Number of patients readmitted	593	1,540	1,421
Average length of readmission (days)	8.4	5.5	5.6
Cost per day	$768 - $920	$801 - $925	$700 - $826
Average total cost of readmission‡	$6,451 - $7,728	$4,406 - $5,088	$3,920 - $4,626
Additional annual cost of readmissions	$1.28 - $1.53 million	$2.26 - $2.61 million	$1.86 - $2.19 million

Data sources: Health Person-Oriented Information Database, 1997/98, 1998/99, 1999/00; Health Costing in Alberta—2002 Annual Report; Ontario Case Costing Initiative—OCCI Database FY 2000/2001—Typical Cases; Ontario Case Costing Initiative—OCCI Database Top 50 Prinicipal Procedures by Volume of Cases FY 1999/2000—Typical Cases (References 11-13)
† "Most responsible diagnosis" = post-operative infection
‡ Average length of stay multiplied by cost per day

Table 6
Adjusted odds ratios for dying in hospital within 30 days of cholecystectomy, hysterectomy or appendectomy in relation to hospitalization with post-operative infection and other selected characteristics, Canada excluding territories, 1997/98 to 1999/00

	Cholecystectomy		Hysterectomy		Appendectomy	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Hospitalization with post-operative infection						
Yes	3.3*	2.5, 4.4	2.5*	1.3, 5.0	1.6	0.8, 3.3
No†	1.0	...	1.0	...	1.0	...
Sex						
Men	1.3*	1.1, 1.6	...	...	1.7*	1.0, 2.7
Women†	1.0	...	...	...	1.0	...
Age group						
≤ 60	0.1*	0.1, 0.1	0.0‡	0.0, 0.1	0.0‡	0.0, 0.0
> 60†	1.0	...	1.0	...	1.0	...
Surgical approach						
Laparoscopic†	1.0	...	...	...	...	...
Open	5.8*	4.7, 7.0	...	...	...	...
Abdominal	...	...	5.6*	3.4, 9.2	...	...
Vaginal†	...	...	1.0	...	...	...
Surgical complexity						
High	...	...	0.6	0.1, 4.4	...	...
Low†	...	...	1.0	...	...	...
Appendix						
Ruptured/Peritonitis/Peritoneal abscess	...	...	...	...	1.4	0.8, 2.2
No record of rupture/peritonitis/ peritoneal abscess†	...	...	...	...	1.0	...
Diabetes						
Yes	1.8*	1.4, 2.3	1.9*	1.1, 3.1	5.0*	2.9, 8.4
No†	1.0	...	1.0	...	1.0	...

Data source: Health Person-Oriented Information Database, 1997/98 to 1999/00
† Reference group
‡ The odds of appendectomy and hysterectomy patients dying in hospital within 30 days of their surgery are significantly reduced for those 60 or younger ($p < 0.02$ and $p < 0.05$, respectively).
··· Not applicable
** Significantly different from reference group ($p < 0.05$)*

does not include the cost of post-operative infection during readmissions when the infection was not the "most responsible" diagnosis (see *Limitations*). Also not included are costs to the health care system that did not involve hospitalization.

Contribution to death unknown

Less than 1% of the patients who underwent a cholecystectomy, hysterectomy or appendectomy died in hospital within 30 days of the procedure (data not shown). Among those who died, the proportion who had developed a post-operative infection requiring in-hospital treatment ranged from 6% to 13%. However, without cause-of-death data, the infection's contribution to death is unknown. It is likely that a combination of factors played a role in these patients' deaths.

Nonetheless, it is evident that for patients with post-operative infection, the odds of dying in hospital within 30 days of surgery—even when other, possibly confounding, factors are taken into account—are elevated. Cholecystectomy patients with post-operative infection faced more than 3 times the odds, and hysterectomy patients 2.5 times the odds, of dying in hospital soon after the surgery, compared with patients not diagnosed with a post-operative infection (Table 6). Post-operative infection did not increase the odds of in-hospital death following appendectomy, reflecting the much younger age of these patients. Death following an appendectomy was significantly associated with diabetes, being male, and advanced age.

Concluding remarks

This analysis of data from the Health Person-Oriented Information Database indicates that hospitalization with post-operative infection following cholecystectomy, hysterectomy or appendectomy is relatively rare—a finding consistent with the literature. Of the 382,277 patients who underwent one of these surgeries in the 1997/98-to-1999/00 period, post-operative infection was documented in hospital records for only 2.2%.

Several factors were associated with post-operative infection: being male, age, surgery performed in the presence of an established infection, surgical complexity, and diabetes. Laparoscopic procedures were related to a greatly reduced risk of post-operative infection among cholecystectomy patients, although other factors likely contributed to this relationship. Infection during the original surgical admission increased the risk of readmission for an infection. Again, however, other factors that could not be taken into account also most certainly contributed to these relationships.

Post-operative infection necessitating hospitalization following these three common surgeries may not occur often, but when it does, it is costly in terms of hospital resources. On average, readmissions for post-operative infection increased time in hospital by 5.5 to 8.4 days, depending on the surgery. It was estimated that these extra days cost the health care system $5.4 to $6.3 million a year. Although the number of infections that could be prevented is not known, even a modest decrease could result in considerable savings.

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Appendix

Table A
Adjusted odds ratios for readmission for post-operative infection within 30 days of cholecystectomy, hysterectomy or appendectomy in relation to selected characteristics, Canada excluding territories, 1997/98 to 1999/00

	Cholecystectomy		Hysterectomy		Appendectomy	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex						
Men	1.1	0.9, 1.3	...	...	1.2*	1.1, 1.3
Women†	1.0	...	...	...	1.0	...
Age group						
≤ 29†	1.0	...	1.0	...	1.0	...
30-39	1.0	0.7, 1.4	0.7*	0.5, 0.8	0.9	0.8, 1.1
40-49	0.8	0.6, 1.2	0.5*	0.4, 0.7	0.9	0.8, 1.1
50-59	1.3	0.9, 1.8	0.4*	0.3, 0.5	0.7*	0.6, 0.9
60-69	1.4*	1.0, 2.0	0.3*	0.2, 0.4	0.6*	0.5, 0.8
70+	1.6*	1.2, 2.2	0.3*	0.2, 0.4	0.5*	0.4, 0.8
Previous post-operative infection diagnosed during surgical stay						
Yes	3.3*	2.2, 4.9	5.5*	4.3, 7.1	3.5*	2.9, 4.3
No†	1.0	...	1.0	...	1.0	...
Surgical approach						
Open	2.3*	1.9, 2.7	...	...	...	...
Laparoscopic†	1.0	...	...	...	...	...
Abdominal	...	...	0.9*	0.8, 1.0	...	...
Vaginal†	...	...	1.0	...	...	...
Surgical complexity						
High	...	...	1.1	0.6,1.8	...	...
Low†	...	...	1.0	...	...	...
Appendix						
Ruptured/Peritonitis/Peritoneal abscess	...	...	...	...	2.3*	2.1, 2.6
No record of rupture/peritonitis/ peritoneal abscess†	...	...	...	...	1.0	...
Diabetes						
Yes	1.4*	1.0, 1.8	2.2*	1.7, 2.8	1.3	0.9, 1.9
No†	1.0	...	1.0	...	1.0	...

Data source: Health Person-Oriented Information Database, 1997/98 to 1999/00
Note: Includes only patients who were readmitted with an infection that was classified as the diagnosis most responsible for the length of stay.
† Reference group
··· Not applicable
** Significantly different from reference group ($p < 0.05$)*

Inflammatory bowel disease—hospitalization

Alice Nabalamba, Charles N. Bernstein and Craig Seko

Abstract

Objectives

This analysis examines trends in hospitalization for Crohn's disease and ulcerative colitis, the two main forms of inflammatory bowel disease (IBD).

Data sources

Data are from the Hospital Morbidity Database for 1983/84 to 2000/01, and from the Health Person-Oriented Information Database for 1994/95 to 2000/01.

Analytical techniques

Sex- and age-specific rates were calculated for separations attributed to Crohn's disease and ulcerative colitis. Rates and hospital days were also calculated for hospitalizations in which IBD was among the first five diagnostic codes on a patient's discharge abstract. The frequency of rehospitalization was examined.

Main results

From the early 1980s to the mid-1990s, annual rates of hospitalization for Crohn's disease and ulcerative colitis rose slightly, but have since levelled off. Hospitalization rates for both conditions are highest among people in their twenties. The average length of stay for patients with either disease fell from about 2 weeks in 1983/84 to 9 or 10 days in 2000/01. More than a quarter of patients hospitalized for Crohn's disease and over 20% of those with ulcerative colitis were readmitted within the same year.

Key words

Crohn's disease, ulcerative colitis, patient admission, length of stay, patient readmission

Authors

Alice Nabalamba (613-951-7188; Alice.Nabalamba@statcan.ca) is with the Health Statistics Division and Craig Seko is with the Methodology Division, both at Statistics Canada in Ottawa, Ontario, K1A 0T6. Charles N. Bernstein is with the University of Manitoba.

Inflammatory bowel disease (IBD) is a debilitating chronic condition that affects the gastrointestinal tract. It refers to two distinct disorders: Crohn's disease and ulcerative colitis (see *Inflammatory bowel disease*). These disorders frequently develop in young adulthood—an important time for family formation and laying the foundations of a career. Quality of life is often adversely affected, as IBD may result in lost productivity at school or work,[1] or in problems socializing. Patients usually need continuous medication and long-term follow-up.

While a recent estimate placed the number of Canadians with IBD between 150,000 and 160,000,[2] relatively few people are hospitalized for either Crohn's disease or ulcerative colitis. Together, these diagnoses account for less than half of one percent of hospital stays annually. However, during the past two decades, the yearly number of IBD hospitalizations and the rate per 100,000 population have remained stable. This stability persisted in the context of an overall decline in hospital use, as governments attempted to reduce costs and treat a growing number of conditions on an ambulatory basis.

Hospital data cannot, of course, be used to estimate the prevalence of IBD. Nonetheless, hospital discharge data are a means of identifying and quantifying those patients who require substantial health care resources. With information from Statistics Canada's Hospital Morbidity Database, this article tracks hospitalizations for IBD at the national and provincial levels from 1983/84 through 2000/01 (see M*ethods*). Annual numbers and rates of hospitalization for patients with a primary diagnosis of Crohn's disease or ulcerative colitis are presented by age, sex and province, along with average length of stay and total hospital days. With information from the Health Person-Oriented Information Database, the proportions of patients who are rehospitalized are shown for 1994/95 through 2000/01.

Readmission common

In 2000/01, a total of 5,564 people were admitted to hospital with a primary diagnosis of Crohn's disease, and another 2,756, with ulcerative colitis. However, together, these 8,320 people accounted for 12,254 IBD admissions, indicating that many

Inflammatory bowel disease

Inflammatory bowel disease, or IBD, refers to two distinct disorders: Crohn's disease and ulcerative colitis. The severity of these diseases can range from mild to debilitating. Even with treatment, most patients continue to have symptoms—they are simply more manageable. Although severity may fluctuate over time, for many patients, it is progressive.

Crohn's disease is chronic inflammation of the intestinal wall that usually begins in young adulthood (typically between 15 and 30).[3-5] The ileum (last part of the small intestine) and the colon (major part of the large intestine) are affected most frequently, although inflammation can occur in any part of the digestive tract from the mouth to the anus. Symptoms include diarrhea, abdominal pain, fever and weight loss. Periods of mild or no symptoms may alternate with severe episodes, which can last weeks or several months. Some people may have years that are symptom-free, while for others, symptoms can be chronic and unrelenting.

For mild episodes, patients may alter their diet and use medications such as analgesics and antidiarrheal preparations. For moderate symptoms, corticosteroids are usually required. And for the advanced disease, where there is corticosteroid-resistance or dependence, conventional immunosuppressive therapy may be used, and more recently, novel and costly biological therapies have been introduced.[6,7] Despite treatment, Crohn's disease tends to recur and often requires surgery to remove the diseased part of the intestine. However, surgery is not undertaken unless it is absolutely necessary, as further areas in the remaining intestine may become affected.

Crohn's disease can involve complications. Intestinal obstruction as a result of thickening of the intestinal wall is common. Damage to the small intestine may prevent absorption of nutrients and lead to anemia and vitamin deficiencies. Long-term inflammation of the colon increases the risk of colorectal cancer.

Ulcerative colitis is chronic inflammation of the rectum and colon that usually begins in young adulthood.[3-5] Symptoms include severe diarrhea, passage of blood and mucus, abdominal pain, fever, and eventually, weight loss. The symptoms are often intermittent, and patients may have months or years that are symptom-free.

Ulcerative colitis is usually treated with medications, although surgery to remove the diseased colon and rectum may be necessary. People with ulcerative colitis are at increased risk of colon cancer.

