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Summer 1998 Volume 10 No. 1

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Research Articles

In-depth research and analysis in the fields of health and vital statistics

Falling short of Pap test guidelines

Judy Lee, Greg F. Parsons and Jane F. Gentleman

Abstract

Objectives

This article examines the associations between women's characteristics and getting or not getting a Pap test.

Data source

The data are from the 1994/95 National Population Health Survey (NPHS) conducted by Statistics Canada.

Analytical techniques

Multivariate logistic regressions were used to determine the odds of women not complying with Pap test guidelines, that is, of never having had a Pap test, and among women who had had one, of not having done so in the last three years.

Main results

One in four women aged 18 to 69 had either never had a Pap test or had not had one in the three years before the NPHS. Notably, older women—who are at the greatest risk for cervical cancer—are less compliant with screening guidelines than younger women. Other characteristics of women with high odds of never having had a Pap test are: being single, being a resident of Quebec, having immigrated to Canada, having less than a secondary school education, not being in the highest income group, and having had no sex partners in the previous year.

Key words

Pap smear, Pap test, cervical cancer, mass screening

Authors

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According to a 1995 national forum on cervical cancer screening, "There is no other cancer for which screening reduces the incidence of invasive disease as dramatically and predictably as cervical cancer."[1] Screening for this disease is done using a simple, low-cost procedure called the Papanicolaou smear, known commonly as the Pap test. This test detects the presence of abnormal cells in the cervix, including those that are precursors to the invasive form of cervical cancer.

At present, the most established Canadian cervical cancer screening programs are in British Columbia and Nova Scotia. These programs began in 1949 and 1991, respectively. Other provinces have implemented programs to varying degrees. There has been a series of national initiatives to establish a comprehensive population-based cervical cancer screening program,[1-4] but for a variety of reasons, a fully integrated system has yet to be established in any province or territory.[1,5,6]

Methods

Data source

The data in this article are from Statistics Canada's 1994/95 National Population Health Survey (NPHS). The NPHS is a longitudinal survey designed to collect information related to the health of the Canadian population over time. In 1994/95, it surveyed household residents in all provinces and territories, except persons living on Indian reserves, Canadian Forces bases, and in some remote areas. A more detailed description of the survey design, sample and interview procedures is found in published reports.[7]

The 1994/95 NPHS provincial, non-institutional sample consisted of 27,263 households, of which 88.7% agreed to participate in the survey. After the application of an eligibility rule, 20,725 households remained in scope.

One knowledgeable person in every participating household provided general socio-demographic and health information about each household member. In total, data pertaining to 58,439 individuals were collected.

In addition, one randomly selected person in each of the 20,725 participating households was chosen to provide in-depth information about his or her own health. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to these in-depth health questions was 96.1%, or 17,626 respondents.

In the remaining 2,383 participating households, the randomly selected respondent was younger than age 12. In-depth health information was collected for these individuals as part of Statistics Canada's 1994/95 National Longitudinal Survey of Children and Youth (NLSCY).

Of the 17,626 randomly selected respondents aged 12 or older, 14,786 were eligible members of the NPHS longitudinal panel. These respondents were also eligible for the Health Canada supplement. The response rate for these Health-Canada-sponsored questions was 90.6%.

Of the 17,626 randomly selected respondents aged 12 or older, the remaining 2,840 were sponsored by provincial governments that elected to enlarge the sample sizes in their provinces. These respondents will not be followed-up and were not eligible for the Health Canada supplement.

To ascertain women's Pap test histories, female respondents aged 18 and older, who were selected to answer the in-depth health questions, were asked, "Have you ever had a Pap smear test?" Those who answered "yes" were then asked, "When was the last time?" Of this group of respondents, only those eligible for the Health Canada supplement were analysed in this article, as they were also asked about the number of sex partners they had had in the past year (a risk factor for cervical cancer).[8] The survey asked "How many sexual partners have you had within the past twelve months?"

After the exclusion of 20 women who did not respond to some of the survey questions, 6,878 respondents remained in the study population. They represented 10,718,417 non-institutionalized women aged 18 and older who were residing in the 10 provinces.

Analytical techniques

Multivariate logistic regressions were used to predict the odds of women not complying with recommendations for Pap test screening, that is, the odds of never having had a Pap test, and among women who had ever had one, the odds of not having done so in the last three years. The data were weighted to represent the Canadian population. The sample weights were adjusted so that they average to 1. This approach permits a less biased estimate of the standard errors.

The independent variables in the regressions were age, marital status, province of residence, residence/non-residence in a census metropolitan area (CMA), highest level of education, household income, main activity, country of birth, number of sex partners in the last year, and presence of cancer. CMAs are large urban centres consisting of an urbanized core with 100,000 or more inhabitants, and adjacent urban and rural areas that have a high degree of economic and social integration with the urbanized core. There are 25 CMAs in Canada.[9] Household income is a derived measure of income adequacy based on household size. Main activity refers to the principal way in which the respondent reported spending most of her time. The cancer variable was included in the model to adjust the other results for whether or not the woman had this disease. It was presumed that cancer patients would likely undergo a more intense scrutiny of their health. A respondent who had ever had cancer was not recorded as having it at the time of the survey if the diagnosis occurred at least five years earlier, and she had been told that the disease was cured. An estimated 2.4% of the women in this study had cancer (of any kind) at the time of the survey.

Limitations

Pap test data from the NPHS are subject to the problems inherent in self-reported data. Women who agreed to participate in the NPHS may be more likely than non-respondents to have engaged in health-promoting behaviour such as having a Pap test. Some respondents wishing to provide a socially desirable answer may have said that they had had a Pap test when, in fact, they had not. Also, respondents might not have remembered accurately the date of their last Pap test. Studies of self-reported Pap test histories tend to over-report screening.[10]

Ideally, Pap test rates and cervical cancer rates would be based on counts of women with intact cervixes, which depend upon rates of total hysterectomy over many previous years. Without this adjustment, rates of non-compliance with cervical cancer screening guidelines presented in this article are overestimated.[11]

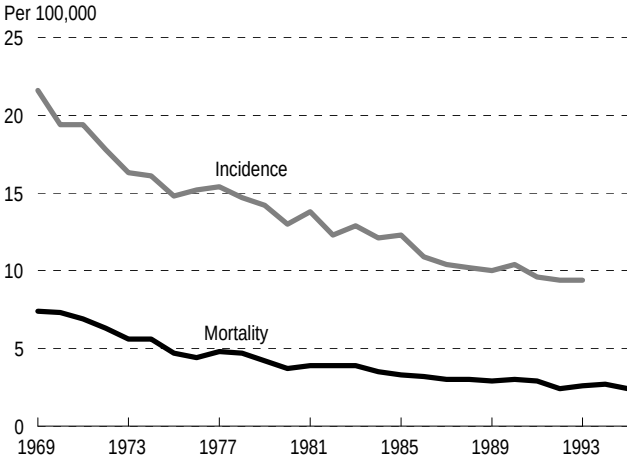
As a result of the introduction of cervical cancer screening in British Columbia in 1949 and its subsequent gradual adoption across Canada, cervical cancer incidence and mortality rates have decreased dramatically.[5] Between 1969 and 1998, the age-standardized incidence rate fell from 21.8 to an estimated 8.3 cases per 100,000 females (Chart 1).[12,13] Similarly, the mortality rate dropped during the same period from 7.4 to an estimated 2.2 deaths per 100,000, with the most pronounced decline among older women (Chart 2).[12] Despite these gains, there will be an estimated 1,400 new cases of cervical cancer in 1998. This same year, the disease is expected to cause the deaths of 400 Canadian women.[12]

Women with cervical cancer have a relatively good prognosis, with a deaths-to-cases ratio of 0.29[12] and a five-year relative survival rate of 74%.[14] Depending on the stage to which the cancer has advanced at the time of detection, cervical cancer can be readily treated, with pre-cancerous cells removed by laser, cyrosurgery (destruction of tissue by the application of extreme cold), and conization (surgical removal of a cone of tissue); invasive tumours require a simple or radical hysterectomy, or radiotherapy with chemotherapy.[8] Most cases of invasive cervical cancer occur in women not previously screened or not screened recently.[8,15]

Women who are older, immigrants, Aboriginal, smokers, and/or with a lower socioeconomic status face a higher risk of cervical cancer. Early sexual activity, number of sex partners and exposure to human papilloma virus (HPV) are also risk factors. There is a strong causal relationship between HPV (which can be spread through sexual contact) and cervical cancer (and its precursors).[8,16-18]

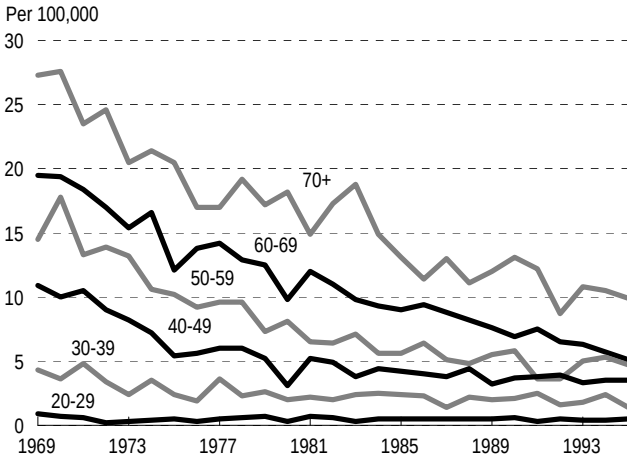
This article analyzes data from the 1994/95 National Population Health Survey (NPHS), which provided information on the self-reported Pap test histories of Canadian women aged 18 and older. The study relates women's propensity to get Pap tests to selected demographic, socioeconomic and lifestyle characteristics (see *Methods*). According to the NPHS, about one in six Canadian women aged 18 and older have never had a Pap test—a finding consistent with past research.[19-21] Previous studies have shown that factors related to Pap test use include age, marital status, education, income, work status, ethnicity, Aboriginal status, immigrant status, urban or rural residence, and lifestyle and health-related behaviour.[15,19-29]

Chart 1
Age-standardized cervical cancer incidence and mortality rates, females, all ages, Canada, 1969 to 1995



Data sources: *Cancer Incidence in Canada, 1969-1993 (Reference 13); Canadian Vital Statistics Data Base*
Note: *Rates are standardized to the age distribution of the 1991 Canadian population. Projected incidence rates (1994 to 1998) and projected mortality rates (1996 to 1998) are available, but not shown.*

Chart 2
Cervical cancer mortality rates, by age group, women aged 20 and older, Canada, 1969 to 1995



Data source: *Canadian Vital Statistics Data Base*

According to the 1994/95 NPHS, over 1.2 million women aged 18 to 69—the age group targeted for cervical cancer screening—reported having never had a Pap test. Another 1.2 million had their last test more than three years before the survey. In total, one in four women in the targeted age group had not been screened in accordance with current guidelines, hereafter referred to as Pap test non-compliance.

Non-compliance does not imply personal responsibility. Women may or may not get a Pap test for a variety of reasons, including awareness, belief in its effectiveness, promotion by health care providers, and access to programs and services.

A national workshop conducted in 1989 produced 27 recommendations for the establishment of a national screening program (see *Screening guidelines)*. The recommendations on screening frequency were that "physicians should ensure that cervical cytology smears are taken soon after age 18 or once women are sexually active. The process should be repeated after one year, and provided the smears are of appropriate quality and normal, at least every three years until the woman reaches age 70. This will ensure that as many women as possible throughout Canada are offered the protection that regular cervical cytologic screening provides."[4] In practice, it is possible for women to get a Pap test more often than the guidelines recommend, for example, as part of a regular health examination or as a prerequisite to obtaining some forms of birth control.

Senior women

Lifetime rates of non-compliance with Pap test guidelines vary with age, decreasing abruptly from 51% to 19% between the age groups of 18 to 19 and 20 to 29. The rate continues to decline to a low of 8% among 30- to 49-year-old women. Thereafter, the rate increases, reaching 34% at ages 70 and older (Chart 3 and Table 1). In the multivariate analysis, the odds of lifetime non-compliance were lowest among women aged 30 to 39 and highest among those 70 and older (Table 2).

Among women who have had at least one Pap test, whether they received it as recently as recommended is very strongly related to age. The older a woman is, the less likely she is to have had her most recent Pap test in the last three years.