The causes of IBD are unknown, but recent studies have shown that genetic factors are important.[8-10] The environment may also play a role, although findings are inconclusive. One study has suggested that mycobacteria originating in farm animals are transferred through the food chain and increase susceptibility to Crohn's disease,[11] but other researchers have not found evidence of an association with mycobacteria, either serologically or in tissue studies.[12,13] Some research suggests that improved hygiene has reduced exposure to micro-organisms and thereby weakened immune systems, and contributed to the development of diseases such as IBD.[14,15] The higher prevalence of IBD after partners have lived together further indicates an environmental connection.[16]

Prenatal or childhood infections such as measles and mumps (in close succession) have also been linked to a higher likelihood of developing IBD.[17,18] Cigarette smoking has been associated with the development and/or exacerbation of Crohn's disease, although the prevalence of ulcerative colitis tends to be low among current smokers.[19-22] Appendectomy at an early age has been related to a decreased likelihood of developing ulcerative colitis.[23-26]

Table 1
Individual patients and total separations for Crohn's disease and ulcerative colitis, Canada excluding territories, 1994/95 to 2000/01

	Crohn's disease			Ulcerative colitis		
	Number of patients	% with at least two hospital stays during year	Number of separa-tions	Number of patients	% with at least two hospital stays during year	Number of separa-tions
1994/95	5,696	28.8	8,621	2,698	23.2	3,863
1995/96	5,598	29.7	8,720	2,656	23.6	3,832
1996/97	5,702	28.4	8,711	2,575	23.8	3,727
1997/98	5,727	29.5	8,838	2,554	24.7	3,712
1998/99	5,727	28.3	8,714	2,670	22.7	3,850
1999/00	5,435	28.4	8,383	2,739	23.5	3,925
2000/01	5,564	27.5	8,305	2,756	22.1	3,949

Data source: Health Person-Oriented Information Database, 1994/95 to 2000/01

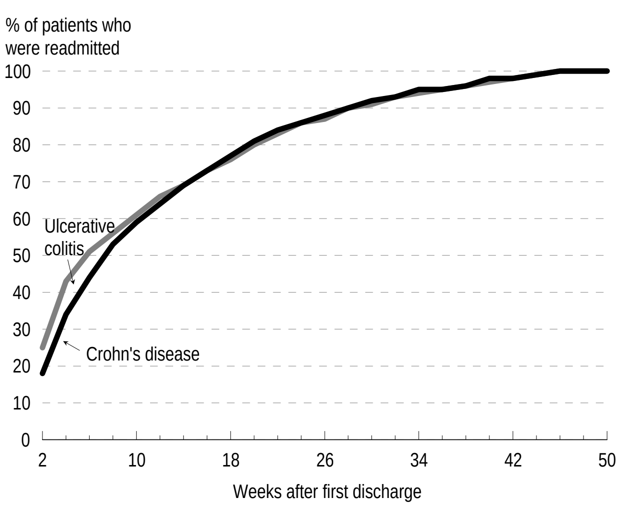
IBD patients were hospitalized at least twice that year (Table 1). More than a quarter (28%) of Crohn's disease patients had at least two hospital stays for the condition in 2000/01; the percentage for ulcerative colitis patients was 22%. Both proportions were almost unchanged from 1994/95 (the earliest year for which comparable data are available), when the figures were 29% and 23%, respectively.

For many of these rehospitalized IBD patients, the time between discharge and readmission was relatively short. More than a quarter of them were back in hospital within 3 weeks; half, within 7 weeks; and two-thirds within 15 weeks (Chart 1). However, from the limited information available on patients' records, it is not possible to determine if these readmissions had been planned in advance for further treatment, or if they resulted from a relapse of the disease.

Levelling off

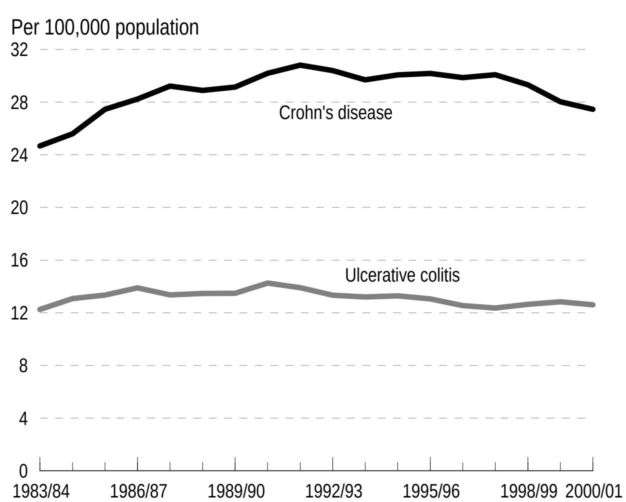
Annual age-adjusted hospitalization rates for Crohn's disease and ulcerative colitis were relatively stable throughout the two decades (Chart 2). In 2000/01, the rate for Crohn's disease was 27.5 hospitalizations per 100,000 population—a small increase from 24.7 per 100,000 in 1983/84. The rate for ulcerative colitis was 12.6 per 100,000 population in 2000/01, about the same as the 1983/84 rate of 12.3 per 100,000.

Chart 1
Time to readmission for rehospitalized Crohn's disease and ulcerative colitis patients, Canada excluding territories, 2000/01



Data source: Health Person-Oriented Information Database, 2000/01
Note: Rates of readmission for Crohn's disease and ulcerative colitis patients are based on first rehospitalization in 2000/01 primarily due to same condition.

Chart 2
Age-adjusted hospitalization rates for Crohn's disease and ulcerative colitis, Canada excluding territories, 1983/84 to 2000/01



Data source: Hospital Morbidity Database, 1983/84 to 2000/01
Note: Rates based on records where Crohn's disease or ulcerative colitis was "tabulating diagnosis" (most significant condition causing hospital stay).

Methods

Data source

The data in this article are from Statistics Canada's Hospital Morbidity Database and Health Person-Oriented Information Database. The Hospital Morbidity Database consists of information on hospital separations (discharges or deaths) from most acute care and some psychiatric, chronic and rehabilitation hospitals.[27] Each record contains demographic (for example, date of birth, sex, postal code), administrative (for example, scrambled or unscrambled health insurance number, dates of admission and separation), and clinical information (for example, diagnoses). The data are based on the April-to-March fiscal year. Hospital admission data were available for the entire 1983/84 to 2000/01 period; patient-linked data from the Health Person-Oriented Information Database were available only for the years 1994/95 to 2000/01.

Population estimates used to calculate rates were provided by Statistics Canada's Demography Division.

Analytical techniques

Hospital patients often receive several diagnoses. Each record in the Hospital Morbidity Database can contain up to 16 diagnostic codes. Among these, the condition that accounts for the major part of the hospital stay is known as the "tabulating diagnosis." This diagnosis is usually the same as the primary diagnosis, which is the condition listed first in the patient's discharge abstract. In this article, the term "primary diagnosis" is used. In accordance with the *International Classification of Diseases, Ninth Revision* (ICD-9), Crohn's disease was defined as the presence of diagnostic codes 555.0, 555.1, 555.2 and 555.9; ulcerative colitis, code 556.[28] Hospitalization rates for Crohn's disease or ulcerative colitis are based on records in which one of these conditions was the primary diagnosis. As well, a total rate of hospitalization for inflammatory bowel disease (IBD) was calculated based on records with a diagnosis of Crohn's disease or ulcerative colitis among the first five diagnostic codes.

Hospitalization rates were standardized using the indirect method. The hospitalization rates for Canada in 1991 were applied to each province's age- and sex-specific population distribution to generate the number of inpatients that would be expected in the province if it had the same rates as Canada.

Admission and separation dates were used to calculate length of stay (discharge date minus admission date).

Because hospital patients may be admitted and discharged more than once in any year, counts of separations exceed the number of people who were hospitalized. Hospital separation records for each patient were linked, based on a unique patient identifier (patient names are not provided to Statistics Canada) and sorted chronologically to generate a count of inpatients (as opposed to separations). For each patient, admission and separation dates were used to create hospitalization episodes. A yearly count of patients hospitalized for Crohn's disease and for ulcerative colitis was produced starting in 1994/95 (the earliest year for which complete data that enable tracking all hospitalizations in all provinces are available).

Limitations

The Hospital Morbidity Database and the Health Person-Oriented Information Database include only patients who were admitted to hospital. Those treated in hospital but not admitted for an overnight stay are excluded, as are people treated on an outpatient basis, and of course, individuals who receive care in doctors' offices, clinics or other non-hospital settings. Consequently, this article underestimates the true burden of inflammatory bowel disease, as it reflects only the more acute and severely symptomatic cases.

The data pertain primarily to patients in acute care hospitals. Depending on the year and jurisdiction, data for patients in other types of hospitals may or may not be reported. No adjustment was made for these or other excluded patients (military hospitals, prison hospitals, patients treated outside their home province, and patients in the territories).

The extent to which provincial variations in hospitalization rates result from differences in outpatient treatment and management of inflammatory bowel disease is unknown. As well, geographic variations may reflect provincial differences in extraction and coding practices. A patient record can have up to 16 diagnostic codes. The number of codes on a patient's chart varies from year to year and from province to province. To minimize the impact of this inconsistency, this analysis included only the first five diagnostic codes on a patient's discharge abstract. Thus, hospitalizations where inflammatory bowel disease appeared, but ranked lower among the diagnoses, were excluded. This practice may have resulted in some underestimation of IBD hospitalizations.

This stability in rates of hospitalization for Crohn's disease and ulcerative colitis contrasts with the sharp drop in hospitalization rates overall. During the same period, the total hospitalization rate for all reasons fell steadily from 14,426 to 8,947 per 100,000 (see *Trends in hospitalization*). In fact, despite population growth, in 2000/01, there were fewer hospitalizations in Canada (2.86 million) than there had been in 1983/84 (3.62 million). By contrast, the numbers for both Crohn's disease and ulcerative colitis were slightly higher at the end than at the beginning of the period. Consequently, although patient's with Crohn's disease and ulcerative colitis accounted for just 0.4% of all admissions to acute care hospitals in 2000/01, this was up slightly from 0.3% in 1983/84.

Younger patients

Unlike many conditions that necessitate hospitalization and tend to affect older people, IBD hospitalization rates are high among young adults (Chart 3, Appendix Tables A and B).

For Crohn's disease, hospitalization rates peak among people in their twenties, and fall at successively older ages. In 2000/01, the rate for 20- to 29-year-olds was 48 hospitalizations per 100,000 population; for seniors aged 70 or older, 15.4 per 100,000.

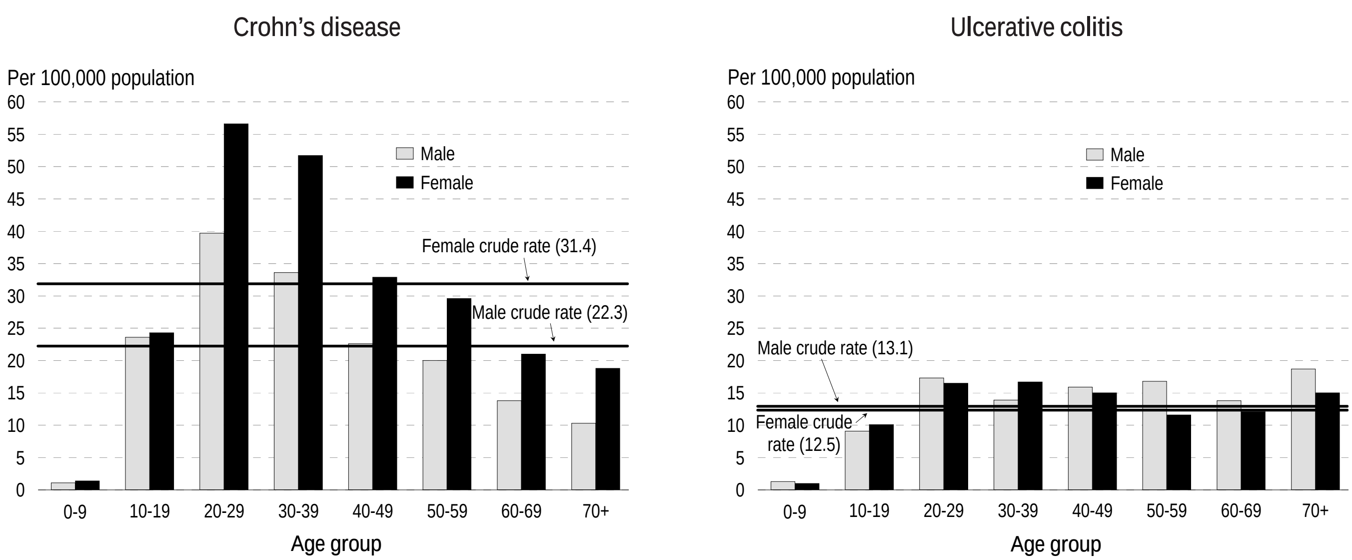
Hospitalization rates for ulcerative colitis vary little after age 20. In 2000/01, the highest rate—16.9 per 100,000—was among people in their twenties, but from ages 30 to 69, rates were not much lower, ranging between 12.9 and 15.5 per 100,000. At age 70 or older, the rate was 16.5 per 100,000, although it is possible that some older patients with ischemic colitis, a condition that mostly affects the elderly, were incorrectly coded as having ulcerative colitis.

Few children are hospitalized with either Crohn's disease or ulcerative colitis. From the early 1980s through 2000/01, hospitalization rates for both conditions among children younger than 10 hovered around 1 per 100,000.

Women's rate higher for Crohn's disease

Women are considerably more likely than men to be hospitalized for Crohn's disease. The rate in 2000/01 was 31.4 hospitalizations per 100,000 females, compared with 22.3 per 100,000 males (Chart 3). Among children and teenagers, rates varied little by sex, but starting among people in their twenties, a difference emerged: 56.5 hospitalizations per 100,000 women in this age range, compared with 39.7 per 100,000 men. This gap persisted in all older age groups.

Chart 3
Age-specific hospitalization rates for Crohn's disease and ulcerative colitis, by sex, Canada excluding territories, 2000/01



Data source: Hospital Morbidity Database, 1983/84 to 2000/01

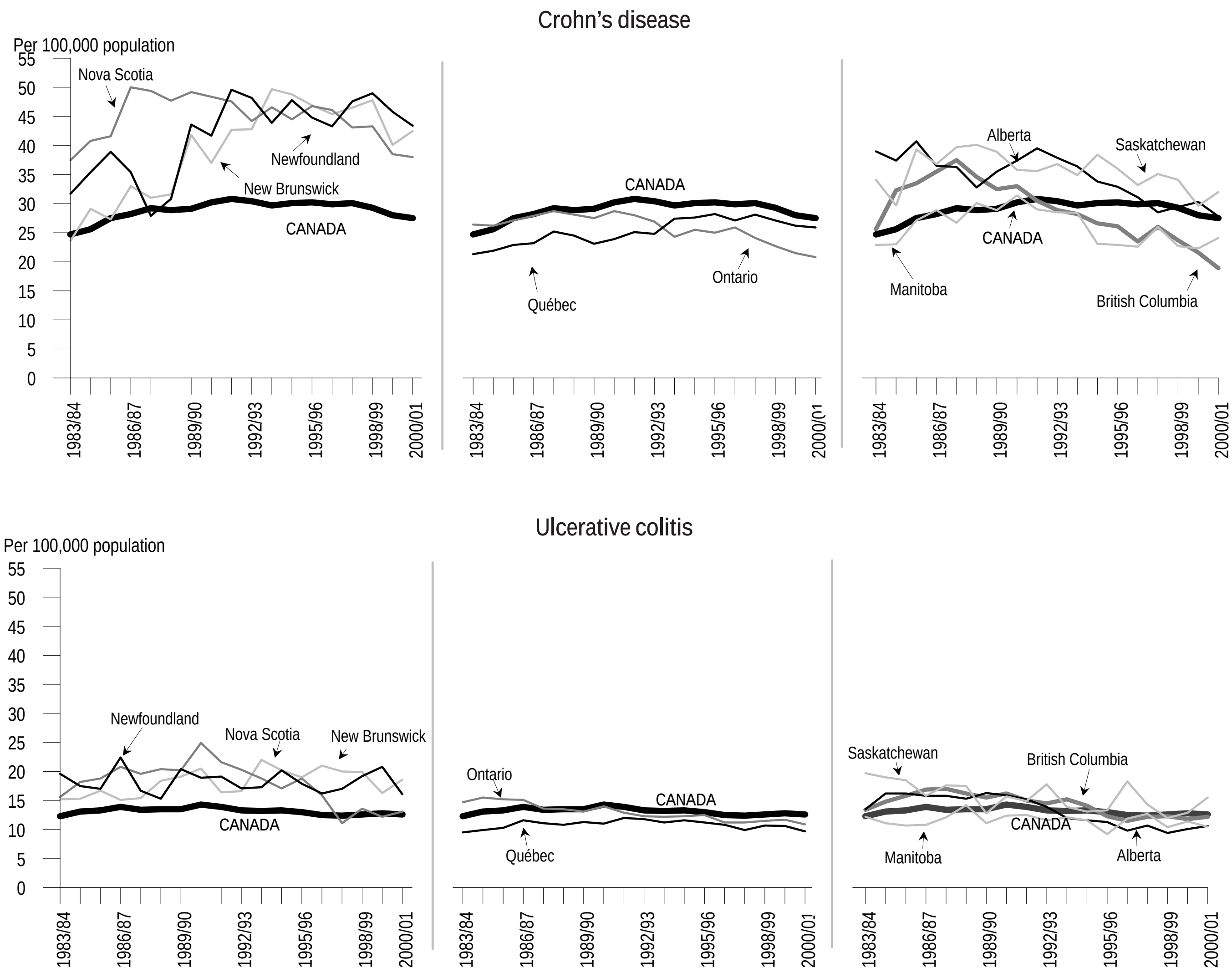
Hospitalization rates for ulcerative colitis were about the same among males and females. In 2000/01, the rates were 13.1 per 100,000 males and 12.5 per 100,000 females. And for each age group, differences in hospitalization rates between the sexes were small.

In the provinces

In 2000/01, hospitalization rates for Crohn's disease rates were above the 1983/84 level in the Atlantic provinces, Québec and Manitoba (Appendix Table C). By contrast, in Ontario, Saskatchewan, Alberta and British Columbia, 2000/01 rates were down from 1983/84.

Throughout the period, Crohn's disease hospitalization rates tended to be high in the Atlantic provinces, Saskatchewan and Alberta, and low in Ontario and Québec (Chart 4). Rates in British Columbia had been well above the national level in the early 1980s, but by the late 1990s, were the lowest in the country.

Chart 4
Age-adjusted hospitalization rates for Crohn's disease and ulcerative colitis, by province,† 1983/84 to 2000/01



Data source: *Hospital Morbidity Database, 1983/84 to 2000/01*
† Because of low numbers in Prince Edward Island, small changes in annual hospitalizations can produce sharp fluctuations in rates; therefore, data for Prince Edward Island are not shown but are included in national totals (Appendix Table A).

Hospitalization rates for ulcerative colitis were generally high in the Atlantic provinces and Saskatchewan, and low in the other provinces (Appendix Table D).

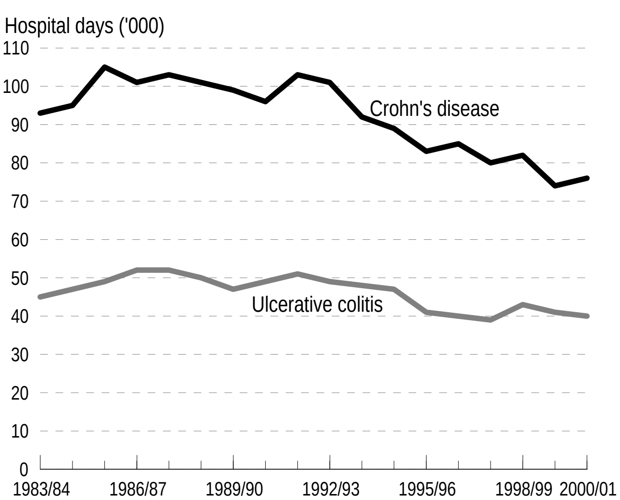
Shorter stays/Fewer days

During the past two decades, hospital stays for IBD have become shorter. In the early 1980s, patients admitted with a primary diagnosis of Crohn's disease or ulcerative colitis stayed an average of about two weeks (Appendix Tables E and F). By 2000/01, the average was 9 or 10 days.

Shorter stays have meant that the annual number of hospital days devoted to the two diseases has fallen (Appendix Tables E and F). In 2000/01, Crohn's disease patients accounted for about 76,000 hospital days, compared with almost 93,000 days in 1983/84 (Chart 5). Close to 40,000 hospital days were attributable to ulcerative colitis in 2000/01, down from nearly 45,000 days in 1983/84.

However, this decline in IBD patient-days was slower than the drop in hospital days overall (see *Trends in hospitalization*). Consequently, as a percentage of all hospital days, those accounted for by Crohn's disease or ulcerative colitis rose from 0.34% to 0.46%.

Chart 5
Annual number of hospital days for Crohn's disease and ulcerative colitis, 1983/84 to 2000/01



Data source: Hospital Morbidity Database, 1983/84 to 2000/01

Trends in hospitalization

Over the past two decades, the likelihood of being admitted to hospital has declined sharply, and those who are admitted now tend to stay less time than would have been the case 20 years ago.

In the 1980s and early 1990s, the annual number of hospitalizations was relatively stable, hovering around 3.7 million. However, since 1991/92, the number has dropped steadily so that in 2000/01, it was 2.9 million. The falling numbers reflect a sharp decline in the overall hospitalization rate, from 14,426 per 100,000 population at the beginning of the period to 8,947 per 100,000 at the end. This suggests that many patients who would once have been admitted are receiving treatment on an outpatient basis, and only the more serious cases are hospitalized. Even so, the average time that patients stay in hospital fell from close to 12 days in the late 1980s to less than 9 days in 2000/01. Lower hospitalization rates and shorter stays have meant that the annual number of days Canadians spent in hospital dropped from over 40 million in the 1980s and early 1990s to just over 25 million in 2000/01.

Total hospital separations, age-adjusted rates, average length of stay and total hospital days, Canada excluding territories, 1983/84 to 2000/01

	Hospital separations			
	Number (millions)	Age-adjusted rate per 100,000 population	Average length of stay (days)	Total hospital days (millions)
1983/84	3.62	14,426	11.3	40.8
1984/85	3.64	14,294	11.4	41.5
1985/86	3.65	14,106	11.7	42.8
1986/87	3.69	14,021	11.7	43.2
1987/88	3.70	13,847	11.9	43.8
1988/89	3.65	13,396	11.9	43.4
1989/90	3.62	13,058	11.4	41.4
1990/91	3.62	12,868	11.4	41.4
1991/92	3.65	12,742	11.4	41.4
1992/93	3.44	11,828	11.0	37.7
1993/94	3.41	11,548	11.0	37.5
1994/95	3.33	11,364	10.9	36.2
1995/96	3.19	10,748	10.8	34.5
1996/97	3.06	10,151	10.7	32.9
1997/98	3.00	9,798	9.9	29.5
1998/99	2.95	9,498	8.6	25.4
1999/00	2.91	9,258	8.7	25.4
2000/01	2.86	8,947	8.8	25.1

Data source: Hospital Morbidity Database, 1983/84 to 2000/01

Beyond the primary diagnosis

Admissions with Crohn's disease or ulcerative colitis as the primary diagnosis give only part of the picture of the impact these conditions have on hospital resources. For example, in 2000/01, Crohn's disease was the primary diagnosis on the patient's discharge abstract for 8,305 hospitalizations, but it was listed second for another 4,207, and third for 1,964. The pattern was the same for ulcerative colitis—3,949 hospitalizations were attributed to the disease, but it was the second diagnosis recorded in another 1,494 admissions, and third in an additional 920.

If hospitalizations with Crohn's disease or ulcerative colitis recorded among the first five diagnoses from a patient's chart are considered together, in 2000/01, the total number amounted to 23,152, and the hospitalization rate was 74.5 per 100,000 population (Appendix Table G). These hospitalizations accounted for 206,095 days, almost twice the total when only primary diagnoses are considered (115,580).

Concluding remarks

Crohn's disease and ulcerative colitis made up less than half of one percent of all hospital separations in 2000/01. However, over the past two decades, IBD hospitalization rates have been relatively stable, in sharp contrast to a steady decline in the overall rate of hospitalization in Canada. As a result, the percentage of all hospitalizations attributable to IBD has risen.

To a considerable degree, the stability of IBD rates reflects a high proportion of readmissions, with about a quarter of patients being hospitalized at least twice within the same year. In an era of cutbacks and efforts to treat more conditions on an ambulatory basis, Crohn's disease and ulcerative colitis seem to be resistant. If people are increasingly treated as outpatients, but a substantial number still require hospital care, this could indicate a rising prevalence of these diseases.

The average length of stay for IBD patients has fallen since the early 1980s, with a consequent drop in patient-days. Even so, this decrease did not keep pace with the drop in patient-days overall, so by 2000/01, the percentage of all hospital days attributable to Crohn's disease and ulcerative colitis was actually higher than in 1983/84.

Provincial variations in IBD hospitalization rates, particularly for Crohn's disease, could result from a combination of several factors. For example, the high rates in the Atlantic region (and to a lesser extent in Saskatchewan) might reflect the substantial proportion of the population living in rural areas. Both conditions require prolonged care and monitoring by a specialist. Because of the distances involved, it may be more difficult to treat rural residents as outpatients, so there may be a tendency to hospitalize those who would need repeated trips for care. The decision to hospitalize an IBD patient may reflect physicians' diagnostic and practice styles, experience, and the availability of alternatives, but such data are not available from the Hospital Morbidity Database or the Health Person-Oriented Information Database. Differences in disease prevalence and severity may also play a role, but again, such information is not available.

In an era of general decline in hospitalization rates, the stability of rates for Crohn's disease and ulcerative colitis suggests that management of the conditions is challenging for both the health care system and for the people diagnosed. Unlike many other patients, those hospitalized—and repeatedly hospitalized—for IBD are often in their twenties and thirties, an important time in family and career development.