Screening guidelines

In 1989, the National Workshop on Screening for Cancer of the Cervix issued recommendations for cervical screening, the highlights of which follow.[4]

- All women aged 18 and older who have had sexual intercourse should be encouraged to participate in a cervical cytology screening program.
- A second smear should, in general, be taken after one year, especially for women who begin screening after age 20.
- If the first two smears are satisfactory and show no significant epithelial abnormality, women should, in general, be advised to be rescreened every three years to age 69.
- Women over age 69 who have had at least two satisfactory smears and no significant epithelial abnormality in the last nine years and who have never had biopsy-confirmed severe dysplasia or carcinoma in situ (cervical intraepithelial neoplasia III) can be dropped from the cervical cytology screening program.
- The recommended frequency of rescreening for women aged 18 to 69 is appropriate for all risk groups.
- Women entering a screening program at age 67 or older should have two satisfactory smears at least six months apart; those over age 69 can then be dropped from the program if the smears show no epithelial abnormality.
- The recommended screening frequencies apply to women whose smears show no epithelial abnormality. If abnormalities are detected, schedules for repeat examinations should be dictated by the requirements of surveillance, diagnosis, treatment and follow-up.
- Women do not need to be screened if they have never had sexual intercourse or have had a hysterectomy for benign conditions with adequate pathological documentation that the cervical epithelium has been totally removed and previous smears have been normal.

The guidelines stress the importance of high-quality laboratory services for reading cytology smears, with adequate internal and external quality-control systems, and information systems to monitor screening frequencies and to issue reminders to attend at the recommended intervals.

Among women aged 60 to 69 who had ever had a Pap test, nearly a third had not done so in the three years before their NPHS interview (Table 1). Not surprisingly, the age group with the largest share of women not getting a Pap test in the last three years was 70 and older. The low screening rates among older women may be partially related to the higher prevalence of hysterectomies in this group.[11,25]

In the absence of tests showing problems, the guidelines recommend that senior women be dropped from screening programs. However, it is recommended that senior women who have never had a Pap test get tested. According to the guidelines, "women entering a screening program at age 67 or older should have two satisfactory smears at least six months apart; those over age 69 can then be dropped from the program if the smears show no epithelial abnormality."[4]

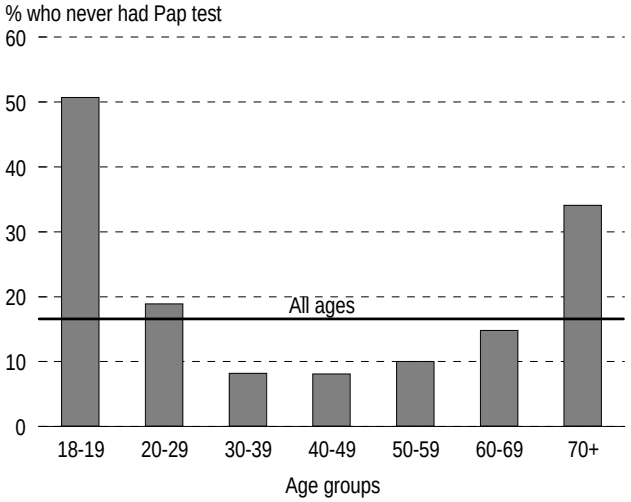
Thus, older women, who have the highest incidence and mortality rates of cervical cancer,[13] are highly non-compliant with Pap test guidelines, although they might be expected to be the most likely to have ever had a Pap test, having had the longest opportunity to do so. These findings concur with past studies that identify older women as an under-served group for Pap tests.[20,23,25,30,31]

Immigrant women

Studies of cancer screening among ethnic and immigrant groups have suggested that cultural barriers may inhibit some women from taking Pap tests.[22,31] NPHS data support these findings (Table 2). For example, women born in Asia had the highest odds of never having had a Pap test—almost nine times those of Canadian-born women. Since 20% of all Canadian women aged 18 and older are immigrants, this situation affects a sizeable proportion of the female population (Appendix).

Although Asian-born women were the least likely to have ever had a Pap test, those who had had one were very likely to have had it less than three years ago. Women born in South America, Central America, the Caribbean or Africa who had had at least one Pap test were also more compliant with guidelines for test recency than Canadian-born women.

Chart 3
Lifetime Pap test non-compliance rates, women aged 18 and older, Canada excluding territories, 1994/95



Data source: *1994/95 National Population Health Survey*
Note: *Univariate rates were weighted to represent 10,718,417 non-institutionalized women aged 18 and older in the 10 provinces.*

Socioeconomic characteristics

Some strong socioeconomic effects that support findings from previous studies were also evident.[19,20,25] The less educated a woman was, the higher were her chances of never having had a Pap test. Women with less than a secondary education had odds for lifetime non-compliance that were more than twice those for women with a college diploma or university degree. Also, women in the lowest two household income groups had significantly higher odds than women in the highest group. Similarly, women in the lowest three household income groups had odds that were significantly higher than those for women in the highest income group.

Education and income also appear to be factors related to Pap test recency. Compared to women with college or university education, those with secondary or less than secondary education and who had ever had a Pap test had significantly higher odds of having their most recent test three or more years ago.

Table 1
Pap test non-compliance rates, women aged 18 and older, Canada excluding territories, 1994/95

			Ever had Pap test		
		Never had Pap test†	Total†	Had last test 3 or more years ago‡	Had last test in last 3 years‡
				%	
All women 18 and older		**15.4**	**84.6**	**18.3**	**81.7**
Age	18-19	50.7	49.3	.8	99.2
	20-29	18.9	81.1	2.7	97.3
	30-39	8.2	91.8	10.7	89.3
	40-49	8.1	92.0	15.6	84.4
	50-59	10.0	90.0	24.1	75.9
	60-69	14.8	85.2	31.1	68.9
	70+	34.1	66.0	54.2	45.8
Marital status	Single (never married)	32.3	67.7	10.3	89.7
	Now married	10.4	89.6	17.5	82.5
	Common-law/Living with partner	9.1	90.9	8.4	91.6
	Separated or divorced	9.2	90.8	18.1	81.9
	Widowed	25.4	74.6	44.9	55.1
Province of residence	Quebec	23.7	76.3	15.8	84.2
	New Brunswick	15.7	84.3	24.3	75.7
	Newfoundland	13.1	86.9	23.6	76.4
	Ontario	14.5	85.5	18.6	81.5
	Prince Edward Island	11.6	88.5	20.9	79.1
	Nova Scotia	10.5	89.5	20.1	79.9
	Alberta	10.1	89.9	11.5	88.5
	British Columbia	11.3	88.7	22.5	77.5
	Manitoba	8.9	91.1	20.9	79.1
	Saskatchewan	7.7	92.3	22.3	77.7
Resides in census metropolitan area	No	13.5	86.5	23.2	76.8
	Yes	16.6	83.4	15.2	84.8
Education	Less than secondary	24.3	75.7	29.3	70.8
	Secondary	15.2	84.8	20.6	79.4
	Beyond high school	13.7	86.3	15.0	85.0
	College or university	9.6	90.5	12.2	87.8
Household income	Low	22.6	77.4	22.7	77.3
	Lower middle	18.3	81.7	23.4	76.6
	Upper middle	10.6	89.4	15.5	84.5
	High	8.8	91.2	10.2	89.8
Main activity	Working	13.6	86.4	10.9	89.1
	Working and caregiving	4.9	95.1	12.1	87.9
	Caregiving	14.0	86.0	19.5	80.5
	Looking for work	16.7	83.3	14.0	86.0
	Retired, at school, ill	27.0	73.0	32.3	67.7
Place of birth	Canada	13.3	86.7	18.6	81.4
	Other North America, Europe, Australia	16.3	83.7	21.4	78.6
	South Am, Central Am, Caribbean, Africa	29.5	70.5	5.9	94.2
	Asia	39.2	60.8	9.9	90.1
Number of sex partners in last 12 months§	None	47.1	52.9	15.6	84.4
	One	9.3	90.7	8.7	91.3
	Two	13.4	86.6	5.2	94.8
	Three or more	13.5	86.5	1.4	98.6
Has cancer	No	15.5	84.5	18.2	81.8
	Yes	11.6	88.5	23.1	76.9

Data source: *1994/95 National Population Health Survey*
Note: *Because of rounding, figures may not sum to 100%. "Unknown" categories are not shown.*
† Univariate rates were weighted to represent 10,718,417 non-institutionalized women aged 18 and older in the 10 provinces who responded "yes" or "no" to the Pap test question.
‡ Univariate rates were weighted to represent 9,062,010 non-institutionalized women aged 18 and older in the 10 provinces who ever had a Pap test. Excludes women who had had a Pap test, but did not indicate recency.
§ Women over age 45 were not asked about the number of sex partners.

Table 2
Odds ratios for non-compliance with Pap test guidelines, women aged 18 and older, Canada excluding territories, 1994/95

		Never had Pap test		If ever had Pap test, had last test 3 or more years ago	
Independent variable	Category	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Age	18-19	5.11**	3.4, 7.6	.05**	-- .4
	20-29	2.19**	1.7, 2.9	.21**	.1, .3
	30-39†	1.00	...	1.00	...
	40-49	1.26	.9, 1.8	1.46**	1.1, 1.9
	50-59	1.63	1.0, 2.7	1.94**	1.3, 2.9
	60-69	2.18**	1.3, 3.7	2.34**	1.6, 3.5
	70+	7.31**	4.3, 12.4	5.62**	3.6, 8.8
Marital status	Single (never married)†	1.00	...	1.00	...
	Now married	.37**	.3, .5	.60**	.4, .8
	Common-law/Living with partner	.38**	.3, .6	.71	.4, 1.1
	Separated or divorced	.26**	.2, .4	.67*	.5, 1.0
	Widowed	.31**	.2, .4	.81	.6, 1.2
Province of residence	Quebec	5.22**	3.0, 9.1	.78	.5, 1.2
	New Brunswick	2.76**	1.4, 5.5	1.11	.6, 1.9
	Newfoundland	2.11	1.0, 4.6	1.18	.7, 2.1
	Ontario	1.84*	1.1, 3.2	1.00	.7, 1.5
	Prince Edward Island	1.79	.5, 6.6	.86	.3, 2.5
	Nova Scotia	1.52	.7, 3.1	.97	.6, 1.6
	Alberta	1.41	.8, 2.6	.56*	.4, .9
	British Columbia	1.27	.7, 2.3	1.20	.8, 1.8
	Manitoba	1.03	.5, 2.1	1.03	.6, 1.7
	Saskatchewan†	1.00	...	1.00	...
Resides in census metropolitan area	No†	1.00	...	1.00	...
	Yes	.97	.8, 1.2	.68**	.6, .8
Education	Less than secondary	2.12**	1.7, 2.7	1.46**	1.2, 1.8
	Secondary	1.64**	1.3, 2.1	1.67**	1.3, 2.1
	Beyond high school	1.04	.8, 1.3	1.19	1.0, 1.5
	College or university†	1.00	...	1.00	...
Household income	Low	1.57**	1.1, 2.2	1.45*	1.1, 2.0
	Lower middle	1.70**	1.3, 2.3	1.81**	1.4, 2.4
	Upper middle	1.26	.9, 1.7	1.41*	1.1, 1.8
	High†	1.00	...	1.00	...
Main activity	Working†	1.00	...	1.00	...
	Working and caregiving	.65**	.5, .9	1.11	.9, 1.4
	Caregiving	1.10	.9, 1.4	1.35*	1.1, 1.7
	Looking for work	.81	.5, 1.4	1.47	.8, 2.7
	Retired, at school, ill	1.20	.9, 1.5	1.13	.9, 1.5
Place of birth	Canada†	1.00	...	1.00	...
	Other North America, Europe, Australia	1.87**	1.5, 2.4	.89	.7, 1.1
	South Am, Central Am, Caribbean, Africa	3.55**	2.4, 5.2	.35**	.2, .7
	Asia	8.73**	6.5, 11.8	.58*	.4, .9
Number of sex partners in last 12 months‡	None	9.48**	5.1, 17.8	7.81*	1.5, 40.6
	One	2.02*	1.1, 3.7	4.73	.9, 23.9
	Two	1.55	.7, 3.3	3.58	.6, 20.9
	Three or more†	1.00	...	1.00	...
Has cancer	No	1.41	.8, 2.4	1.40	.9, 2.1
	Yes†	1.00	...	1.00	...
Number of observations		6,878		5,945	

Data source: *1994/95 National Population Health Survey*
Notes: *Odds ratios are from two multivariate logistic regressions, the first weighted to represent 10,718,417 women aged 18 and older in the 10 provinces, and the second weighted to represent the 9,062,010 of these women who had ever had a Pap test and had indicated recency. Reference categories are the same for both regressions, and the reference categories do not always have the lowest or highest odds. The odds ratio for one category relative to another is equal to the ratio of their respective odds ratios. "Unknown" categories for the following variables were included in the model but are not shown here: education, income, and number of sex partners in last 12 months.*
† Identifies reference category, for which the odds ratio is always 1.00.
‡ Women over age 45 were not asked about the number of sex partners.
-- Amount too small to be expressed
... Not applicable
** $0.01 < p \leq 0.05$*
*** $p \leq 0.01$*

Province of residence

Women living in Quebec had significantly elevated odds of never having had a Pap test, almost twice those of residents of New Brunswick, the province with the second highest odds. Women in the four westernmost provinces had the lowest non-compliance odds. For British Columbia and Nova Scotia, which have the longest-running cervical screening programs, the odds of lifetime non-compliance were not significantly different from Saskatchewan, the province with the lowest odds.