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Appendix

Table A
Hospital separations and age-specific rates for Crohn's disease, Canada excluding territories, 1983/84 to 2000/01

		Age group							
	Total	0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70+
Number of separations									
1983/84	6,403	45	952	2,147	1,439	713	477	373	257
1984/85	6,741	38	913	2,365	1,531	694	559	353	288
1985/86	7,313	35	964	2,532	1,705	870	512	358	337
1986/87	7,607	35	1,023	2,554	1,830	885	577	390	313
1987/88	7,948	41	1,096	2,602	1,873	960	599	433	344
1988/89	7,977	42	1,020	2,551	1,913	1,023	595	472	361
1989/90	8,135	31	962	2,592	2,057	1,146	586	448	313
1990/91	8,489	44	1,024	2,704	2,007	1,168	692	475	375
1991/92	8,763	32	980	2,774	2,219	1,277	639	451	391
1992/93	8,731	36	930	2,691	2,262	1,328	630	487	367
1993/94	8,562	35	915	2,606	2,233	1,305	622	484	362
1994/95	8,621	53	864	2,630	2,200	1,379	661	454	380
1995/96	8,720	46	967	2,514	2,309	1,397	663	447	377
1996/97	8,711	34	914	2,400	2,345	1,428	742	475	373
1997/98	8,838	55	1,017	2,391	2,347	1,416	739	454	419
1998/99	8,714	28	1,031	2,176	2,282	1,448	861	479	409
1999/00	8,383	47	975	2,096	2,208	1,398	795	443	421
2000/01	8,305	48	992	2,030	2,132	1,371	896	421	415
Rate per 100,000 population									
1983/84	24.7	1.2	24.1	43.6	35.0	25.3	19.3	18.9	15.1
1984/85	25.6	1.0	23.7	47.9	36.1	23.9	22.7	17.5	16.4
1985/86	27.5	1.0	25.3	50.9	39.0	28.9	20.7	17.3	18.6
1986/87	28.2	0.9	27.0	51.9	41.0	27.9	23.2	18.4	16.7
1987/88	29.2	1.1	28.9	53.6	41.0	28.8	24.0	19.9	17.9
1988/89	28.9	1.1	26.8	52.9	40.6	29.2	23.7	21.3	18.3
1989/90	29.1	0.8	25.2	54.5	42.5	31.3	23.1	19.9	15.3
1990/91	30.2	1.1	26.7	58.3	40.6	30.6	26.8	20.9	17.6
1991/92	30.8	0.8	25.3	60.7	43.8	32.2	24.3	19.6	17.7
1992/93	30.4	0.9	23.8	60.0	43.7	32.4	23.3	21.0	16.1
1993/94	29.7	0.9	23.2	59.7	42.7	30.7	22.2	20.8	15.3
1994/95	30.1	1.3	21.8	61.0	42.3	32.6	23.6	19.6	16.4
1995/96	30.2	1.2	24.1	59.4	44.1	31.8	23.0	19.2	15.9
1996/97	29.9	0.9	22.6	57.2	44.8	31.6	24.8	20.4	15.3
1997/98	30.1	1.4	25.0	57.0	45.2	30.6	23.4	19.4	16.7
1998/99	29.3	0.7	25.2	52.0	44.5	30.7	26.0	20.3	15.9
1999/00	28.0	1.2	23.7	49.8	43.6	28.9	23.0	18.6	16.0
2000/01	27.5	1.3	23.9	48.0	42.5	27.7	24.8	17.5	15.4

Data source: *Hospital Morbidity Database, 1983/84 to 2000/01*
Note: *Rate for total population is age-adjusted.*

Table B
Hospital separations and age-specific rates for ulcerative colitis, Canada excluding territories, 1983/84 to 2000/01

	Total	Age group							
		0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70+
Number of separations									
1983/84	3,102	40	346	757	657	326	336	295	345
1984/85	3,347	46	338	839	681	427	319	343	354
1985/86	3,501	40	371	924	747	413	363	320	323
1986/87	3,689	38	341	975	827	482	338	333	355
1987/88	3,600	37	319	973	787	429	340	332	383
1988/89	3,687	55	358	880	841	495	316	341	401
1989/90	3,749	46	344	955	866	523	304	328	383
1990/91	4,011	56	412	964	941	547	309	379	403
1991/92	3,969	48	362	961	935	545	334	330	454
1992/93	3,856	45	356	921	903	529	324	329	449
1993/94	3,856	52	326	846	948	575	371	341	397
1994/95	3,863	44	351	804	970	579	362	318	435
1995/96	3,832	30	346	798	884	650	340	365	419
1996/97	3,727	25	336	764	872	641	386	320	383
1997/98	3,712	35	368	720	850	641	372	338	388
1998/99	3,850	42	393	695	830	657	470	347	416
1999/00	3,925	38	391	764	876	694	398	304	460
2000/01	3,949	44	396	713	766	764	511	310	445
Rate per 100,000 population									
1983/84	12.3	1.1	8.8	15.4	16.0	11.6	13.6	14.9	20.3
1984/85	13.1	1.3	8.8	17.0	16.1	14.7	12.9	17.0	20.1
1985/86	13.4	1.1	9.7	18.6	17.1	13.7	14.7	15.5	17.8
1986/87	13.9	1.0	9.0	19.8	18.5	15.2	13.6	15.7	19.0
1987/88	13.4	1.0	8.4	20.1	17.2	12.9	13.7	15.3	20.0
1988/89	13.5	1.4	9.4	18.2	17.8	14.1	12.6	15.4	20.3
1989/90	13.5	1.2	9.0	20.1	17.9	14.3	12.0	14.6	18.7
1990/91	14.3	1.4	10.7	20.8	19.0	14.4	12.0	16.7	19.0
1991/92	13.9	1.2	9.4	21.0	18.5	13.8	12.7	14.4	20.6
1992/93	13.3	1.1	9.1	20.6	17.5	12.9	12.0	14.2	19.6
1993/94	13.2	1.3	8.3	19.4	18.1	13.5	13.3	14.7	16.8
1994/95	13.3	1.1	8.9	18.6	18.7	13.7	12.9	13.7	18.8
1995/96	13.1	0.8	8.6	18.8	16.9	14.8	11.8	15.7	17.6
1996/97	12.6	0.6	8.3	18.2	16.7	14.2	12.9	13.7	15.7
1997/98	12.4	0.9	9.0	17.2	16.4	13.9	11.8	14.4	15.5
1998/99	12.6	1.1	9.6	16.6	16.2	13.9	14.2	14.7	16.2
1999/00	12.8	1.0	9.5	18.2	17.3	14.4	11.5	12.8	17.5
2000/01	12.6	1.1	9.6	16.9	15.3	15.5	14.2	12.9	16.5

Data source: Hospital Morbidity Database, 1983/84 to 2000/01
Note: Rate for total population is age-adjusted.

Table C
Hospital separations and age-adjusted rates for Crohn's disease, Canada and provinces, 1983/84 to 2000/01

	Canada†	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Number of separations											
1983/84	6,403	170	21	307	158	1,336	2,269	225	312	902	703
1984/85	6,741	191	22	341	198	1,395	2,310	231	278	875	900
1985/86	7,313	212	28	354	189	1,489	2,463	279	372	973	954
1986/87	7,607	195	35	431	231	1,542	2,615	301	352	874	1,031
1987/88	7,948	156	23	431	220	1,693	2,766	281	381	876	1,121
1988/89	7,977	175	46	424	228	1,688	2,825	320	384	811	1,076
1989/90	8,135	251	30	444	307	1,625	2,842	309	368	906	1,053
1990/91	8,489	244	45	443	277	1,703	3,019	340	340	975	1,103
1991/92	8,763	297	53	444	326	1,828	3,028	319	342	1,060	1,066
1992/93	8,731	290	52	415	328	1,819	2,928	316	356	1,023	1,020
1993/94	8,562	270	41	443	385	2,033	2,682	318	342	1,005	1,036
1994/95	8,621	286	58	422	365	2,050	2,843	259	376	941	1,016
1995/96	8,720	268	59	450	367	2,123	2,849	261	359	942	1,034
1996/97	8,711	258	47	450	361	2,082	3,025	261	337	914	969
1997/98	8,838	283	45	426	374	2,184	2,875	305	364	866	1,103
1998/99	8,714	292	72	436	390	2,147	2,774	270	360	926	1,018
1999/00	8,383	273	53	394	331	2,101	2,688	269	316	982	953
2000/01	8,305	262	46	395	356	2,115	2,677	296	346	928	851
Age-adjusted rate per 100,000 population											
1983/84	24.7	31.7	18.3	37.5	23.6	21.3	26.4	22.9	34.1	39.0	25.6
1984/85	25.6	35.4	18.8	40.8	29.1	21.9	26.2	23.0	29.7	37.4	32.3
1985/86	27.5	38.9	23.4	41.6	27.3	22.9	27.1	27.1	39.3	40.7	33.5
1986/87	28.2	35.4	29.1	50.0	33.0	23.2	27.9	28.9	36.8	36.5	35.5
1987/88	29.2	27.9	18.8	49.4	31.0	25.2	28.7	26.7	39.7	36.3	37.5
1988/89	28.9	30.8	37.0	47.7	31.6	24.5	28.1	30.1	40.1	32.8	34.6
1989/90	29.1	43.6	24.0	49.2	41.8	23.1	27.5	28.9	38.9	35.5	32.5
1990/91	30.2	41.7	35.6	48.4	37.0	23.9	28.7	31.4	35.8	37.4	33.0
1991/92	30.8	49.6	41.2	47.6	42.7	25.1	28.0	29.0	35.6	39.5	30.5
1992/93	30.4	48.2	40.3	44.2	42.8	24.8	26.9	28.5	36.8	37.9	28.9
1993/94	29.7	43.9	31.1	46.6	49.7	27.4	24.3	28.4	34.9	36.4	28.2
1994/95	30.1	47.9	43.5	44.5	48.8	27.6	25.5	23.1	38.4	33.8	26.6
1995/96	30.2	44.8	43.3	46.8	46.9	28.2	25.0	22.9	36.0	32.9	26.1
1996/97	29.9	43.3	33.7	46.1	45.4	27.1	25.9	22.6	33.2	31.1	23.5
1997/98	30.1	47.6	31.7	43.1	46.5	28.2	24.1	26.0	35.1	28.5	26.0
1998/99	29.3	49.0	49.9	43.3	47.8	27.1	22.7	22.7	34.1	29.4	23.7
1999/00	28.0	45.8	36.1	38.5	40.1	26.2	21.5	22.3	29.6	30.3	21.6
2000/01	27.5	43.4	30.7	38.0	42.5	25.9	20.8	24.1	32.0	27.8	18.9

Data source: Hospital Morbidity Database, 1983/84 to 2000/01
† Excludes territories

Table D
Hospital separations and age-adjusted rates for ulcerative colitis, Canada and provinces, 1983/84 to 2000/01

	Canada†	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Number of separations											
1983/84	3,102	99	9	125	99	579	1,238	119	180	291	363
1984/85	3,347	89	13	149	101	612	1,333	111	176	353	410
1985/86	3,501	89	18	158	113	655	1,364	110	175	368	451
1986/87	3,689	118	16	177	104	758	1,399	112	151	362	492
1987/88	3,600	89	24	170	108	735	1,298	128	170	366	512
1988/89	3,687	84	19	181	132	736	1,341	152	170	364	508
1989/90	3,749	114	17	183	140	789	1,351	120	124	404	507
1990/91	4,011	108	22	229	153	785	1,468	137	154	404	551
1991/92	3,969	112	27	204	126	879	1,400	140	149	400	532
1992/93	3,856	101	27	193	128	871	1,336	132	179	368	521
1993/94	3,856	104	17	182	172	843	1,359	139	141	326	570
1994/95	3,863	119	25	166	153	873	1,388	134	134	318	550
1995/96	3,832	106	20	185	151	862	1,443	108	138	319	496
1996/97	3,727	97	16	159	170	846	1,332	141	193	284	483
1997/98	3,712	102	14	113	165	792	1,366	153	154	322	528
1998/99	3,850	116	10	142	167	868	1,446	128	132	295	537
1999/00	3,925	126	17	129	138	869	1,497	142	144	325	533
2000/01	3,949	100	18	142	162	829	1,453	135	176	354	574
Age-adjusted rate per 100,000 population											
1983/84	12.3	19.6	7.9	15.6	15.2	9.5	14.7	12.2	19.7	13.5	13.4
1984/85	13.1	17.5	11.2	18.2	15.3	9.9	15.5	11.1	19.0	16.2	14.8
1985/86	13.4	17.0	15.1	18.8	16.7	10.3	15.2	10.7	18.5	16.2	15.8
1986/87	13.9	22.4	13.3	20.8	15.1	11.6	15.1	10.8	15.8	15.8	16.9
1987/88	13.4	16.7	19.6	19.6	15.4	11.1	13.6	12.1	17.6	15.8	17.0
1988/89	13.5	15.3	15.2	20.4	18.4	10.8	13.5	14.2	17.5	15.3	16.2
1989/90	13.5	20.4	13.4	20.2	19.1	11.3	13.1	11.1	12.8	16.3	15.5
1990/91	14.3	18.9	17.2	24.9	20.5	11.0	14.0	12.4	15.7	15.9	16.2
1991/92	13.9	19.1	20.5	21.6	16.4	12.0	12.9	12.5	14.9	15.2	15.0
1992/93	13.3	17.1	20.4	20.3	16.6	11.8	12.3	11.6	17.8	13.9	14.5
1993/94	13.2	17.3	12.6	18.8	22.0	11.2	12.2	12.1	13.9	12.0	15.2
1994/95	13.3	20.2	18.3	17.1	20.2	11.6	12.3	11.6	13.1	11.6	14.1
1995/96	13.1	17.9	14.3	18.8	19.0	11.2	12.5	9.2	13.3	11.3	12.3
1996/97	12.6	16.2	11.2	15.9	21.0	10.8	11.2	11.9	18.3	9.8	11.5
1997/98	12.4	17.0	9.6	11.1	20.0	9.9	11.2	12.7	14.3	10.7	12.2
1998/99	12.6	19.2	6.7	13.6	19.9	10.7	11.5	10.4	12.0	9.4	12.3
1999/00	12.8	20.8	11.2	12.2	16.3	10.6	11.7	11.4	12.9	10.1	11.8
2000/01	12.6	16.1	11.5	13.1	18.6	9.7	10.9	10.5	15.5	10.6	12.2

Data source: *Hospital Morbidity Database, 1983/84 to 2000/01*
† Excludes territories

Table E
Number of hospital days and average length of stay for Crohn's disease, by age group, Canada excluding territories, 1983/84 to 2000/01

	Total	Age group							
		0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70+
Number of days									
1983/84	92,567	436	12,454	28,048	19,088	10,282	8,207	7,047	7,005
1984/85	95,489	344	10,748	31,489	19,832	10,311	9,518	5,803	7,444
1985/86	104,961	381	11,681	31,427	23,215	11,443	8,047	9,653	9,114
1986/87	101,366	266	11,395	30,468	23,782	11,144	8,338	7,513	8,460
1987/88	102,567	266	12,552	30,096	24,143	12,604	8,611	7,095	7,200
1988/89	100,589	419	10,330	30,352	23,572	13,016	7,918	7,789	7,193
1989/90	99,372	255	10,129	28,723	23,641	14,100	7,957	6,764	7,803
1990/91	96,015	204	10,644	27,484	21,284	12,514	8,861	7,781	7,243
1991/92	102,928	229	9,248	29,448	24,435	13,928	8,257	6,186	11,197
1992/93	100,503	240	8,960	28,713	23,608	13,715	8,020	6,149	11,099
1993/94	91,611	290	7,874	24,578	22,838	14,788	8,573	6,753	5,919
1994/95	88,577	424	7,179	24,786	21,345	14,291	8,414	6,213	5,926
1995/96	82,768	359	8,266	21,389	21,521	12,934	6,811	5,429	6,061
1996/97	85,196	331	7,547	20,048	20,468	13,399	6,989	5,848	10,569
1997/98	79,896	512	8,523	19,688	19,407	12,636	7,625	5,182	6,325
1998/99	82,054	261	8,223	17,550	20,070	13,692	9,257	5,307	7,696
1999/00	73,600	419	8,347	16,673	18,713	11,582	7,581	4,881	5,406
2000/01	75,709	284	7,675	15,635	16,949	11,678	9,349	4,919	9,222
Average number of days									
1983/84	14.5	9.7	13.1	13.1	13.3	14.4	17.2	18.9	27.3
1984/85	14.2	9.1	11.8	13.3	13.0	14.9	17.0	16.4	25.9
1985/86	14.4	10.9	12.1	12.4	13.6	13.2	15.7	27.0	27.0
1986/87	13.3	7.6	11.1	11.9	13.0	12.6	14.5	19.3	27.0
1987/88	12.9	6.5	11.5	11.6	12.9	13.1	14.4	16.4	20.9
1988/89	12.6	10.0	10.1	11.9	12.3	12.7	13.3	16.5	19.9
1989/90	12.2	8.2	10.5	11.1	11.5	12.3	13.6	15.1	24.9
1990/91	11.3	4.6	10.4	10.2	10.6	10.7	12.8	16.4	19.3
1991/92	11.8	7.2	9.4	10.6	11.0	10.9	12.9	13.7	28.6
1992/93	11.8	8.0	9.4	10.7	11.0	11.0	12.9	14.0	29.1
1993/94	10.7	8.3	8.6	9.4	10.2	11.3	13.8	14.0	16.4
1994/95	10.3	8.0	8.3	9.4	9.7	10.4	12.7	13.7	15.6
1995/96	9.5	7.8	8.5	8.5	9.4	9.3	10.3	12.2	16.1
1996/97	9.8	9.7	8.3	8.4	8.7	9.4	9.4	12.4	28.3
1997/98	9.0	9.1	8.4	8.2	8.3	8.9	10.3	11.5	15.1
1998/99	9.4	9.3	8.0	8.1	8.8	9.5	10.7	11.1	18.7
1999/00	8.8	8.9	8.6	8.0	8.5	8.3	9.6	11.0	12.9
2000/01	9.1	5.8	7.7	7.7	8.0	8.5	10.5	11.7	22.2

Data source: *Hospital Morbidity Database, 1983/84 to 2000/01*

Table F
Number of hospital days and average length of stay for ulcerative colitis, by age group, Canada excluding territories, 1983/84 to 2000/01

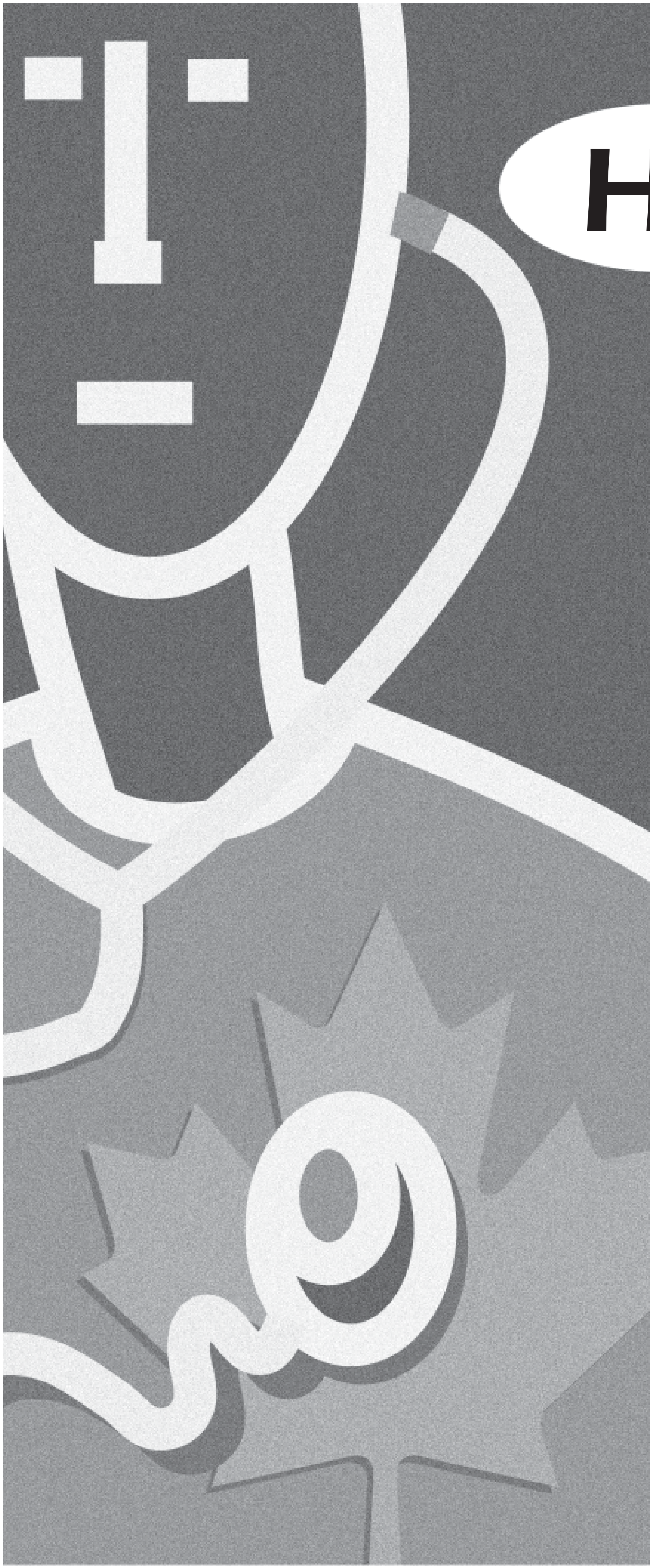
	Total	Age group							
		0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70+
Number of days									
1983/84	44,888	393	4,367	10,550	8,201	4,447	4,650	5,115	7,165
1984/85	46,585	667	3,981	10,553	8,813	5,894	4,516	5,307	6,854
1985/86	48,786	347	4,006	11,307	9,730	5,432	5,709	5,351	6,904
1986/87	52,000	336	3,859	12,149	10,254	6,571	4,792	5,289	8,750
1987/88	51,537	382	3,450	12,241	10,191	6,674	5,295	5,557	7,747
1988/89	49,638	528	3,576	9,948	10,285	6,457	4,118	5,728	8,998
1989/90	47,287	485	3,862	10,624	10,044	6,634	4,047	4,276	7,315
1990/91	48,971	455	4,128	11,091	10,296	6,998	4,224	5,465	6,314
1991/92	50,578	419	3,662	11,060	10,809	6,378	4,961	4,514	8,775
1992/93	49,072	386	3,460	10,537	10,474	6,222	4,834	4,542	8,617
1993/94	48,379	494	3,448	9,175	10,849	6,922	4,321	4,843	8,328
1994/95	47,066	543	2,973	8,035	9,955	6,693	4,234	8,328	6,308
1995/96	40,930	239	3,097	7,772	8,790	6,790	3,729	4,351	6,163
1996/97	40,354	254	2,952	7,117	8,453	7,260	4,568	3,822	5,930
1997/98	39,142	352	3,346	6,481	8,064	6,280	4,004	4,215	6,400
1998/99	42,686	463	3,611	6,505	7,743	6,492	5,298	4,388	8,186
1999/00	41,125	299	3,633	6,858	8,412	7,201	4,207	3,971	6,546
2000/01	39,871	508	3,605	6,054	6,744	7,136	5,122	3,888	6,817
Average number of days									
1983/84	14.5	9.8	12.6	13.9	12.5	13.6	13.8	17.3	20.8
1984/85	13.9	14.5	11.8	12.6	12.9	13.8	14.2	15.5	19.4
1985/86	13.9	8.7	10.8	12.2	13.0	13.2	15.7	16.7	21.4
1986/87	14.1	8.8	11.3	12.5	12.4	13.6	14.2	15.9	24.7
1987/88	14.3	10.3	10.8	12.6	13.0	15.6	15.6	16.7	20.2
1988/89	13.5	9.6	10.0	11.3	12.2	13.0	13.0	16.8	22.4
1989/90	12.6	10.5	11.2	11.1	11.6	12.7	13.3	13.0	19.1
1990/91	12.2	8.1	10.0	11.5	10.9	12.8	13.7	14.4	15.7
1991/92	12.7	8.7	10.1	11.5	11.6	11.7	14.9	13.7	19.3
1992/93	12.8	8.6	9.8	11.5	11.6	11.8	15.0	13.8	19.2
1993/94	12.6	9.5	10.5	10.8	11.4	12.1	11.7	14.2	20.9
1994/95	12.2	11.5	8.5	10.0	10.3	11.6	11.7	26.2	14.5
1995/96	10.7	8.0	9.0	9.7	10.0	10.4	11.0	11.9	14.7
1996/97	10.8	9.8	8.8	9.3	9.7	11.3	11.8	11.9	15.5
1997/98	10.5	10.0	9.1	9.0	9.5	9.8	10.8	12.5	16.4
1998/99	11.1	11.0	9.2	9.4	9.3	9.9	11.3	12.7	19.7
1999/00	10.5	7.7	9.3	9.0	9.6	10.4	10.6	13.1	14.2
2000/01	10.1	11.8	9.1	8.5	8.8	9.4	10.0	12.5	15.3

Data source: *Hospital Morbidity Database, 1983/84 to 2000/01*

Table G
Hospital separations and age-specific rates for patients with inflammatory bowel disease,† Canada excluding territories, 1983/84 to 2000/01

	Total	Age group							
		0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70+
Number of separations									
1983/84	14,388	102	1,576	4,199	3,240	1,646	1,391	1,156	1,078
1984/85	15,330	105	1,518	4,654	3,425	1,775	1,418	1,210	1,225
1985/86	16,595	105	1,677	4,951	3,753	2,046	1,516	1,271	1,276
1986/87	17,368	105	1,719	5,006	4,084	2,174	1,570	1,390	1,320
1987/88	17,966	101	1,776	5,188	4,146	2,331	1,579	1,414	1,431
1988/89	18,805	133	1,833	5,155	4,431	2,534	1,616	1,526	1,577
1989/90	19,701	105	1,720	5,248	4,799	2,850	1,576	1,778	1,625
1990/91	21,211	136	1,902	5,592	4,983	3,037	1,864	1,922	1,775
1991/92	21,645	112	1,756	5,627	5,316	3,263	1,891	1,740	1,940
1992/93	21,592	108	1,722	5,502	5,239	3,247	1,918	1,795	2,061
1993/94	22,408	124	1,662	5,402	5,514	3,558	2,109	1,921	2,118
1994/95	23,017	156	1,665	5,367	5,677	3,682	2,218	1,959	2,293
1995/96	23,418	131	1,759	5,156	5,632	3,899	2,303	2,008	2,530
1996/97	22,313	101	1,687	4,872	5,612	3,742	2,255	1,859	2,185
1997/98	22,595	132	1,829	4,807	5,513	3,844	2,329	1,867	2,274
1998/99	22,878	109	1,854	4,474	5,547	3,881	2,726	1,950	2,337
1999/00	22,942	117	1,893	4,559	5,517	3,937	2,708	1,825	2,386
2000/01	23,152	121	1,923	4,352	5,235	4,103	2,961	1,903	2,554
Rate per 100,000 population									
1983/84	56.4	2.8	39.8	85.2	78.8	58.4	56.4	58.4	63.5
1984/85	59.2	2.9	39.3	94.2	80.8	61.2	57.5	60.0	69.6
1985/86	63.0	2.9	44.0	99.6	85.9	68.0	61.2	61.5	70.3
1986/87	65.1	2.8	45.4	101.7	91.5	68.4	63.2	65.6	70.5
1987/88	66.5	2.7	46.9	106.9	90.6	69.8	63.4	65.1	74.6
1988/89	68.5	3.5	48.2	106.9	93.9	72.3	64.2	68.8	79.8
1989/90	70.8	2.7	45.0	110.4	99.2	77.8	62.1	79.1	79.3
1990/91	75.4	3.5	49.5	120.6	100.8	79.7	72.3	84.5	83.5
1991/92	75.9	2.8	45.4	123.0	105.0	82.4	71.9	75.8	87.8
1992/93	74.8	2.7	44.1	122.7	101.2	79.1	70.9	77.5	90.1
1993/94	76.9	3.1	42.1	123.8	105.4	83.7	75.4	82.6	89.6
1994/95	79.4	3.9	42.0	124.4	109.3	87.0	79.3	84.6	99.0
1995/96	79.8	3.3	43.9	121.7	107.6	88.9	79.7	86.4	106.4
1996/97	75.4	2.5	41.7	116.0	107.2	82.7	75.3	79.7	89.6
1997/98	75.5	3.3	45.0	114.7	106.1	83.1	73.7	79.7	90.9
1998/99	75.5	2.8	45.4	106.8	108.1	82.1	82.2	82.8	91.1
1999/00	75.0	3.0	46.1	108.4	108.8	81.5	78.3	76.7	90.7
2000/01	74.5	3.2	46.4	102.9	104.4	83.0	82.1	79.3	94.7

Data source: Hospital Morbidity Database, 1983/84 to 2000/01
Note: Rate for total population is age-adjusted.
† Based on records where inflammatory bowel disease was one of the first five diagnostic codes on patient's chart.