Alberta women who had had a Pap test were the most compliant with the three-year frequency guideline; their odds of non-compliance were the lowest among the ten provinces. And while residents of Quebec had the highest lifetime non-compliance odds, Quebec women who had had a Pap test were relatively compliant with the three-year frequency guideline. Conversely, British Columbia women had relatively low lifetime non-compliance odds, but those who had had a Pap test had the highest odds of having their last test more than three years ago. Hence, even in the province with the most well-established cervical cancer screening program in Canada, recommended guidelines are not being fully met.

Residents of large urban areas

Living in a large metropolitan area had no significant effect on whether women had ever had a Pap test. However, among women who had had one, it did have a significant effect on when they had their last test. Compared with women in smaller metropolitan or rural areas, women in census metropolitan areas had significantly lower odds of having had their most recent Pap test three or more years ago. This suggests that access to medical facilities is more limited in smaller metropolitan or rural areas, affecting the recency of screening.

Number of sex partners

Cervical cancer is strongly associated with having had first intercourse at an early age and with having multiple sex partners, because it is associated with the human papilloma virus (HPV), which can be sexually transmitted.[4,6,8] The results of this study show that the more sex partners a woman had in the last year, the more likely she was to have ever had a Pap test. Given the guidelines for cervical cancer screening, which recommend that screening begin at the onset of sexual activity, it is not surprising that women with three or more sex partners in the 12 months before their NPHS interview had the lowest odds of never having had a Pap test—one-ninth the odds for women with no sex partner.

Among women who have had at least one Pap test, the effect of the number of sex partners in the last 12 months on Pap test recency was similar. Women with three or more sex partners had the lowest odds of not having had a test in the previous three years, compared to women with one sex partner.

Whether this compliance is due to success in conveying information about cervical cancer to women at increased risk is a matter of speculation. It may be related to the practice by doctors of conducting a Pap test before prescribing or renewing prescriptions for birth control pills.

Marital status and main activity

Single women were the most likely to have never had a Pap test. In addition, single women who had ever had a Pap test had the highest odds of having had the last one three or more years ago. Widowed women, who were very likely to have ever had a Pap test, were relatively unlikely to have had one within the last three years.

Women whose main activity included both working and caregiving had the lowest odds of never having had a Pap test, significantly lower than for women who only worked. Women whose main activity was caregiving had the second highest odds of not having had their most recent test within the last three years, significantly higher than for women whose main activity was working.

Implications

Efforts to improve Pap test compliance in order to further reduce cervical cancer incidence and mortality may be best directed by focussing on groups of women highlighted in this article and in

past research. For example, the high rates of lifetime non-compliance among those born outside Canada might be useful for programs attempting to focus their activity. Cervical cancer is a very common cancer in developing countries—with both high incidence and mortality rates[16,32] (see *International comparisons).*

It has been found that groups at low risk for cervical cancer are over-screened, while groups at high risk are under-screened,[33] a finding consistent with those in this article to some extent. Older women are at greater risk for cervical cancer, yet NPHS data indicate that they do not receive Pap tests as frequently as recommended. On the positive side, women with multiple sex partners, who are also at elevated risk for developing cervical cancer via HPV infection, exhibit the lowest odds of non-compliance with screening guidelines.

International comparisons

The quinquennial publication *Cancer Incidence in Five Continents*[32] compiles data from cancer registries around the world and is the source of the following cervical cancer incidence rates.

Country/ Cancer registry	Age-standardized cervical cancer incidence rate per 100,000 females, 1988 to 1992
Zimbabwe: Harare, Africans†	67.2
Ecuador: Quito	31.7
Costa Rica	24.5
Philippines: Manila	21.6
India: Bombay	20.2
Czech Republic	16.4
Hong Kong	15.3
Denmark	15.2
England and Wales‡	12.5
USA: SEER,§ Black	12.0
Australian Capital Territory	10.3
Japan: Osaka	9.2
Canada	**7.8**
USA: SEER,§ White	7.5
China: Shanghai	3.3

Note: *Rates are standardized to the World Standard Population.*
† Data from Zimbabwe are for 1990-1992.
‡ Data from England and Wales are for 1988-1990.
§ The Surveillance, Epidemiology and End Results program

Half of invasive cervical cancer cases occur in women with no previous cytologic examination or whose last exam was more than five years ago.[15] The findings of this study—that a large number of Canadian women have never had a Pap test or have had one more than three years ago—suggest that more effort is needed to reach these women.

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Appendix

Percentage distributions of characteristics, women aged 18 and older, by level of Pap test guideline compliance, Canada excluding territories, 1994/95

		All women	Had Pap test in last 3 years†	Had last Pap test 3 or more years ago†	Never had Pap test
Total		**10,718,417**	**7,402,822**	**1,659,188**	**1,654,278**
				%	
		100.0	100.0	100.0	100.0
Age	18-19	3.2	2.3	.1	10.6
	20-29	17.6	20.1	2.5	21.6
	30-39	24.6	29.3	15.6	13.0
	40-49	18.4	20.7	17.1	9.6
	50-59	13.1	13.0	18.4	8.5
	60-69	11.3	9.6	19.4	10.9
	70+	11.7	5.1	27.0	25.8
Marital status	Single (never married)	17.2	15.1	7.7	35.9
	Now married	56.7	60.7	57.6	38.2
	Common-law/Living with partner	6.8	8.2	3.4	4.0
	Separated or divorced	9.5	10.2	10.1	5.7
	Widowed	9.9	5.9	21.3	16.2
Province of residence	Newfoundland	1.9	1.9	2.6	1.6
	Prince Edward Island	.5	.5	.6	.3
	Nova Scotia	3.3	3.4	3.8	2.2
	New Brunswick	2.6	2.4	3.4	2.6
	Quebec	25.3	23.6	19.7	38.9
	Ontario	37.8	38.1	38.7	35.4
	Manitoba	3.7	3.8	4.5	2.1
	Saskatchewan	3.3	3.4	4.4	1.6
	Alberta	9.0	10.3	6.0	5.9
	British Columbia	12.7	12.6	16.3	9.3
Resides in census metropolitan area	No	38.2	36.8	49.5	33.5
	Yes	61.8	63.2	50.5	66.5
Education	Less than secondary	25.5	19.8	36.5	40.3
	Secondary	17.5	17.0	19.7	17.2
	Beyond high school	26.1	27.7	21.8	23.1
	College or university	30.8	35.5	22.0	19.1
	Unknown	.1	--	--	.4
Household income	Low	20.2	17.4	22.9	29.5
	Lower middle	28.9	26.2	35.7	34.3
	Upper middle	33.4	36.6	29.8	23.1
	High	13.5	16.0	8.1	7.7
	Unknown	4.0	3.8	3.5	5.4
Main activity	Working	24.9	27.7	15.1	21.9
	Working and caregiving	20.4	24.7	15.2	6.5
	Caregiving	27.2	27.2	29.4	24.7
	Looking for work	2.0	2.1	1.5	2.2
	Retired, at school, ill	25.5	18.3	38.8	44.7
Place of birth	Canada	80.4	82.1	83.7	69.4
	Other North America, Europe, Australia	11.8	11.2	13.5	12.4
	South America, Central America, Caribbean, Africa	3.0	2.9	.8	5.7
	Asia	4.9	3.9	1.9	12.5
Number of sex partners in last 12 months‡	None	6.3	4.1	3.4	19.3
	One	45.9	55.1	23.4	27.7
	Two	2.5	3.0	.7	2.2
	Three or more	1.8	2.2	.1	1.6
	Not asked/Unknown	43.4	35.7	72.3	49.2
Has cancer	Yes	2.4	2.3	3.1	1.8
	No	97.6	97.7	96.9	98.2

Data source: *1994/95 National Population Health Survey*

Note: *Distributions were weighted to represent non-institutionalized women aged 18 and older in the 10 provinces.*

† Excludes women who had ever had a Pap test, but did not indicate recency.

‡ Women over age 45 were not asked about the number of sex partners.

-- Amount too small to be expressed

Pregnancy-related hospital use

Timothy Werschler

Abstract

Objectives

This article describes provincial variations in women's hospital use during pregnancy, childbirth and the postnatal period.

Data source

The data were extracted from the Person-Oriented Information Data Base, maintained by Health Statistics Division at Statistics Canada. This data base is comprised of hospital admission data submitted by general and allied hospitals to provincial and territorial governments and is considered complete for each jurisdiction. Data were not available for the Yukon Territory.

Analytical techniques

A group of 57,627 women who gave birth during October and November 1993 was identified from hospital admission records using selected ICD-9 and CCP codes. These records were then linked to other hospital admissions that occurred in the six months before and the four months after childbirth.

Main results

Approximately 15% of women who gave birth in October and November 1993 were admitted to hospital at least once during the six months before childbirth. Only 4% were re-admitted during the four months after the birth.

Key words

re-admission rate, length of stay, health care policy, childbirth, episiotomy, cesarean

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Hospitals are commonly thought of as places for the ill and the injured. However, a major function of many hospitals is to provide care related to childbirth. In fiscal year 1993/94, one in four hospital admissions among women was to give birth.

Although each pregnancy and delivery is unique, the experiences of Canadian women are shaped, in part, by the health care that they receive. Many factors influence pregnancy-related hospital use, for example, the availability of hospital resources, distance to hospital, physician practice patterns, hospital policies and the availability of outpatient services. And because health care is under provincial and territorial jurisdiction, pregnancy-related hospital use may also vary regionally.

This article examines the pregnancy-related hospital use of 57,627 women who were admitted to hospital to give birth during October and November, 1993 and is based on data from Health Statistics Division's Person-Oriented Information Data Base. It analyzes provincial variations in women's hospital use during pregnancy, childbirth, and the postnatal period (see *Methods*).

Unlike "traditional" hospital admission data bases, in the Person-Oriented Information Data Base, records that pertain to the same individual can be linked by the health insurance number reported at the time of admission. This linkage enables an analysis based on people as opposed to events (hospital admissions).

For two provinces, Quebec and Nova Scotia, it was only possible to link hospital admission records that occurred within a single fiscal year. Consequently, women who gave birth in hospital during October and November were chosen for analysis. This allowed an examination of all hospital admissions of these women during the six months before childbirth and the four months afterward.

Most new mothers in hospital for delivery only

Of the women in the study group, 81% were admitted to hospital only once during fiscal year

Methods

Data source

The data in this analysis were extracted from the Person-Oriented Information Data Base, maintained by Health Statistics Division at Statistics Canada. The data base is comprised of hospital admission data submitted by general and allied hospitals to provincial and territorial governments, and is considered complete for each jurisdiction. Data were not available for the Yukon Territory.

Each hospital admission record contains information on the patient's characteristics (such as sex and age), diagnoses, surgical procedures performed, length of stay, hospital location, and other related information. The data undergo several checks to ensure their general integrity and suitability for analytical purposes.

Analytical techniques

Because no single diagnosis or procedure code can be used to unambiguously signal the occurrence of a birth during a hospital stay, a woman was considered to have given birth if one of the following codes appeared on her hospital record:[1,2]

Delivery in a completely normal case: ICD-9 code 650
Complications in labour and delivery: ICD-9 codes 660 to 669
Outcome of delivery: ICD-9 codes V27.0 to V27.7
Induction, instrumental, cesarean delivery: CCP codes 84.0 to 86.2
Other and unspecified cesarean: CCP codes 86.8 to 86.9
Birth not elsewhere classified or specified: CCP code 87.98

Minor changes in these selection criteria did not result in major changes in the size of the study population or its composition, as most women were identifiable by more than one of the above codes. Under the selection criteria, women having stillbirths were included in this analysis, which serves to make the sample more complete. However, it was not possible to identify which births were stillbirths. Other procedures, such as repair of hernia (CCP codes 650-659) were not used as selection criteria because these codes do not unambiguously signal a birth.