Health Matters

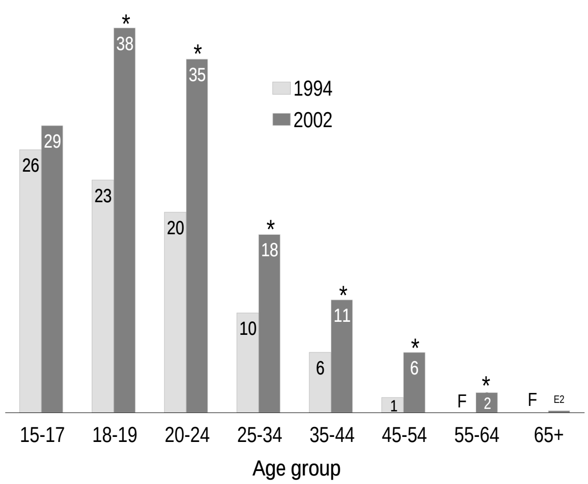
Short, descriptive reports, presenting recent information from surveys and administrative databases

USE OF CANNABIS AND OTHER ILLICIT DRUGS

Michael Tjepkema

In 2002, about 3 million Canadians aged 15 or older, or 12.2%, admitted having used cannabis—that is, marijuana or hashish—at least once in the previous 12 months. This estimate, based on data from the Canadian Community Health Survey (CCHS), represents a significant increase in self-reported drug use over the last decade. In 1989, 6.5% of Canadians reported using cannabis; by 1994, the figure had risen to 7.4%.[1,2] This rise in drug use mirrors another recent study, which showed increased cannabis use among Ontario high school students over the same period.[3] It may also partly reflect changing attitudes about drug use.

Percentage of population aged 15 or older who used cannabis in past year, by age group, 1994 and 2002



Data sources: 2002 Canadian Community Health Survey; 1994 Canada's Alcohol and Other Drugs Survey
* Significantly higher than estimate for 1994 ($p < 0.05$)
E2 Coefficient of variation 25.1% to 33.3%
F Coefficient of variation greater than 33.3%

Other drugs

The CCHS collected data on five other drugs: cocaine/crack, ecstasy, LSD and other hallucinogens, speed/amphetamines, and heroin. Overall, 2.4% of Canadians aged 15 or older had used at least one of these drugs in the year before the survey—up from 1.6% in 1994. An estimated 321,000 people (1.3%) had used cocaine/crack, making it the most commonly used of these other drugs.

Among "current users" (people who had used any illicit drug in the past year), 81.2% had used cannabis only. Another 16.0% reported both cannabis and one of the other drugs, and the remaining 2.9% had used one of the other drugs, but not cannabis.

Males, teens—higher use

A higher proportion of males (15.5%) than females (9.1%) had used cannabis in the past year. Similarly, more males than females had used other illicit drugs (*Table A*). With one exception (15- to-17- year-olds), males in all age groups were more likely than females to be cannabis users (*Table B*).

Cannabis use was most prevalent at younger ages. About 3 in 10 teens aged 15 to 17 (29%) reported having used marijuana or hashish in the past year. Cannabis use peaked at ages 18 and 19, reaching 38%. After age 24, the percentage of current users began to drop, although numbers in the age groups from 25-to-34 to 45-to-54 were still substantial.

Between 1994 and 2002, cannabis use rose significantly in all age groups but two: 15-to-17 and 65-or-older.

Frequency

Among people who had used cannabis in the past year, the frequency of use varied. Close to half (47%) used the drug less than once a month. One in ten reported weekly use, and another 10%, daily.

As a percentage of the total population aged 15 or older, 1.1% of Canadians used cannabis daily; 2.8%, more than once a week; 3.9%, at least once a week; and 6.0%, at least once a month. In general, males were more likely than females to be frequent users.

Frequency of cannabis use in past year

	Total	Male	Female
		%	
Among current users:			
Less than once a month	47.3	41.3	57.5*
1 to 3 times a month	18.0	18.2	17.6
Once a week	9.7	11.3	7.1*
More than once a week	15.3	18.2	10.3*
Every day	9.7	11.1	7.4*

Data source: 2002 Canadian Community Health Survey
** Significantly different from estimate for males ($p < 0.05$)*

In 2002, over 10 million people reported having tried cannabis at least once. This represents 41.3% of the population aged 15 or older. When one-time-only users are excluded, the figure drops to 32.0%.

Lifetime use of other illicit drugs ranged from 0.7% for heroin to 8.4% for LSD and other hallucinogens (*Table A*). When illicit drugs excluding cannabis are combined, 13.7% of the population, or 3.4 million people, have tried one of them.

In 2002, lifetime use of cannabis was highest for young adults aged 18 to 24, declined gradually through ages 25 to 54, and then dropped off quickly. The pattern was similar for other illicit drugs (*Table B*).

The percentage of residents who had ever used cannabis was above the national average in Nova Scotia, Alberta and British Columbia. In terms of other drugs, Québec, Alberta and British Columbia were above the overall average.

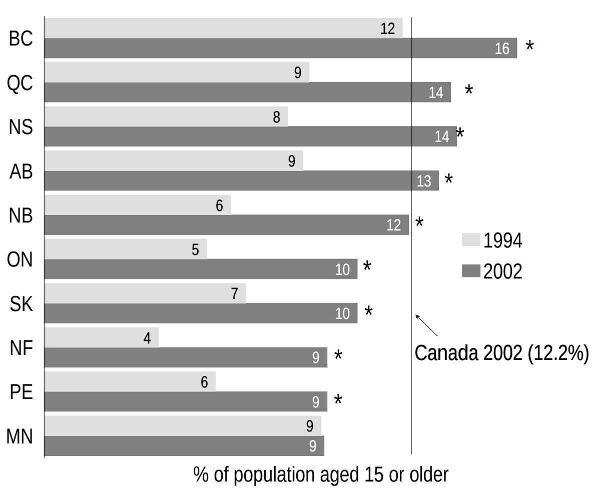
In the provinces

In every province except Manitoba, the level of cannabis use was higher in 2002 than in 1994. In 2002, rates of cannabis use significantly exceeded the national average in Québec and British Columbia *(Table B)*. Residents of Newfoundland and Labrador, Prince Edward Island, Ontario, Manitoba and Saskatchewan had lower-than-average rates.

Lifetime use

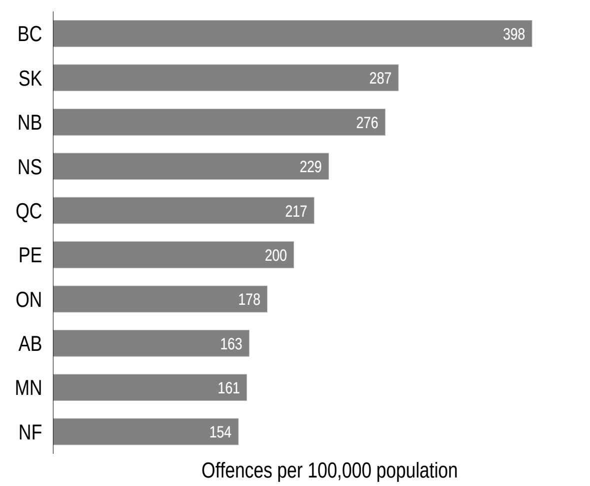
Although most Canadians are not current users of illicit drugs, many have tried them at some point in their lives. Men were more likely than women to have tried an illicit drug.

Cannabis use in past year, by province, 1994 and 2002



Data sources: 2002 Canadian Community Health Survey; 1994 Canada's Alcohol and Other Drugs Survey
** Significantly higher than estimate for 1994 ($p < 0.05$)*

Federal drug offences related to cannabis, by province



Data source: Canadian Crime Statistics, 2002 (Reference 4)

Criminal offences for cannabis rising

The *Controlled Drugs and Substances Act,* which governs drugs such as cannabis, cocaine and heroin and restricted substances such as ecstasy and LSD, can lead to a charge and conviction for a criminal offence.

Between 1991 and 2002, the rate of cannabis-related drug offences increased from 119 to 223 offences per 100,000 population. Most of these offences (72%) involved possession. Other charges included trafficking, production and importation.

In 2002, British Columbia had the highest rate of cannabis drug offences; Newfoundland and Labrador, the lowest. However, information on drug offences is based on police records, and may reflect enforcement efforts as much as differences in drug activity.[5]

Michael Tjepkema (416-952-4620; Michael.Tjepkema@statcan.ca) is with the Health Statistics Division of Statistics Canada, based in the Toronto Regional Office, 25 St. Clair Avenue E., Toronto, Ontario, M4T 1M4.

The Questions

Respondents to both the Canadian Community Health Survey (CCHS) and Canada's Alcohol and Other Drugs Survey (CADS) were asked: *"Have you ever used or tried marijuana, cannabis or hashish?"* and, if so, *"Have you used it in the past 12 months?"* Respondents who had used cannabis at least once in the past 12 months were considered to be *current users*. Similar questions were asked about the other illicit drugs.

The data are limited by the possibility of under-reporting. Although respondents were assured of confidentiality, some may have been reluctant to report drug use. Furthermore, the likelihood of under-reporting may have been different in 1994 than in 2002.

Data sources

Use of cannabis and other illicit drugs in 2002 was estimated using data from cycle 1.2 of the Canadian Community Health Survey (CCHS), which began in May 2002 and was conducted over eight months.[6] The CCHS covers people aged 15 or older living in private dwellings in the 10 provinces. Residents of the three territories, Indian reserves, institutions, and certain remote areas, as well as full-time members of the Canadian Armed Forces, were excluded. The sample consisted of 36,984 persons aged 15 or older; the response rate was 77%.

For this article, to account for survey design effects, standard errors and coefficients of variation were estimated using the bootstrap technique.[7,8]

Estimates of *use of cannabis and other illicit drugs in 1994* are from Canada's Alcohol and Other Drugs Survey (CADS). CADS covered people living in the 10 provinces. Full-time residents of institutions and residents of the territories were excluded. Data collection began in September 1994 and was conducted over three months. The sample consisted of 12,155 people aged 15 or older; the response rate was 76%. For this article, a survey design effect of 1.43 was used to partially account for the survey not being a simple random sample.

Estimates of criminal offences come from the Uniform Crime Reporting (UCR) survey. The UCR consists of data on incidents that have come to the attention of the police. The survey counts only the most serious offence committed in each criminal incident, and consequently, underestimates the total number of drug-related incidents. Additional information about the UCR can be found on the Statistics Canada website (www.statcan.ca).

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Table A

Illicit drug use, by sex, household population aged 15 or older, Canada excluding territories

	Past year						Lifetime					
	Total		Male		Female		Total		Male		Female	
	'000	%	'000	%	'000	%	'000	%	'000	%	'000	%
Cannabis†	3,049	12.2	1,896	15.5	1,153	9.1*	10,315	41.3	5,758	47.0	4,558	35.9*
Cannabis‡	2,824	11.3	1,780	14.5	1,043	8.2*	7,993	32.0	4,595	37.5	3,399	26.8*
Cocaine/Crack	321	1.3	235	1.9	86	0.7*	2,001	8.0	1,311	10.7	690	5.4*
Ecstasy	199	0.8	121	1.0	78	0.6*	732	2.9	455	3.7	277	2.2*
Hallucinogens (LSD, PCP)	145	0.6	98	0.8	48	0.4*	2,098	8.4	1,356	11.1	741	5.8*
Speed (amphetamines)	136	0.5	83	0.7	53E1	0.4*E1	1,148	4.6	736	6.0	412	3.2*
Heroin	10E2	0.0E2	7E2	0.1E2	F	F	185	0.7	131	1.1	54	0.4*
Any illicit drug excluding cannabis	589	2.4	392	3.2	198	1.6*	3,410	13.7	2,118	17.3	1,291	10.2*

Data source: 2002 Canadian Community Health Survey
Note: Because of rounding, detail may not add to totals.
†Includes one-time use
‡ Excludes one-time use
* Significantly different from estimate for males ($p < 0.05$)
E1 Coefficient of variation 16.6% to 25.0%
E2 Coefficient of variation 25.1% to 33.3%
F Coefficient of variation greater than 33.3%

Table B

Illicit drug use, by age, sex and province, household population aged 15 or older, Canada excluding territories