This selection method yielded a study population of 57,627 women. During the same period, 61,243 births were registered across the country (live and stillbirths combined). After adjusting for multiple births, birth registrations yield an estimate of 59,915 women. This suggests that the population examined in this article accounts for approximately 96% of all women who gave birth during that period.

Limitations

The data analyzed in this article pertain only to hospital admissions. While the vast majority of Canadian women give birth in hospitals, many health-care services rendered before and after childbirth are provided in physicians' offices or on an outpatient basis at a hospital. Information on the services performed during these visits is not discussed here.

Hospital admissions that occurred outside the province where the woman usually resided were excluded. Out-of-province hospital admissions accounted for approximately 3% of hospital stays in 1993/94. Conversely, women who moved to another province and were subsequently admitted to hospital were identified on the data base as two different people. The result is a slight upward bias of approximately 1% in the total number of patients at the national level (based on current annual inter-provincial migration rates).

The Person-Oriented Information Data Base does not contain data on newborns. They are often given the same health insurance number as their mother, with a unique number assigned some days after the birth. Consequently, records relating to services provided to newborns immediately after delivery and during subsequent hospital admissions cannot be easily linked. Birth-related admissions data do not contain information on parity. Thus, it is not possible to examine the relationship between parity and length of stay, readmission rates, and procedures used at birth.

1993/94, and that was to give birth (Table 1). Approximately 15% were hospitalized at least once during the six months before childbirth, a finding consistent with research in the United States.[3,4] Only 4% of the women were re-admitted during the four months after the birth.

Prenatal admissions

Hospital admission rates during the six months before childbirth varied considerably across the country. British Columbia, Ontario, Alberta and Quebec had rates at or below the national average. The remaining provinces (including the Northwest Territories) had above-average rates, with Manitoba and Newfoundland recording the highest.

The leading diagnoses among the women who were hospitalized during the six months before childbirth were threatened labour, other complications of pregnancy not elsewhere classified (such as minor infections of the genitourinary tract, liver disorders, and gestational edema), and other complications classifiable elsewhere but complicating pregnancy (such as diabetes mellitus, anemia, and cardiovascular diseases). Together, these causes accounted for over half of all prenatal admissions (Table 2).

Table 1
Pregnancy-related hospital admission rates, by province/ territory, October-November, 1993

	Women who gave birth	Prenatal admission rate	Postnatal admission rate	Admission for birth only
	Number		%	
Canada	**57,627**	**14.9**	**3.8**	**81.3**
Nfld.	1,004	20.5	5.1	74.4
P.E.I.	238	19.3	5.5	75.2
N.S.	1,704	17.2	5.8	77.1
N.B.	1,413	15.7	5.2	79.1
Que.	13,444	14.9	3.0	82.2
Ont.	22,943	13.7	3.1	83.2
Man.	2,228	21.9	4.9	73.2
Sask.	2,075	19.9	7.5	72.7
Alta.	5,460	14.6	5.6	79.8
B.C.	6,937	13.6	4.1	82.4
N.W.T.	181	19.3	7.2	73.5

Data source: *Person-Oriented Information Data Base, Health Statistics Division*

Length of hospital stay varies provincially

Using administrative data on hospital admission and separation dates for birth-related stays, it is possible to produce consistent estimates of the average length of stay by province or territory. At the national level, the average hospital stay for giving birth was 3.6 days (Table 3). However, women in Ontario and western Canada experienced shorter average stays than did their counterparts in the east. The shortest average stays were in the Northwest Territories, Alberta, and Ontario. Unlike most other jurisdictions, the comparatively brief length of stay in the Northwest Territories (2.8 days) may be influenced by the practice of transporting women with high-risk pregnancies to larger, more specialized medical facilities in neighbouring provinces.

Table 2
Leading diagnoses at prenatal hospitalization, Canada, October-November, 1993

Diagnosis (ICD-9 code)	Number	Percent of prenatal admissions†	Percent of all births
			%
Threatened labour (644)	3,917	33	6.8
Other complications of pregnancy not elsewhere classified (646)	1,199	10	2.1
Other complications classifiable elsewhere but complicating pregnancy (648)	1,089	9	1.9
Antepartum hemorrhage, abruptio placentae, and placenta praevia (641)	844	7	1.5
Hypertension complicating pregnancy, childbirth and the puerperium (642)	831	7	1.4
Excessive vomiting (643)	669	6	1.2
Other problems associated with amniotic cavity and membranes (658)	405	3	0.7
Hemorrhage in early pregnancy (640)	317	3	0.6
Abnormality of organs and soft tissues of pelvis (654)	241	2	0.4
Other fetal and placental problems affecting management of mother (656)	229	2	0.4

Data source: *Person-Oriented Information Data Base, Health Statistics Division*

† Rate is based on 11,807 prenatal hospital admissions and includes multiple admissions of the same person (15% of admissions).

The average length of stay figures reported in this article are comparable to those in Health Canada's *Survey of Routine Maternity Care and Practices in Canadian Hospitals*.[5] Differences may be attributable to the units of analysis. The figures in this article are based on birth-related hospital stays and are population-weighted. In Health Canada's report, the hospital/obstetrics ward is the unit of analysis and each unit is given equal weight.

One in three women giving birth undergo an episiotomy

One of the most common procedures performed during childbirth is a routine episiotomy (CCP code 85.7) (Table 4). When episiotomies performed in conjunction with forceps or vacuum extractions are included (codes 84.1 and 84.71), 31% of births involved some kind of episiotomy. (By comparison, a total episiotomy rate of approximately 55% was estimated in the Health Canada study.[5] Again, this difference may reflect the unit of analysis.)

A similar proportion of women experienced a repair of other obstetric lacerations (36%), with some of the lacerations resulting from an episiotomy. Despite the widespread application of episiotomy, some researchers suggest that there is little evidence to support its routine use and that health outcomes can be improved with a reduction in the episiotomy rate.[6,7]

One in seven labours induced

Some labours that begin naturally cease following admission to hospital and are then re-initiated medically. In other cases, labour is induced from the start, often because the pregnancy has extended past the anticipated date of childbirth. In the study group, about one in seven deliveries were medically induced, and one in three women experienced an artificial rupture of membranes.

When labour is induced, it can be scheduled during traditional work hours when the attending physician and hospital staff are readily available. Hospital admissions of women giving birth were approximately 10% above average during the work-week and 20% below average on weekends and holidays.

Cesarean section

In total, 18% of all births were delivered by cervical cesarean section, a procedure that is performed more often on older women and women who have previously undergone a cesarean.[8,9] This figure is consistent with estimates reported elsewhere. However, some recent research suggests that the cesarean rate can be reduced to 9% without adversely affecting maternal or infant health outcomes.[5,10]

Table 3
Average length of hospital stay for childbirth, by province/territory, October-November, 1993

	Total hospital days			Women admitted to hospital			Average length of stay		
	Total	Cesarean	Non-Cesarean	Total	Cesarean	Non-Cesarean	Total	Cesarean	Non-Cesarean
		Days			Number			Days	
Canada	**209,325**	**61,780**	**147,545**	**57,627**	**10,484**	**47,143**	**3.6**	**5.9**	**3.1**
Newfoundland	4,302	1,257	3,045	1,004	204	800	4.3	6.2	3.8
Prince Edward Island	1,114	375	739	238	48	190	4.7	7.8	3.9
Nova Scotia	7,354	2,063	5,291	1,704	330	1,374	4.3	6.3	3.9
New Brunswick	6,365	2,105	4,260	1,413	301	1,112	4.5	7.0	3.8
Quebec	56,197	15,191	41,006	13,444	2,292	11,152	4.2	6.6	3.7
Ontario	75,629	23,345	52,284	22,943	4,160	18,783	3.3	5.6	2.8
Manitoba	7,782	2,614	5,168	2,228	395	1,833	3.5	6.6	2.8
Saskatchewan	7,943	2,036	5,907	2,075	347	1,728	3.8	5.9	3.4
Alberta	17,257	4,654	12,603	5,460	895	4,565	3.2	5.2	2.8
British Columbia	24,882	8,095	16,787	6,937	1,502	5,435	3.6	5.4	3.1
Northwest Territories	500	45	455	181	10	171	2.8	4.5	2.7

Data source: *Person-Oriented Information Data Base, Health Statistics Division*

There is a higher rate of maternal and neonatal morbidity associated with cesarean section compared with vaginal deliveries.[11] Understandably, this procedure generally involves longer hospital stays (Table 3). However, some recent American studies maintain that health outcomes can be improved and costs significantly reduced when post-cesarean early discharge programs are coupled with home follow-up.[12,13] In Canada, approximately 25% of hospitals report some type of formalised early discharge program.[5]

Fetal surveillance

There was substantial regional variation in fetal surveillance during childbirth (CCP code 87.5), with the principal techniques including needlescopy, fetal EKG, and blood sampling. In Nova Scotia and New Brunswick, fetal surveillance was used in fewer than 5% of births. In Quebec, Ontario, Manitoba, Saskatchewan and British Columbia, 15% to 18% of births were monitored in this fashion. In Newfoundland, it was done during one-third of all births, and in Alberta, over half were monitored this way. Other research indicates that a majority of Canadian hospitals have policies that support the use of initial electronic fetal monitoring, but only a minority support the use of continuous electronic fetal heart rate monitoring.[5]

While some type of assistance is rendered during most births, there appears to be considerable variation in practice across the country. These differences suggest that the choice of procedure may be influenced to some extent by regional convention. However, because these estimates are based on a two-month period only, they should be interpreted with caution. Some of the variation may be due to the relatively brief period to which the rates refer or to provincial variations in coding practices.

The variation in the frequency of "other obstetric operations" is most likely due to coding conventions in each jurisdiction. This code is used as a catch-all for births where no clear procedure was performed and may be unevenly applied.

Short hospital stays lead to high re-admission rates?

With the reduction in the length of hospital stays,[14,15] concern has been growing about whether the health of new mothers or their children is compromised. Hospital re-admission rates have been used in an attempt to gauge change in health outcomes, but such information can be misleading—since re-admission rates may say more about the availability of health services and how they are delivered in each

Table 4
Prevalence rates of most common birth-related procedures, by province/territory, October-November, 1993

Procedure (CCP code)	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	N.W.T.
							%					
Repair of other obstetric lacerations (87.8)	36	29	17	36	15	38	34	35	37	40	39	44
Artificial rupture of membranes (85.0)	35	36	53	41	12	44	32	32	26	36	33	40
Episiotomy (85.7)	21	24	34	24	17	29	20	23	17	18	15	15
Other operations on fetus and amnion (87.5)	20	33	-	4	1	17	16	17	15	57	18	7
Cervical cesarean (86.1)	18	20	23	19	21	17	17	20	17	16	22	6
Manually assisted delivery (85.6)	16	15	-	16	12	12	22	1	16	12	14	21
Other obstetric operations (87.9)	15	8	-	-	-	24	19	-	10	-	6	1
Medical induction of labour (85.5)†	14	16	19	17	9	13	14	20	11	14	14	8
Vacuum extraction (84.71)	7	5	2	3	3	8	6	3	11	9	6	10
Low forceps delivery with episiotomy (84.1)	4	4	3	4	4	4	4	6	3	3	3	1

Data source: *Person-Oriented Information Data Base, Health Statistics Division*
Note: *Rate is based on 56,967 women having at least one procedure performed during childbirth.*
† Includes manual rotation of fetal head, assisted spontaneous delivery, Credé manœuvre, and other procedures.
- Nil or zero

province than about health outcomes.[16] For example, in Nova Scotia, the average length of stay for childbirth was a full day longer than in Ontario, yet Nova Scotia's hospital admission rates for the period before and after childbirth were both measurably higher than in Ontario.

Postnatal admissions

Only 4% of women in the study group were re-admitted during the four months after the birth of their child (Table 1). Other research corroborates this finding and also reports that only a small proportion of women who experience postnatal complications are hospitalized.[11,17] Among those hospitalized, the leading diagnoses were cholelithiasis (gall stones), postpartum hemorrhage, postpartum care and examination, and major puerperal infection (Table 5). For this group, an average of 45 days elapsed between the date of discharge and their first re-admission.

There was some provincial variation in admission rates after childbirth. Only Quebec and Ontario had rates below the national average. Saskatchewan and the Northwest Territories posted the highest. Admission rates in Prince Edward Island and the Northwest Territories must be interpreted with caution, as they are based on small numbers.

Table 5
Leading diagnoses at postnatal hospitalization, Canada, October-November, 1993

Diagnosis (ICD-9 code)	Number	Percent of postnatal admissions†	Percent of of all births
		%	
Cholelithiasis (574)‡	392	15	0.7
Postpartum hemorrhage (666)	248	10	0.4
Postpartum care and examination (V24)	228	9	0.4
Major puerperal infection (670)	166	6	0.3
Contraceptive management (V25)	91	4	0.2
Other and unspecified complications of the puerperium (674)‡	80	3	0.1
Other symptoms involving abdomen and pelvis (789)	52	2	0.1
Persons seeking consulation without complaint or sickness (V65)‡	52	2	0.1
Infection of the breast and nipple associated with childbirth (675)	51	2	0.1
Other complications of pregnancy not elsewhere classified (646)	42	2	0.1

Data source: *Person-Oriented Information Data Base, Health Statistics Division*

† Rate is based on 2,598 postpartum hospital admissions and includes multiple admissions of the same person (15% of admissions).

‡ It is unknown whether admissions for these diagnoses are pregnancy-related.

Summary

The use of hospital resources during pregnancy, childbirth, and the postnatal period varies considerably across the country. In the Atlantic provinces, a larger percentage of women were hospitalized before and after childbirth than elsewhere in Canada, and their average length of hospital stay when giving birth was also the longest. By contrast, women in Ontario, British Columbia and Alberta had comparatively short stays for childbirth and generally low rates of hospitalization before and after childbirth.

The situation was mixed in other provinces. Quebec women experienced relatively long hospital stays but had low admission rates during the prenatal and postnatal periods. Conversely, in Manitoba, Saskatchewan and the Northwest Territories, hospital stays were short but admission rates before and after delivery were relatively high.

The findings in this article reflect birth-related hospital use during 1993/94, the most recent period for which linked hospital admissions data are available. Since then, there have been changes in pregnancy-related hospital use including more specific hospital policies on length of stay for an uncomplicated birth, greater access to midwifery services, and steady growth in the availability of prenatal and postnatal care programs offered outside hospital settings.

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Home care in Canada

Kathryn Wilkins and Evelyn Park

Abstract

Objectives

This article describes the social, socioeconomic and other health-related characteristics of people receiving formal, publicly funded home care services.

Data source

The data are from the household component of the 1994/95 National Population Health Survey. The analysis covers 16,291 respondents aged 18 or older.

Analytical techniques

Recipients of publicly funded home care services were profiled using weighted univariate frequencies and multivariate logistic regression.

Main results

Recipients of publicly funded home care services in 1994/95 numbered over half a million. People who were elderly, female, had two or more chronic conditions or were living with others accounted for large proportions of these recipients. Characteristics significantly associated with receiving home care included old age, poor or fair general health, abstinence from alcohol (compared with regular use), low income, living alone, needing help with some activity of daily living, and having cancer or the effects of a stroke.

Key words

home care services, aged, disabled, home nursing, activities of daily living

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In recent years, health care restructuring has resulted in bed and hospital closures.[1] Cost containment measures have also given rise to shorter hospital stays. Falling hospital admission rates and shorter stays suggest that some patients are now discharged at an earlier stage of recovery from surgery or illness than in the past.[2,3] In addition, with the growth of the elderly population, the number of people living in the community with chronic, debilitating conditions such as arthritis and dementia is increasing.[4]

The provision of health care and support services in the home is currently receiving much attention from all levels of government as a cheaper alternative to, or means of transition from, both acute and long-term institutional care. A report released in 1997 by the National Forum on Health named home care as one of three "areas for action to move toward a more integrated system."[5] Home care was identified as a priority for funding in the 1997 federal budget, and in 1998, home care was the subject of a national conference.[6]

In addition to the recommendation of merging home care into publicly funded health care services, the National Forum on Health noted the desirability of standardizing home care across Canada. Currently, home care services are centrally organized in some provinces, but regionally or locally controlled in others. A physician's referral may be required in one place, while in another, a referral

Methods

Data source

Most of the analysis in this article is based on the household component of Statistics Canada's 1994/95 National Population Health Survey (NPHS) for the 10 provinces. Some data from the institutional component, which covered residents of long-term health care facilities, are also presented.

The household component of the NPHS sample consisted of 27,263 households, of which 88.7% agreed to participate in the survey. After the application of a screening rule (to keep the sample representative),[7] 20,725 households remained in scope.

One knowledgeable person in every participating household provided general socio-demographic and health information about each household member. In total, data pertaining to 58,439 individuals were collected. (The data base containing these data is called the General file). In addition, one randomly selected person in each of the 20,725 participating households was chosen to provide in-depth information about their own health. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to these in-depth health questions was 96.1% or 17,626 respondents. (The data base containing in-depth health information as well as data from the General file pertaining to these respondents is called the Health file.) Only the 16,291 records corresponding to adults (aged 18 or older) were analyzed for this article.

Analytical techniques

Tabulations of selected variables were used to describe recipients of publicly funded home care (referred to as formal home care services) and to compare them with the general household population. Estimates were weighted to the age and sex distribution of the 1994/95 Canadian population aged 18 and older.

Multiple logistic regression was used to study the associations of independent variables with home care use. The regression analysis was performed on data for the 568 respondents aged 18 or older who reported receiving home care in the 12 months before the survey, as well as the 15,663 respondents who did not receive it and for whom complete data were available. To avoid losing data from the 4% of respondents who did not provide income information, the category "household income: data not available" was created. To reduce bias, regressions were weighted using survey weights re-scaled to sum to the sample size. To account for design effects, odds ratios were considered statistically significant only if the values of the lower and upper bounds of their 95% confidence interval were not in the range 0.945 to 1.055.

Limitations

Formal home care constitutes only a part of all care rendered to people in their home. Although those who receive home nursing services probably have greater physical needs, or at least need more specialized care than can be provided by household members, it is reasonable to expect that in many respects, formal home care recipients do not differ much from people who receive informal care. However, since data on informal care were not available, respondents receiving informal care only were included with those not receiving formal home care.

The absence of a uniform definition of formal home care limits the interpretation of the findings. Services differ in structure, access and content among provincial and regional jurisdictions. To account for some of the differences, province was included in the initial regression models. However, the effect on the probability of receiving home care was negligible, so the variable was dropped from the analysis.

Selection bias may further limit interpretation of the data. Household members who were not available to be selected as survey respondents for the in-depth health interview may not have enjoyed the same level of health as those who were available and selected. For example, some people who had received home care during the 12 months before the survey may not have been interviewed because they were ill or in hospital. To partially assess the extent of such bias, weighted estimates of the number of people who received home care were produced using the data from the randomly selected respondents (Health file), as well as from all household members (General file). Although the estimate using data for all household members was slightly higher (2.6% versus 2.4%), the difference was reassuringly small.

All data were self-reported, and the degree of their validity is unknown. To minimize reporting error related to chronic diseases, respondents were instructed to report only those conditions that were (or were expected to be) of at least six months' duration and had been diagnosed by a health professional.

from a social service agency suffices.[8,9] And in most but not all jurisdictions, home care recipients are charged nominal fees, depending on their ability to pay.[10] In some areas, home care includes a comprehensive range of services including physiotherapy, speech therapy, occupational therapy, and palliative and acute care; in others, only standard functions such as nursing and homemaking services are available.

This lack of uniformity poses a challenge to research and may help explain why published reports on home care have focused almost exclusively on provincially or regionally administered programs.[11-13] If home care services are to be standardized as recommended by the National Forum on Health, understanding home care recipients at the national level is essential.

The National Population Health Survey (NPHS), a comprehensive, population-based survey of the health of Canadians, has collected information about publicly funded home care services across the country. Based on 1994/95 NPHS data, this article provides a profile of users of formally organized home care, in terms of health conditions and behavioural, personal and social characteristics (see *Methods* and *Definitions*). The article also shows which factors, adjusting for other relevant variables, are associated with receiving home care. Finally, it looks at what proportion of people needing help actually receive formal home care.

Women and home care—an indirect link

In 1994/95, an estimated 522,900 Canadian adults, or 2.4% of people aged 18 and older, reported receiving formal home care in the 12 months before the survey. Over one-third (36%) of them were younger than 65—a clear indication that home care is not limited to geriatric services.

Although the proportion under 65 is substantial, this age group comprises a much smaller share of home care users than of the non-recipient household population (Table 1). Only 1% of the household population under age 65 received home care, compared with 8% of 65- to 79- year-olds and 22% of those aged 80 and older. Not surprisingly, seniors' odds of receiving home care, even after controlling for the presence of specific chronic

Table 1
Selected characteristics of recipients and non-recipients of formal home care in past year, household population aged 18 and older, Canada excluding territories, 1994/95

	Home care recipients	Non-recipients
	%	
Age		
18-64	35.9	86.0
65-79	39.8	11.9
80+	24.3	2.1
Sex		
Male	32.7	49.5
Female	67.4	50.6
Living arrangements		
Alone	39.0	12.0
With others	61.0	88.0
Household income		
Lowest	13.9	5.4
Lower middle	25.1	11.1
Middle	33.0	28.0
Upper middle	18.4	35.2
Highest	5.2	15.5
Data not available	4.4	4.7
Chronic conditions†‡		
Arthritis/Rheumatism	45.7	13.4
Back problems (non-arthritic)	27.6	14.8
Chronic bronchitis/Emphysema	11.3	3.1
Cancer	9.6	1.6
Cataracts	17.2	2.3
Diabetes	15.5	3.1
Heart disease	25.3	3.7
High blood pressure	28.8	9.2
Effects of stroke	10.0	0.7
Urinary incontinence	8.0	1.0
2+ chronic conditions	56.3	14.0
General health status		
Poor	20.6	2.0
Fair	29.0	8.2
Good	29.2	27.0
Very good	16.5	37.3
Excellent	4.8	25.5
Needs help with ADL†	25.4	0.9
Moving about inside house	13.0	0.5
Personal care	22.5	0.7
Needs help with IADL†	72.3	7.6
Preparing meals	31.4	1.4
Shopping for groceries	40.8	2.5
Housework	50.9	2.8
Heavy household chores	63.0	7.0
Activity-limiting injury in past 12 months	21.5	15.8
Hospital stay in past 12 months		
None	50.5	90.8
1-7 nights	21.7	6.9
8+ nights	27.8	2.1
Alcohol use		
None	47.5	20.1
Occasional (< 1 drink per week)	34.9	41.5
Regular (at least 1 drink per week)	17.6	38.4
Smoking		
Never	37.2	38.0
Occasional/Former	42.4	35.8
Daily	20.5	26.2

Data source: *1994/95 National Population Health Survey, Health file*
† Sum of percentages may exceed 100% because multiple responses are allowed.
‡ As diagnosed by a health professional

conditions and other health-related factors, were nearly three times those of people aged 18 to 64 (Table 2).

Two-thirds of home care recipients were women, but the adjusted odds of receiving home care were no higher for women than for men. This reflects the association between being female and factors that are more strongly associated with receiving home care, such as reaching old age, having chronic conditions, and needing help with activities of daily living (ADL).

Direct information on disease severity was not available from the NPHS. However, three variables were used as indicators of health: self-reported general health, number of chronic conditions, and time spent in hospital in the past year. Half of home

Definitions

The following definition was read to NPHS respondents: "*Home care* services are health care or homemaker services received at home, with the cost being entirely or partially covered by government (e.g., nursing care; help with bathing; help around the home; physiotherapy; counseling; and meal delivery)." Respondents were asked: "Have you received any home care services in the past 12 months? (Yes No) What type of services have you received? (Specify)."

To measure the prevalence of *chronic conditions*, respondents were asked: "Do you have any of the following long-term conditions (refers to conditions that have lasted or are expected to last six months or more) that have been diagnosed by a health professional: asthma, arthritis or rheumatism, back problems excluding arthritis, high blood pressure, chronic bronchitis or emphysema, diabetes, heart disease, cancer, effects of stroke, urinary incontinence, cataracts and glaucoma?"