	Currently use cannabis		Lifetime: Cannabis[†]		Lifetime: Other illicit drug[‡]	
	'000	%	'000	%	'000	%
Total	3,049	12.2	7,993	32.0	3,410	13.7
Male	1,896	15.5	4,595	37.5	2,118	17.3
Female	1,153	9.1 *	3,399	26.8*	1,291	10.2*
Age group						
15-17	388	28.5	405	29.7	109	8.0
Male	200	28.4	210	29.8	57	8.1
Female	188	28.6	195	29.6	52	7.8
18-19	327	38.2[§]	416	48.5[§]	156	18.2[§]
Male	187	42.3	224	50.7	79	17.9
Female	140	33.8 *	192	46.2	77	18.4
20-24	670	35.1	995	52.1	477	25.0[§]
Male	398	41.4	552	57.4	282	29.3
Female	272	28.7 *	443	46.8*	195	20.6*
25-34	717	17.7[§]	1,813	44.8[§]	889	22.0[§]
Male	461	23.1	1,030	51.5	555	27.8
Female	256	12.5 *	784	38.3*	333	16.3*
35-44	608	11.2[§]	2,432	44.7	1,046	19.2[§]
Male	420	15.3	1,404	51.0	654	23.8
Female	188	7.0 *	1,027	38.2*	393	14.6*
45-54	266	6.0[§]	1,491	33.6[§]	596	13.4[§]
Male	182	8.4	893	41.2	394	18.2
Female	85	3.7 *	598	26.3*	202	8.9*
55-64	64	2.0[§]	363	11.4[§]	112	3.5[§]
Male	42[E1]	2.6[E1]	234	14.6	81	5.1
Female	22[E1]	1.4*[E1]	129	8.2*	31	2.0*
65+	9[E2]	0.2[§E2]	78	2.1[§]	25[E1]	0.7[§E1]
Male	F	F	48	3.0	16[E2]	1.0[E2]
Female	F	F	30	1.4*	9[E2]	0.4[E2]
Province						
Newfoundland and Labrador	41	9.4[††]	119	27.2[††]	31	7.1[††]
Prince Edward Island	11	9.4[††]	33	29.1	9	7.9[††]
Nova Scotia	104	13.7	267	35.4[††]	88	11.7[††]
New Brunswick	73	12.1	179	29.5	66	10.9[††]
Québec	816	13.5[††]	1,994	33.1	939	15.6[††]
Ontario	1,004	10.4[††]	2,746	28.5[††]	1,011	10.5[††]
Manitoba	80	9.3[††]	251	29.0[††]	101	11.7[††]
Saskatchewan	79	10.4[††]	220	29.1[††]	83	11.0[††]
Alberta	318	13.1	896	37.0[††]	412	17.0[††]
British Columbia	523	15.7[††]	1,286	38.7[††]	669	20.1[††]

Data source: 2002 Canadian Community Health Survey
Note: Because of rounding, detail may not add to totals.
† Excludes one-time use
‡ Includes cocaine/crack, ecstasy, hallucinogens, amphetamines, and heroin
** Significantly different from estimate for males ($p < 0.05$)*
§ Significantly different from estimate for next younger age group ($p < 0.05$)
†† Significantly different from estimate for Canada ($p < 0.05$)
E1 Coefficient of variation 16.6% to 25.0%
E2 Coefficient of variation 25.1% to 33.3%
F Coefficient of variation greater than 33.3%

CREUTZFELDT-JAKOB DISEASE

Pamela L. Ramage-Morin

Creutzfeldt-Jakob disease (CJD) is a rare, degenerative neurological disease that affects humans and is always fatal. First identified in the 1920s, CJD belongs to a class of diseases known as transmissible spongiform encephalopathies or prion diseases. Prion diseases are widespread among animals and include scrapie in goats and sheep, and bovine spongiform encephalopathy (BSE) in cattle. The latter, known as "mad cow disease," was identified in England in 1986, where it was attributed to the practice of feeding cattle meat-and-bone meal supplements made from scrapie-infected sheep or from rendered bovines already infected with BSE.[1] The consumption of BSE-infected beef has been associated with CJD.

Variant CJD

There are four forms of CJD.[2] The form associated with the consumption of BSE-infected beef, the highly publicized *variant* Creutzfeldt-Jakob disease (vCJD), is extremely rare. Worldwide, most vCJD deaths have occurred in the United Kingdom, the focal point of the "mad cow disease" outbreak. To date, 139 people in the UK have died from vCJD. In addition, 7 people with probable cases are still alive.[3] The average age of onset of vCJD is 29, and the time between the appearance of symptoms and death is up to 14 months. There has been one vCJD death in Canada—a man who had been in the United Kingdom during the outbreak there.[4]

The risk of exposure to BSE-infected cattle has been far lower in Canada than in the United Kingdom. Three cases of BSE have been found in Canadian cattle; the first was a cow imported from Britain in 1987, the second, reported on May 20, 2003, was a cow raised in Alberta.[5] The most recent case, identified on December 23, 2003, was a cow in Washington State that had been born in Alberta.[6]

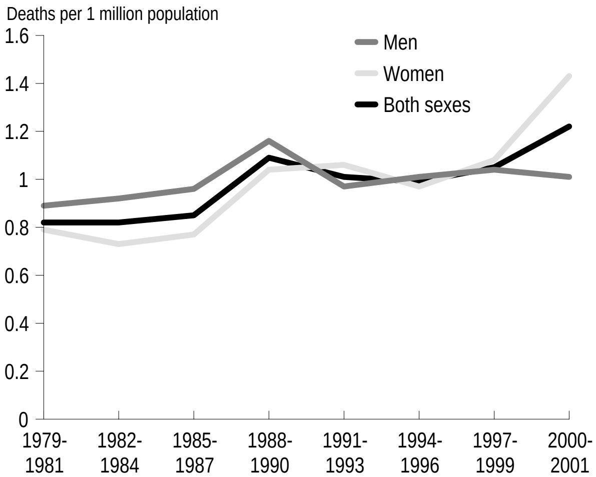
These isolated cases are in stark contrast to the United Kingdom, where 36,680 confirmed BSE cases were reported in 1992 at the peak of the outbreak.[7] Although UK beef has not been imported into Canada for over 30 years, measures have been implemented to reduce the possibility of unrecognized BSE in Canadian herds:[5]

- limiting imports of live ruminants, meat and meat products to countries considered free of BSE;
- establishing BSE as a reportable disease in 1990;
- implementing a surveillance program in 1992 that has resulted in testing approximately 10,000 cattle brains for disease;
- banning the practice of feeding ruminant protein to other ruminants (cattle, sheep, goats, bison, elk, deer) since 1997; and
- introducing the Canadian Cattle Identification Program to ensure that the movements of all cattle and bison can be traced from birth to slaughter.

Classical CJD

The three remaining forms of CJD—sporadic, familial and iatrogenic—are collectively known as *classical* Creutzfeldt-Jakob disease (cCJD). Sporadic CJD, for which the cause is unknown, accounts for 85% to 90% of cases. The familial, or hereditary, form comprises 10% to 15% of cases, while fewer than 1% are iatrogenic; that is, they result from medical examination or treatment. The iatrogenic form has been associated with corneal transplants, contaminated neurosurgical instruments, dura mater grafts, and a history of pituitary-derived (non-synthetic) human growth hormone use.[2] The age of onset for classical CJD is much older than that for variant CJD, averaging between 60 and 65. The time between exposure to the infection and the development of symptoms can extend from 1 to more than 30 years. Once symptoms appear, death rapidly follows, and most patients die in less than 6 months.

Age-standardized mortality rates for Creutzfeldt-Jakob disease, by sex, Canada, 1979 to 2001



Data source: Vital Statistics Death Database
Note: Age-standardized to 1996 Canadian population; three-year averages for 1979 to 1999, two-year average for 2000 to 2001

Deaths

Between 1979 and 2001, 599 deaths in Canada were attributed to Creutzfeldt-Jakob disease, only one of which was BSE-related. This was an annual average of 26 deaths, with the number ranging from a low of 14 in 1979 to a high of 44 in 2001. More women than men died of CJD: 329 versus 270.

The CJD mortality rate rose slightly over the 1979-to-2001 period. The three-year average age-standardized mortality rates for men increased from 0.89 to 1.01 deaths per million, and from 0.79 to 1.43 per million for women. For both sexes together, the rate rose from 0.82 to 1.22 deaths per million population, which is consistent with rates in other countries.

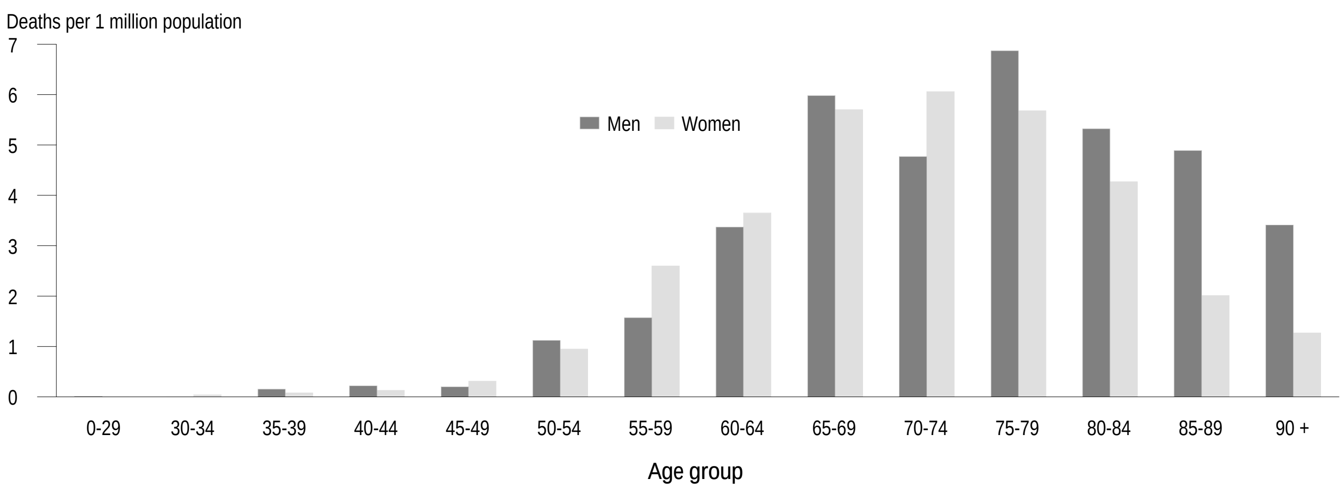
CJD mortality rates rise sharply with age, especially after 50. Rates were highest at ages 75 to 79 for men, and at ages 70 to 74 for women.

Between 1979 and 2001, CJD mortality among the provinces ranged from a low of 0.5 deaths per million population in Newfoundland to a high of 1.3 in Nova Scotia.

Diagnosis and autopsies

Confirming a diagnosis of CJD can be difficult because the clinical symptoms are similar to those of other neurological disorders such as Alzheimer's disease. Brain scans and tonsil biopsy are used to establish a probable diagnosis, but a confirmed diagnosis can only be made with a microscopic examination of the brain tissue after the patient has died. While it might be anticipated that autopsies

Mortality rates for Creutzfeldt-Jakob disease, by age and sex, Canada, 1979 to 2001



Data source: Vital Statistics Death Database would follow the majority of suspected CJD deaths in Canada, between 1979 and 2001, autopsies were performed in 45% of cases. Nonetheless, this is much higher than the 16% of autopsies that were performed for all deaths.

Data source

Information about Creutzfeldt-Jakob Disease deaths was taken from the **Vital Statistics Death Database**, which is based on death certificates submitted by the provinces and territories and maintained by Statistics Canada. The *International Classification of Diseases* (ICD) categorizes Creutzfeldt-Jakob Disease under code 046.1 for deaths from 1979 to 1999 (ICD-9), and code A81.0 for deaths in 2000 and 2001 (ICD-10). No sub-classification distinguishes between the classical and variant forms. However, Health Canada's surveillance system monitors all referrals with suspected CJD. These cases are followed until an autopsy report, or other evidence, confirms the diagnosis and distinguishes variant from the classical forms.

Risk difficult to estimate

The fear and media attention that surround Creutzfeldt-Jakob disease and its bovine counterpart, "mad cow disease," intensified throughout 2003 with the discovery of two BSE-infected cows in North America. Much of the concern focuses on the economic impact. In 2001, the World Health Organization Director General, Dr. Gro Harlem Brundtland, referred to the issue of BSE and its link to CJD as a "global emergency" likely to cost "several tens of billions of dollars."[8]

From the point of view of simply counting occurrences, concern about the public health implications may be unwarranted: between 1979 and 2001, Canadians were more likely to die from extreme cold or from falling off a ladder or scaffold than from CJD. However, the menace of CJD lies in the unknown size of the infected population. The long period between infection and the onset of symptoms makes it difficult to estimate the numbers of people who may be at risk of developing vCJD, particularly as no tests can identify it prior to the onset of symptoms.

Pamela L. Ramage-Morin (613-951-1760; Pamela.Ramage-Morin@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

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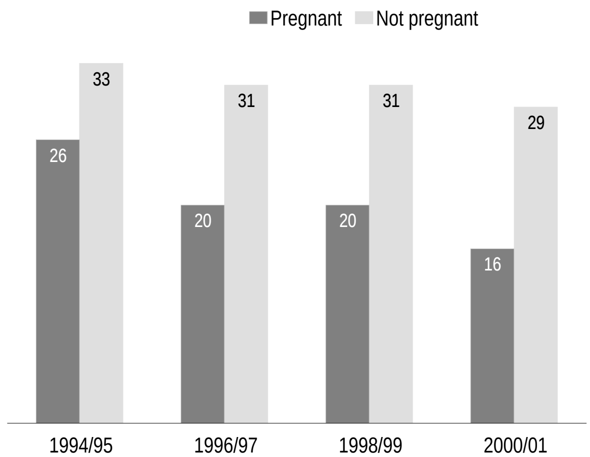
PREGNANCY AND SMOKING

Wayne J. Millar and Gerry Hill

In the second half of the 1990s, the overall smoking rate among women aged 15 to 49 dipped only slightly from 33% in 1994/95 to 29% in 2000/01. At the same time, the proportion of women who reported that they had smoked when they were pregnant dropped sharply, from 26% to 16%. This striking decline among pregnant women may reflect greater awareness of the adverse effects of smoking during pregnancy.[1,2] However, levels of exposure to tobacco smoke are determined not only by personal smoking, but also by exposure to other smokers.