To measure the occurrence of *injuries*, respondents were asked: "In the past 12 months, did you have any injuries that were serious enough to limit your/his/her normal activities?"

Dependency in *instrumental activities of daily living (IADL)* was measured by asking: "Because of any condition or health problem, do you need the help of another person in: Preparing meals? Shopping for groceries or other necessities? Doing normal everyday housework? Doing heavy household chores such as washing walls, yard work, etc.?"

Dependency in *activities of daily living (ADL)* was measured by extending the question to "Personal care such as washing, dressing or eating? Moving about inside the house?"

To obtain *general health status*, respondents were asked: "In general, would you say your health is: Excellent? Very good? Good? Fair? Poor?"

Alcohol use was categorized as:

1. Regular (at least one drink per week),
2. Occasional (maximum of 2-3 drinks per month),
3. Never drank or currently does not drink (no alcoholic beverage in past 12 months)

Smoking was categorized as:

1. Regular smoking (smokes daily now)
2. Former or occasional current smoking ("occasional" is less frequently than daily)
3. Has never smoked

Living arrangement categories were defined as:

1. Lives with at least one other person
2. Lives alone

The average *frequency of contacts* with relatives (living outside one's home), friends and neighbours was measured in two categories:

1. Low-medium (average of 0-4 contacts in past 12 months)
2. Frequent (average of 5-6 contacts in past 12 months)

Household income group is a derived measure of income based on household size:

	Household income group				
Household size	Lowest	Lower middle	Middle	Upper middle	Highest
1 or 2 people	<$10,000	$10,000-$14,999	$15,000-$29,999	$30,000-$59,999	≥$60,000
3 or 4 people	<$10,000	$10,000-$19,999	$20,000-$39,999	$40,000-$79,999	≥$80,000
5 or more people	<$15,000	$15,000-$29,999	$30,000-$59,999	$60,000-$79,999	≥$80,000

care recipients reported their health as "poor" or "fair," 56% had two or more chronic conditions, and 28% had spent eight or more nights in hospital during the previous year. These proportions were notably lower among non-recipients of home care. The odds of receiving home care among people reporting poor or fair health and among those who had spent at least eight nights in hospital remained significantly elevated after controlling for the effects of specific chronic conditions, age, ADL dependency, sex, and other factors included in the analysis.

Table 2
Adjusted odds ratios relating selected characteristics to receipt of formal home care in past year, household population aged 18 and older, Canada excluding territories, 1994/95

	Adjusted odds ratio	95% confidence interval
Demographic factors		
Age 65 or older	2.9*	2.14, 3.79
Female	1.2	0.89, 1.50
Physical needs		
IADL or ADL dependency	10.8*	8.07, 14.40
Hospital stay of 8+ nights in past 12 months†	3.9*	2.86, 5.29
General health status poor or fair‡	1.4*	1.07, 1.83
Activity-limiting injury in past 12 months	1.4	1.03, 1.88§
Chronic conditions††		
Cancer	2.2*	1.40, 3.50
Effects of stroke	1.8*	1.15, 2.96
Diabetes	1.4	0.96, 2.00
Cataracts	1.3	0.91, 1.88
Heart disease	1.3	0.93, 1.75
Urinary incontinence	1.2	0.72, 1.94
2+ chronic conditions	1.2	0.81, 1.74
Chronic bronchitis	1.1	0.72, 1.60
Arthritis/Rheumatism	1.0	0.73, 1.25
Back problems (non-arthritic)	0.9	0.66, 1.18
High blood pressure	0.9	0.67, 1.20
Social, behavioural, economic factors		
Alcohol use: none‡‡	1.8*	1.30, 2.53
Alcohol use: occasional‡‡	1.4	1.03, 1.97§
Living arrangements: alone	1.6*	1.23, 2.14
Household income: lowest, lower middle§§	1.6*	1.19, 2.04
Household income: data not available§§	1.2	0.69, 2.09
Smoking: daily	1.1	0.81, 1.57
Smoking: occasional, former	1.2	0.91, 1.59

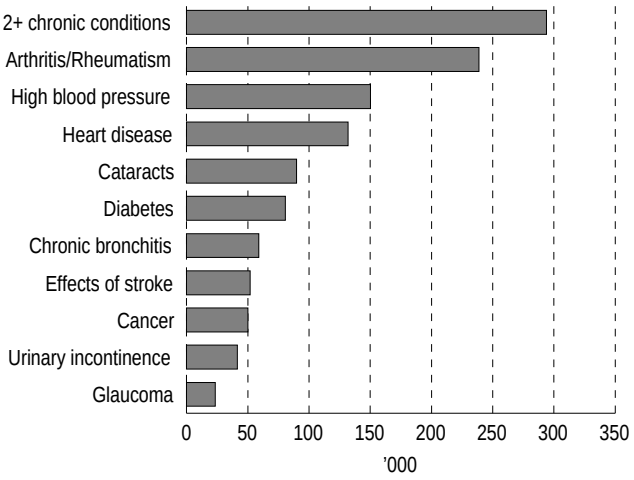
Data source: *1994/95 National Population Health Survey, Health file*
Note: *The sample size is 16,231.*
† Reference category is 0 to <8 nights in hospital.
‡ Reference category is excellent, very good or good health.
§ To account for design effect, confidence intervals in the .945 to 1.055 range were not considered statistically significant.
†† As diagnosed by a health professional. Reference category is absence of condition.
‡‡ Reference category is regular (at least 1 drink per week).
§§ Reference category is middle, upper middle or highest.
** p < 0.05*

High prevalence of arthritis

The high prevalence of certain chronic illnesses among home care recipients does not necessarily imply that the likelihood of receiving home care increased with the presence of these conditions. For example, nearly 240,000 home care recipients had arthritis/rheumatism, and they made up nearly half (46%) of all home care users (Chart 1). However, only 8% of people with arthritis/rheumatism received home care (Chart 2). And after accounting for other factors, their odds of receiving home care were actually the same as for people without arthritis/rheumatism (Table 2).

Among those with other conditions, the proportions of home care users were considerably higher. For example, over one in four people afflicted with the effects of stroke received home care, but they numbered only about 52,000 or 10% of all home care users. This reflects the relatively low prevalence of the effects of stroke in the non-institutionalized population. Therefore, although the odds of receiving home care for people suffering from the effects of stroke are higher than those for people with arthritis/rheumatism, a home care worker's case load would likely include more people

Chart 1
Number who received formal home care in past year, by presence of chronic conditions,† household population aged 18 and older, Canada excluding territories, 1994/95

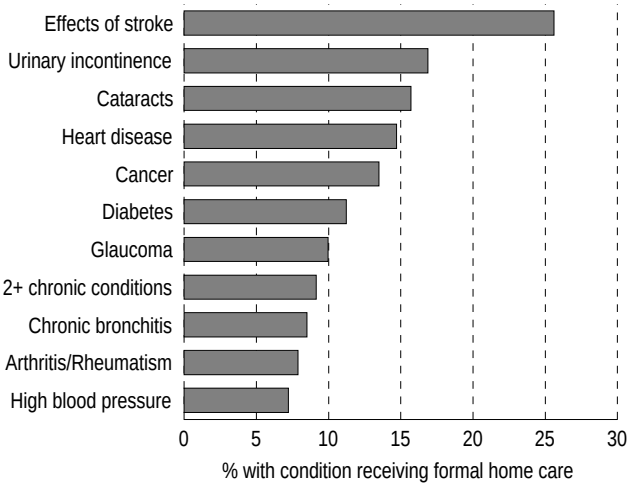


Data source: *1994/95 National Population Health Survey, Health file*
† As diagnosed by a health professional

with arthritis than with the consequences of a stroke.

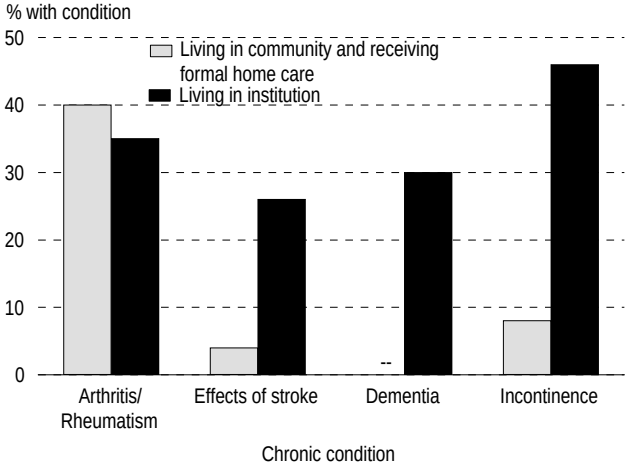
Even after controlling for factors that might help explain the need for home care, people with cancer or the effects of stroke had about twice the odds of receiving home care as did those without these conditions. It may be that these conditions confer specific needs, perhaps for rehabilitative therapy or palliative care, not accounted for by the other health-related characteristics that were considered.

Chart 2
Percentage who received formal home care in past year, by presence of chronic conditions,† household population aged 18 and older, Canada excluding territories,1994/95



Data source: *1994/95 National Population Health Survey, Health file*
† As diagnosed by a health professional

Chart 3
Prevalence of selected chronic conditions, by residence, population aged 65 and older, Canada excluding territories, 1994/95



Data source: *1994/95 National Population Health Survey, Health and Institutional files*
-- Amount too small to be expressed

Older home care recipients outnumber nursing home residents

The number of people aged 65 and older who received home care (335,200) substantially exceeded the number of seniors residing in institutions (185,600).[14] Measuring the extent to which home care services delay or prevent institutionalization is beyond the scope of this article. Furthermore, the degree of family support or of responsibility assumed by informal care givers cannot be examined here. However, a comparison of some of the health-related characteristics of home care recipients with those of residents of long-term care facilities indicates the conditions with which it is possible to remain at home. For example, the prevalence of arthritis/rheumatism was higher among home care recipients than among residents of institutions. By contrast, the percentages of people in institutions with the effects of stroke, dementia and incontinence were strikingly higher than the corresponding percentages among home care recipients (Chart 3).[14]

Social factors

The proportion of home care recipients who were living alone was just over three times as high as the proportion of non-recipients who were living alone (39% versus 12%) (Table 1). The pattern was similar regardless of age, although home care recipients aged 18 to 64 who lived alone were over-represented to a greater degree than those aged 65 and older.

The higher probability of receiving home care among people who lived alone may be partly attributable to a higher prevalence of health-related needs in this group. For example, a larger share of them, particularly those under age 65, had one or more chronic conditions. However, even after adjusting for chronic illnesses and other health-related factors, the odds of receiving formal home care among people living alone were 1.6 times those of people living with at least one other person. This supports the natural assumption that people who live with others tend to receive informal assistance from them.

There was a clear inverse relationship between household income group and the proportion of people receiving home care (Chart 4). This may reflect the poorer health of people of lower socioeconomic status, necessitating a greater need for home care. However, even after controlling for health status, smoking and the presence of numerous chronic conditions, the odds of receiving home care were 1.6 times as high among people in the two lower income groups as among those in the three higher groups. The income variable may capture some aspect of health (or illness) not measured by the other variables included in the model. It also may be that people with more income are better able to afford private home care services, the use of which could not be addressed in this analysis.

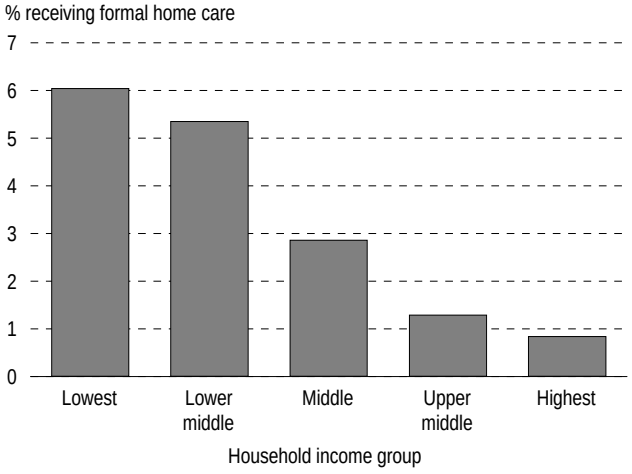
Abstinence from alcohol was also associated with the receipt of home care. When other health-related variables were taken into account, the odds that people who reported not drinking alcohol in the previous 12 months would have received home care were nearly twice those of regular drinkers. The odds that occasional drinkers would have received home care were also higher than for regular drinkers, but did not achieve statistical significance. These findings are consistent with research suggesting that regular, moderate alcohol consumption confers certain beneficial health effects.[15,16] However, the association does not necessarily show that regular drinking *causes* better health, particularly since the results stem from cross-sectional data. Also, no distinction is made here between moderate and heavy regular drinking or between former drinkers and those who have always abstained. The association between abstinence and receiving home care may reflect a tendency of people who develop health problems to reduce or abstain from alcohol consumption.

Many in need not receiving home care

As expected, people who reported needing help to carry out activities of daily living (ADL) or instrumental activities of daily living (IADL) had an extremely high odds ratio (10.8) of receiving home care. Even so, fairly large proportions of people with these needs did not receive formal home care.

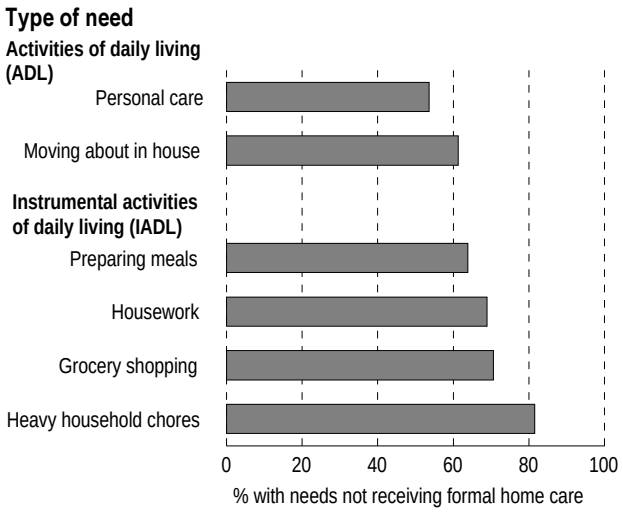
More than half of those (over 136,000) who reported needing assistance with personal care (washing themselves, dressing or eating) received no formal home care (Charts 5 and 6). For people with IADL needs such as preparing meals, shopping and

Chart 4
Percentage who received formal home care in past year, by household income group, household population aged 18 and older, Canada excluding territories, 1994/95



Data source: *1994/95 National Population Health Survey, Health file*

Chart 5
Percentage with ADL or IADL needs who did not receive formal home care in past year, household population aged 18 and older, Canada excluding territories, 1994/95



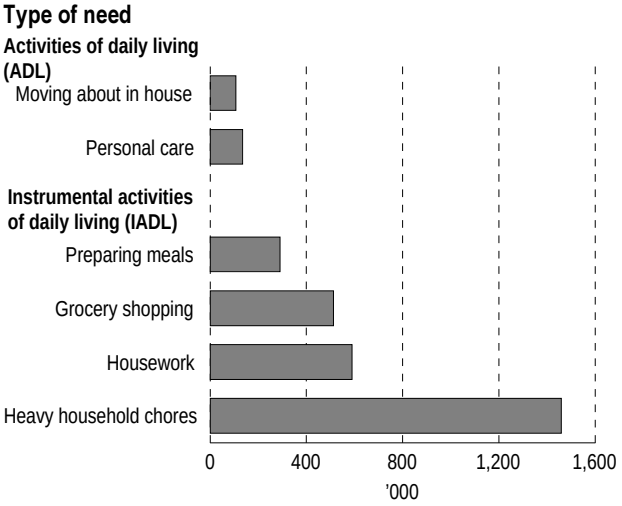
Data source: *1994/95 National Population Health Survey, Health file*

doing housework, the percentages not receiving home care were even greater. At least some of these needs were probably being met by private home care services or by family members, but clearly, formal home care was not being used by many who needed help with fairly basic functions.

These findings are consistent with a recent study in Saskatchewan of hospital patients discharged to their homes. Sixty percent of those who were assessed in hospital as requiring home care did not go on to receive formal services.[17]

Information from other sources indicates that *formal* home care constitutes only part of the support services that people receive. The 1991 Health and Activity Limitation Survey reveals that informal assistance, mostly from family members, accounted for a large segment of all assistance given to disabled seniors.[18] (Editor's note: see *Seniors' needs for health-related personal assistance* in this issue.) The 1990 General Social Survey indicates that 56% of Canadians aged 15 and older received supportive services (a large part of which was housework and household maintenance) from family members and friends.[19] Finally, according to the 1996 General Social Survey, 2.8 million adults provided some sort of informal care to people with long-term health problems.[20] In light of these results, a somewhat unexpected finding from the NPHS is that among people who were IADL- or ADL- dependent, the average frequency of contact with friends, family and neighbours did not vary according to whether they were receiving formal home care. Possibly, if information had been collected about how often these "contacts" involved provision of assistance, differences might have emerged.

Chart 6
Number with ADL or IADL needs who did not receive formal home care in past year, household population aged 18 and older, Canada excluding territories, 1994/95



Data source: *1994/95 National Population Health Survey, Health file*

Concluding remarks

Over half a million Canadians received formal home care in 1994/95. Considerably more seniors received home care than resided in long-term care facilities, and home care is no doubt an important factor in people's ability to remain in the community. Receipt of formal home care is linked not only to age, debility and specific health problems, but also to socioeconomic factors and family structure.

A substantial proportion of people who need help are not receiving formal home care. It is reasonable to assume that in many cases help is being provided by other household members and that some people are receiving private care. As well, it is quite probable that some needs are simply not being met.

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Seniors' needs for health-related personal assistance

Jiajian Chen and Russell Wilkins

Abstract

Objectives

This article examines social and economic differences in the prevalence of needs and unmet needs for health-related personal assistance among the household population aged 65 and older and the sources from which they received support.

Data source

The data are from the 1991 Health and Activity Limitation Survey (HALS).

Analytical techniques

All calculations were based on weighted data. Age-standardized percentages of people with needs and unmet needs for personal assistance were calculated by sex, marital status, living arrangements, education, and household income.

Main results

In 1991, 30% of seniors living in private households had some need for health-related personal assistance. Three-quarters of them required help only with instrumental activities of daily living (IADL); the remainder needed help with basic activities of daily living (ADL). The prevalence of need and unmet need was higher among women than men, was inversely related to household income and education, and was relatively high among formerly married seniors and those living alone. Household seniors were more likely to receive personal assistance from informal than formal sources, although this varied depending on their socioeconomic characteristics and the type of assistance they received.

Key words

activities of daily living, instrumental activities of daily living, formal care, informal care, help received, unmet needs

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In Canada and other industrialized countries, longer life expectancy and continued growth of the older population have heightened concern about the provision of long-term or "continuing" care.[1-11] These terms refer to extended health care services, including home and community-based care in addition to residential care, devoted to non-acute needs, especially needs for personal assistance among people with activity limitations.[1,3,12-14] Continuing care has been estimated to represent "the third largest component of government expenditures within the Canadian health care system, after hospitals and medical services."[15] Planning for future long-term care calls for assessment of the need and of the extent of care currently received.

This article uses data from the 1991 Health and Activity Limitation Survey (HALS) to examine social and economic differences in health-related needs for personal assistance among the elderly population residing in private households (see *Methods* and *Definitions*). It also assesses the extent of unmet needs and the sources from which seniors received assistance.

This analysis finds that in 1991, almost 2 million Canadians aged 15 and older living in private households had some need for health-related personal assistance. The elderly made up a disproportionate share of this group—45%—although they represented just 14% of the household population.

For seniors, provision of care at home may help them avoid, or at least delay, institutionalization. Yet only about half of seniors who required personal assistance had their needs fully met. The prevalence of unmet needs was greater among those in lower-income households and among those with relatively little education. Whether seniors got the help they needed depended on the sources of support available to them, which, in turn, reflected their marital status and living arrangements. In fact, although many received help from formal sources, the majority still relied on informal assistance such as that provided by a spouse, partner or children.

Needs rise with age

According to the 1991 HALS, 9% of the household population aged 15 and older, an estimated 1.9 million people, reported needing health-related personal assistance (Table 1). The prevalence of need increased sharply with age, from 2% among 15- to 24-year-olds to 61% at age 85 and older.

Methods

Data source

The data are from the post-censal Health and Activity Limitation Survey of 1991 (HALS).[16] (An earlier HALS was conducted in 1986/87.) The population aged 15 and older living in private households and in institutions was analyzed. For the total population, the sample size was 101,330, and for the household population, 91,360. For the household population, census questions on activity limitation and handicap were used to select an enriched sample with a far higher proportion of persons with disabilities than would have been possible without the use of the census questions. Additional details are available in the published documentation.[16]

Analytical techniques

Most of the analysis in this article pertains to the household population. Using the HALS master file, weights were recalculated for men and women aged 65 to 74, 75 to 84, and 85 and older. This was done for household data at the Canada level, according to the 1991 Census age- and sex-specific population distributions. All results shown here are based on weighted data.

The percentages of people with needs and unmet needs for health-related personal assistance were calculated for the total population by sex, marital status, education, income, and living arrangements. The percentages were age-standardized by the direct method to the total 1991 HALS population estimates.

Five sources of personal assistance were examined: spouse, children, other relatives, friends or neighbours, and formal services. The percentages of seniors receiving help from each of these sources were classified into overlapping categories and calculated by sex and marital status. The formal or informal character of the support received was then examined using mutually exclusive categories: informal only, formal only, and a mix of both. For all seniors receiving help, the percentages in these categories were calculated by sex, marital status, living arrangements, income, and education (see *Definitions*).

Limitations

HALS data analyzed in this article pertain to 1991. The National Population Health Survey of 1994/95 and the General Social Survey of 1996 provide more recent data, but the sample sizes are much smaller and would not permit the level of analysis presented here. As well, it is highly likely that the 1991 results are still relevant, as the variables examined are not subject to major or rapid change. A comparison of the 1991 data with the 1986/87 HALS showed that the need for health-related assistance, and whether that need was met, were quite similar (data not shown).

While this article focuses mainly on the household population, it is important to note that the institutional population accounts for a substantial portion of the total need for health-related personal assistance (see *Only part of the picture*).

Definitions

In this article, *health-related personal assistance* refers to help needed or received for *instrumental activities of daily living (IADL)* or for basic *activities of daily living (ADL).* IADL refers to grocery shopping, meal preparation, light or heavy housework, or going out for short trips. ADL refers to personal care (eating, bathing, dressing) or moving about within the residence. Because of the nature of the Health and Activity Limitation Survey (HALS), people needing such help must have had at least some degree of disability and must have needed or received help for reasons of health.

Virtually everyone with ADL limitations is also limited in IADL. However, many people with IADL limitations are not restricted in ADL. Therefore, priority was given to needs for help in ADL, grouping needs hierarchically into four categories (only the first applicable category was assigned):

- *Unmet ADL need.* People needing ADL assistance, but not receiving help or needing additional help for at least one ADL.
- *All ADL needs met.* Other people receiving ADL assistance. (This category may include persons with unmet IADL needs.)
- *Unmet need for IADL only.* People needing IADL assistance, but not receiving help or needing additional help for at least one IADL. (This category excludes persons with ADL needs.)
- *All IADL needs met.* Other people receiving IADL assistance. (This category excludes people with ADL needs.)

The sum of these four categories equals the population with any need for help.

When priority is given to ADL needs, people whose ADL needs are all met, but who still have unmet needs for assistance with IADL, are not shown as having unmet needs. Therefore, the population was also grouped by needs met or unmet, including both ADL and/or IADL needs, as follows:

- *Unmet needs for ADL and/or IADL.* People needing ADL and/or IADL assistance, but not receiving help or needing additional help for at least one ADL and/or IADL.
- *All ADL and/or IADL needs met.* Other people receiving ADL and/or IADL assistance.

The sum of these two categories also equals the population with any need for help.

Several questions on the 1991 HALS were used to determine the extent to which needs for health-related personal assistance were met. For example, with respect to personal care, for assignment to the *ADL need unmet* category, respondents must have **either** answered "no" to the question "Because of your condition, do you receive assistance with personal care, such as washing, grooming, dressing or feeding yourself?" and "yes" to the question "Because of your condition, do you need help with your personal care?", **or** "yes" to the first question and "yes" to the question "Because of your condition, do you need ADDITIONAL help with your personal care?"[17] Those who replied that they received help and did not require additional assistance were considered to have their personal care needs *fully met.*

For assignment to the *IADL need unmet* category with respect to light housework, for example, respondents must have **either** answered "yourself alone" to the question "Who usually does your normal everyday housework such as dusting, tidying up? and "yes" to the question "Because of your condition, do you need help doing your everyday housework?", **or** "yourself and someone else" or "someone else" to the first question plus "yes" to the question "Is this because of your health problem?" and "yes" to the question "Because of your condition, do you need ADDITIONAL help doing your everyday housework?"[17] Those who received help and did not require additional assistance were considered to have their light housework needs *fully* met.