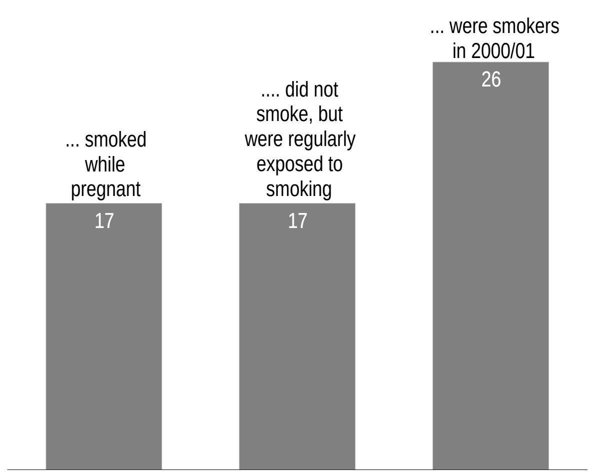
Percentage of women aged 15 to 49 who smoke, 1994/95 to 2000/01



Data sources: 1994/95, 1996/97 and 1998/99 National Population Health Survey; 2000/01 Canadian Community Health Survey

According to the 2000/01 Canadian Community Health Survey, an estimated 1.5 million women aged 15 to 54 had given birth in the previous five years. Seventeen percent of these women had smoked while they were pregnant. As well, 17% of those who did not smoke during their pregnancy had regularly been exposed to smoking at that time or soon after. In 2000/01, about a quarter (26%) of the women who had had a baby in the previous five years reported that they were smokers themselves.

Percentage of women aged 15 to 54 who had a baby in previous five years and who. . .



Data source: 2000/01 Canadian Community Health Survey

Young, low income

The women most likely to smoke and to be exposed to smoking were younger than 25. A third of them had smoked while they were pregnant, and 36% who did not smoke themselves had been exposed to smoking. As well, in 2000/01, 49% of these young women reported that they were smokers. The comparable percentages were much lower among mothers aged 30 or older: 13% had smoked while they were pregnant, and 13% of those who had not smoked had been exposed to smoking. The proportion who reported that they were smokers in 2000/01 was 21%.

Socio-economic status

Smoking and exposure to smoking during and after pregnancy were more common among unmarried than married women. Socio-economic status also made a difference. Regardless of the measure—smoking while pregnant, regular exposure to smoking, or current smoking—rates were about three times higher for women in the lowest income households than for those in the highest. Similarly, rates of smoking and exposure to smoking were highest among women who had not graduated from high school and lowest among those who were college/university graduates.

Provincial rates

The likelihood that women would smoke during and after pregnancy varied by province. Rates of smoking during pregnancy were significantly above the national level in Newfoundland, Prince Edward Island, New Brunswick, Québec and Saskatchewan. In 2000/01, significantly high proportions of women in Newfoundland, Prince Edward Island and Saskatchewan were smokers. In Ontario and British Columbia, rates of smoking during and after pregnancy were significantly low. As well, when they were pregnant, a significantly low proportion of women in British Columbia had regularly been exposed to smoking

Canadian, immigrant mothers

The difference between the smoking behaviour of immigrant and Canadian-born mothers was striking. Just 2% of immigrant women had smoked while they were pregnant, and 8% of those who had not smoked reported having been exposed to smoke; in 2000/01, 8% of these women were smokers. Rates were much higher among non-immigrant women: 22% had smoked while pregnant, 17% who did not smoke had been exposed to smoking, and 32% were smokers in 2000/01.

Starting/Resuming

Among all groups of mothers, the percentage who reported smoking was higher after they had a baby than during pregnancy. For example, even among the women with the lowest smoking rates—older, married, well-educated, higher income—the proportion who smoked after the birth of their baby was higher than the proportion who smoked while they were pregnant. They may have made a conscious decision not to smoke during pregnancy because of potential adverse effects on the fetus. The higher prevalence of smoking after pregnancy suggests that women may be less knowledgeable about the risks of smoking to the health of young children.[3-10]

Influence of others?

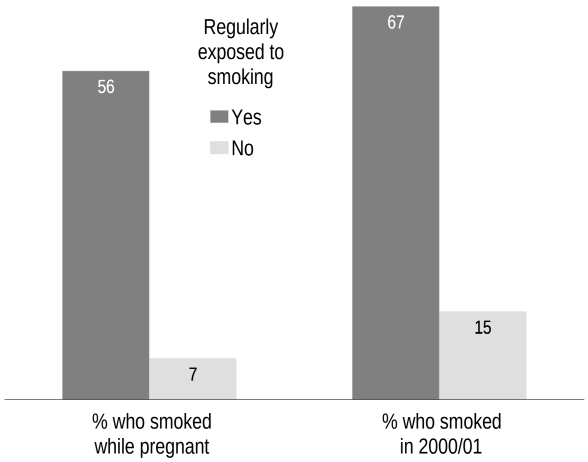
The likelihood that a woman would smoke during and after pregnancy was associated with regular exposure to others' smoking. More than half (56%) of women who had regularly been exposed to smoking also smoked when they were pregnant. This compared with 7% among women who did not report such exposure. As well, in 2000/01, of the women who had given birth in the previous five years, 67% who had regularly been exposed to smoking were themselves smokers, compared with 15% who had not been exposed to smoking.

Smoking exposure of women aged 15 to 54 who had a baby in previous five years

	Smoked while pregnant %	Did not smoke, but regularly exposed to smoking %	Smoker in 2000/01 %
Total	17	17	26
Age group			
Younger than 25	33*	36*	49*
25-29	19*	19	29
30-34	13*	15	21*
35+	14*	11*	21*
Marital status			
Married	14*	15*	22*
Unmarried	34*	30*	52*
Province			
Newfoundland and Labrador	26*	15	38*
Prince Edward Island	28*	17	36*
Nova Scotia	17	18	26
New Brunswick	23*	22	31
Québec	21*	19	29
Ontario	14*	16	24*
Manitoba	21	26	32
Saskatchewan	28*	22	38*
Alberta	19	19	27
British Columbia	14*	8*	23*
Household income			
Low	30*	32*	43*
Lower-middle	21*	20	29*
Upper-middle	16*	13*	25
High	8*	11*	15*
Missing	13*	22	24
Education			
Less than high school graduation	38*	34*	48*
High school graduation	22*	21*	33*
Some postsecondary	22*	27*	37*
College/University graduation	10*	11*	17*
Missing	F	F	F
Immigrant status			
Immigrant	2*	8*	8*
Non-immigrant	22*	18*	32*
Missing	F	F	F

Data source: 2000/01 Canadian Community Health Survey
Note: Because of rounding, detail may not add to totals.
** Significantly different from estimate for total ($p < 0.05$)*
F Coefficient of variation greater than 33.3%

Smoking behaviour of women aged 15 to 54 who had a baby in previous five years



Data source: 2000/01 Canadian Community Health Survey

Wayne J. Millar (613-951-1631; Wayne.Millar@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6; Gerry Hill is a research epidemiologist in Kingston, Ontario, K7M 3Z3.

The Questions

Smoking status was determined by asking respondents if they smoked cigarettes daily, occasionally, or not at all. For this article, those who smoked cigarettes daily or occasionally were defined as "current smokers."

In the Canadian Community Health Survey, *exposure to smoking during and after pregnancy* was determined with the following questions:

- Did anyone regularly smoke in your presence during or after the pregnancy (about six months after)?
- Did you smoke during your last pregnancy?

In the National Population Health Survey, women aged 15 to 49 were asked if they were pregnant. Those who stated that they were pregnant and were currently smoking were defined as having smoked during pregnancy.

Data sources

Smoking and exposure to tobacco smoke at home during pregnancy and *current smoking* among women aged 15 to 54 who had given birth in the previous five years were estimated with data from the first cycle of Statistics Canada's Canadian Community Health Survey (CCHS), conducted from September 2000 through October 2001.[11] The CCHS covers the population aged 12 or older who were living in private households at the time. It does not include residents of Indian reserves, Canadian Forces bases, or some remote areas. The overall response rate for cycle 1 was 85%; the total sample size was 131,535. This article is based on information about 7,614 women aged 15 to 54 who had had a baby in the previous five years, representing a population of 1.5 million.

Supplemental information is from the 1994/95, 1996/97 and 1998/99 National Population Health Survey.

All differences were tested to ensure statistical significance; that is, that they did not occur simply by chance. To account for survey design effects, standard errors and coefficients of variation were estimated using the bootstrap technique. A significance level of $p < 0.05$ was applied in all cases.[12-14]

Estimates of smoking during pregnancy may be low. The data refer to the woman's last pregnancy, which could have been as many as five years earlier. Some women may have had difficulty recalling their smoking behaviour, or may have been reluctant to admit having smoked while pregnant. The apparent decline in smoking among pregnant women since 1994/95 may also signal growing reluctance to admit to smoking during pregnancy rather than a true change in behaviour.

Responses to questions about smoking status in 2000/01 are not strictly comparable. Women who had given birth just before the interview would have had less time to resume or begin smoking than those whose child had been born several years earlier.

No information was collected about the type or number of cigarettes smoked or the number of other household members who smoked, which could affect levels of exposure. Nor is information available about the point at which women resumed or began smoking after giving birth. As well, the question about regular exposure to others' smoking refers to during or six months after the pregnancy. Therefore, it is possible that exposure did not occur while the woman was pregnant.

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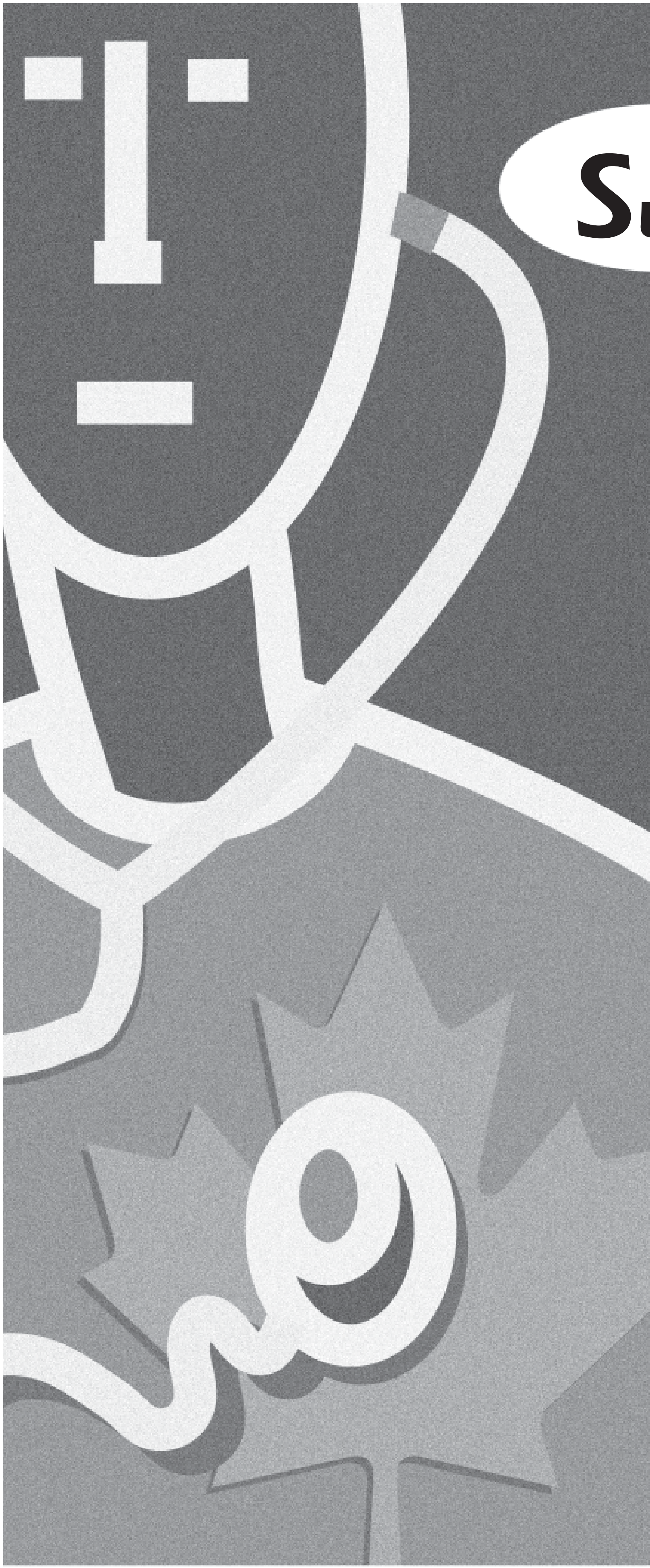

Subject Index

Subject Index Volumes 11 to 15

A

Contraception

D

Data collection

Deaths

Dental care

Dependency

F

Fractures

Functional health

H

Health care

See also Hospitalization
Regional health
Residential facilities

Health insurance

Health services accessibility

Health status indicators

Health surveys

Home care

Hospitalization

I

Immigrants

Income

Injuries

L

Life expectancy

Lone parents

M

Medical record linkage

Medication use

Mental health

Miscarriage

Mortality

N

Neoplasms

Northern residents

Nursing homes

Nutrition

Smoking

Social support

Spontaneous abortion

Stress, psychological

Suicide

Surgery

Survival rates

T

Therapeutic abortion

See Abortion

V

Vital statistics

See also Births
Deaths
Life expectancy
Survival rates

W

Weight

Y

Youths

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Canadian Community Health Survey (CCHS)

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National Population Health Survey (NPHS)

Household - The household component includes household residents in all provinces, with the principal exclusion of populations on Indian Reserves, Canadian Forces Bases and some remote areas in Québec and Ontario.

Institutions - The institutional component includes long-term residents (expected to stay longer than six months) in health care facilities with four or more beds in all provinces with the principal exclusion of the Yukon and the Northwest Territories.

North - The northern component includes household residents in both the Yukon and the Northwest Territories with the principal exclusion of populations on Indian Reserves, Canadian Forces Bases and some of the most northerly remote areas of the Territories.

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The Health Services Access Survey provides detailed information about access to health care services such as 24/7 first contact services and specialized services. Data are available at the national level.

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