Informal sources of help include an individual's spouse, children, other relatives, friends, and neighbours. *Formal* sources refer to voluntary organizations, government agencies, private organizations, or privately employed persons. Some examples of formal help are meals-on-wheels, attendant care, home care service, Victorian Order of Nurses, and friendly visitor service.[17]

Marital status was defined as single (never married); married (living with spouse or common-law partner); and formerly married (widowed, divorced or separated).

Education was defined according to the highest level successfully completed. For analyses of health-related needs, education was grouped into three categories: elementary or less; some high school; high school graduation (with or without additional postsecondary education).

Persons of all ages were categorized into five *income* groups of approximately equal size (quintiles), based on the ratio of economic family income to the Statistics Canada low income cut-offs for the relevant family size and community size groups. The same income cut points were used for all age groups. The quintiles were then grouped into lower (quintiles 1 and 2) and higher (quintiles 3, 4 and 5) income categories.

Living arrangements were grouped into those living alone and those living with others.

Only part of the picture

The household population is only part of the total picture of need for health-related personal assistance, especially among the oldest old and among people needing help with basic activities of daily living (ADL). In 1991, residents of private households represented 79% of the population aged 65 and older needing assistance with ADL and/or IADL, and 53% of the population aged 85 and older with such needs. The percentages are much lower when only those needing help with ADL are considered, because most people in institutions have such needs. The household population accounted for 53% of all people aged 65 and older requiring help with ADL, and at age 85 and older, just 36%.

On the other hand, exclusion of institutional residents makes relatively little difference to the size of the population requiring help with IADL only (data not shown), because those people typically do not require the level and kind of care provided in institutional settings.

By the year 2031, the population aged 85 and older is projected to more than triple.[18] This implies huge increases in the number of people with needs for personal assistance, particularly with ADL. Thus, to get the complete picture of projected needs and unmet needs, it is necessary to include residents of institutions.

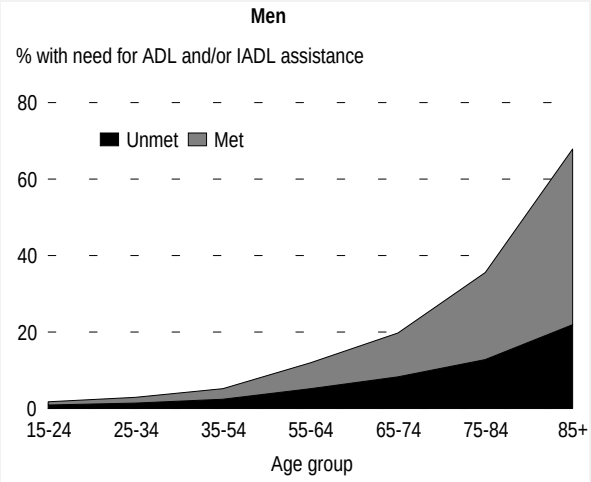
While the prevalence of need for personal assistance in the total population increases sharply with age for both sexes, so does the prevalence of unmet need, but to a much lesser extent. However, at all ages, women are more likely than men to need help as well as to have unmet needs.

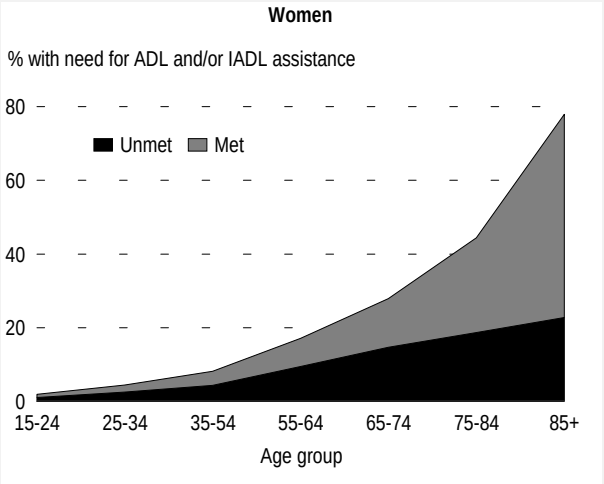
Prevalence of need for health-related personal assistance, total and household population aged 65 and older, Canada, 1991

	Total population with needs†		Household population with needs‡		Percentage point difference	Household as % of total population with needs
	'000	%	'000	%		
ADL and/or IADL needs						
Total 65+§	1,062	34	839	30	4	79
65-74	454	24	418	23	1	92
75-84	399	41	311	35	6	78
85+	209	75	110	61	14	53
ADL needs						
Total 65+§	338	11	179	7	4	53
65-74	83	5	60	3	2	72
75-84	134	14	75	8	6	56
85+	121	43	44	24	19	36

Data source: *1991 Health and Activity Limitation Survey*
† Percentage of total population
‡ Percentage of household population
§ Aged-adjusted

Prevalence of need and unmet need for health-related personal assistance, by sex and age group, total population aged 15 and older, Canada, 1991





Data source: *1991 Health and Activity Limitation Survey*

In 1991, about a third of the household population aged 65 and older—a total of 839,000—required health-related personal assistance. Most of them (661,000) needed help only with instrumental activities of daily living (IADL) such as grocery shopping, meal preparation, and housework. Far fewer seniors living in private households (179,000) needed help with basic activities of daily living (ADL) such as eating and bathing, possibly because many with such requirements reside in health-related institutions (see *Only part of the picture*).

Aging was also associated with an increase in unmet need for help. The prevalence of unmet need for ADL and/or IADL rose from 1% among 15- to 24-year-olds to 12% at ages 65 to 74, and to 35% at age 85 and older.

Among seniors, the prevalence of both needs and unmet needs was higher for women than for men.

Table 1
Prevalence of need and unmet need for health-related personal assistance, by type of need, sex and age, household population aged 15 and older, 1991

		IADL and/or ADL needs		IADL needs only		ADL needs	
	Population	Total	Any unmet	Total	Any unmet	Total	Any unmet
	'000	%					
Both sexes 15+†	**21,063**	**9**	**5**	**7**	**4**	**2**	**1**
15-24	3,766	2	1	1	1	1	-
25-34	4,778	3	2	3	2	1	-
35-54	7,247	6	3	5	3	1	1
55-64	2,365	14	7	12	6	2	1
65-74	1,838	23	12	19	9	3	2
75-84	889	35	18	27	13	8	4
85+	180	61	35	37	19	24	10
65+†	2,907	30	16	23	11	7	3
Men 15+†	**10,294**	**7**	**4**	**6**	**3**	**2**	**1**
15-24	1,910	2	1	1	-	1	-
25-34	2,369	3	2	2	1	1	-
35-54	3,608	5	2	4	2	1	1
55-64	1,159	11	5	9	4	2	1
65-74	828	18	8	16	6	3	2
75-84	358	31	14	25	11	6	2
85+	62	56	30	34	14	22	9
65+†	1,248	26	12	20	8	5	2
Women 15+†	**10,769**	**11**	**6**	**9**	**5**	**2**	**1**
15-24	1,856	2	1	1	1	-	-
25-34	2,410	4	3	4	2	1	-
35-54	3,639	8	4	7	4	1	1
55-64	1,206	16	10	14	8	2	1
65-74	1,010	26	15	23	12	4	3
75-84	530	38	21	28	14	10	5
85+	118	64	38	38	22	26	10
65+†	1,659	33	19	26	13	8	4

Data source: *1991 Health and Activity Limitation Survey*
† Age-adjusted
- Nil or zero

Needs vary with socioeconomic characteristics

For seniors of both sexes, the age-adjusted prevalence of need for personal assistance with ADL and/or IADL was higher among those with lower socioeconomic status (Table 2 and Chart 1). Almost a third (32%) of seniors in lower-income households had such needs, compared with 25% of those in higher-income households. The prevalence of need was also greater among seniors with less than high school education (32%), compared with those who had at least graduated from high school (26%).

Seniors who never married or were formerly married (the majority of whom were widowed) and those who lived alone tended to have a relatively high prevalence of need for personal assistance. While 34% of seniors who were formerly married or who lived alone needed such help, the figures were 27% and 28% for those who were married or living with others, respectively. The pattern was similar for men and women, although the prevalence of need was always higher for women.

Needs for help with ADL, which are more basic, were more common among those with lower socioeconomic status. Overall, 7% of seniors in lower-income households needed assistance with ADL, compared with 4% of those in higher-income households. Formerly married seniors also had a higher prevalence of ADL need (8%) than did those who were currently married or never married (5% and 6%).

However, the prevalence of need for help with ADL among seniors in the household population did not vary greatly by living arrangements (Table 2). This was perhaps because many seniors with ADL needs, especially those without adequate support in the community, were living in health-related institutions.

Table 2
Prevalence of need and unmet need for health-related personal assistance among seniors, by type of need, sex and selected characteristics, household population, Canada, 1991

Sex and selected characteristics	Population	IADL and/or ADL needs		IADL needs only		ADL needs	
		Total	Any unmet	Total	Any unmet	Total	Any unmet
	'000	Age-adjusted %					
Both sexes†	**2,907**	**30**	**16**	**23**	**11**	**7**	**3**
Household income							
Lower	1,673	32	19	24	13	7	4
Higher	1,159	25	11	21	9	4	2
Education							
Elementary or less	1,151	32	17	25	12	7	3
Some high school	708	30	15	23	10	7	4
High school graduation	1,048	26	14	20	11	5	2
Marital status							
Formerly married	972	34	20	26	14	8	4
Never married	246	30	10	24	8	6	1
With spouse or partner	1,688	27	14	21	10	5	3
Living arrangements							
Alone	764	34	21	27	16	6	4
With others	2,069	28	14	22	10	6	3
Men†	**1,248**	**26**	**12**	**20**	**8**	**5**	**2**
Household income							
Lower	701	27	13	21	9	6	2
Higher	530	21	10	18	8	3	2
Education							
Elementary or less	472	26	11	21	8	5	2
Some high school	319	25	13	19	7	6	4
High school graduation	458	23	11	19	9	4	2
Marital status							
Formerly married	183	27	13	21	8	7	4
Never married	88	29	17	23	15	6	1
With spouse or partner	977	24	11	20	8	5	2
Living arrangements							
Alone	167	27	16	22	13	5	3
With others	1,064	24	11	19	8	5	2
Women†	**1,659**	**33**	**19**	**26**	**13**	**8**	**4**
Household income							
Lower	972	35	23	26	16	9	5
Higher	629	29	13	25	10	4	2
Education							
Elementary or less	680	36	21	28	14	8	5
Some high school	388	35	17	27	12	8	4
High school graduation	591	28	17	22	13	6	3
Marital status							
Formerly married	789	35	21	27	15	8	4
Never married	159	34	9	28	6	6	2
With spouse or partner	711	31	18	24	13	7	4
Living arrangements							
Alone	598	36	22	29	17	7	4
With others	1,004	31	17	24	12	7	4

Data source: *1991 Health and Activity Limitation Survey*
† Includes persons with data missing on selected characteristics.

Same pattern for unmet needs

For both sexes, the age-adjusted prevalence of at least one unmet need for personal assistance was also higher among seniors with lower socioeconomic status. While 19% of seniors in lower-income households had unmet needs, this was the case for only 11% of those in higher-income households. Similarly, 17% of seniors with less than high school had unmet needs, compared with 14% of those with at least high school graduation.

Socioeconomic inequality in unmet need among seniors was mainly attributable to differences among women. The age-adjusted prevalence of unmet need was 23% among women in lower-income households, compared with 13% among women in higher-income households. And while 21% of senior women with less than high school had unmet needs, the figure was 17% of those who had at least some high school. By contrast, for men, the prevalence of unmet need varied little by socioeconomic status and was lower than that for women in each category, indicating that senior men's needs were generally better met.

Formerly married seniors of both sexes had a higher prevalence of unmet need than did those who were currently married. However, unmet need tended to be more common among married women than among married men. In fact, one reason for the higher level of unmet need among senior women overall is that husbands are often older, and thus, more likely to be frail and less able to provide support to their wife.[19] Another reason is that women tend to live longer than men, and so are more likely to be widowed and to live alone.

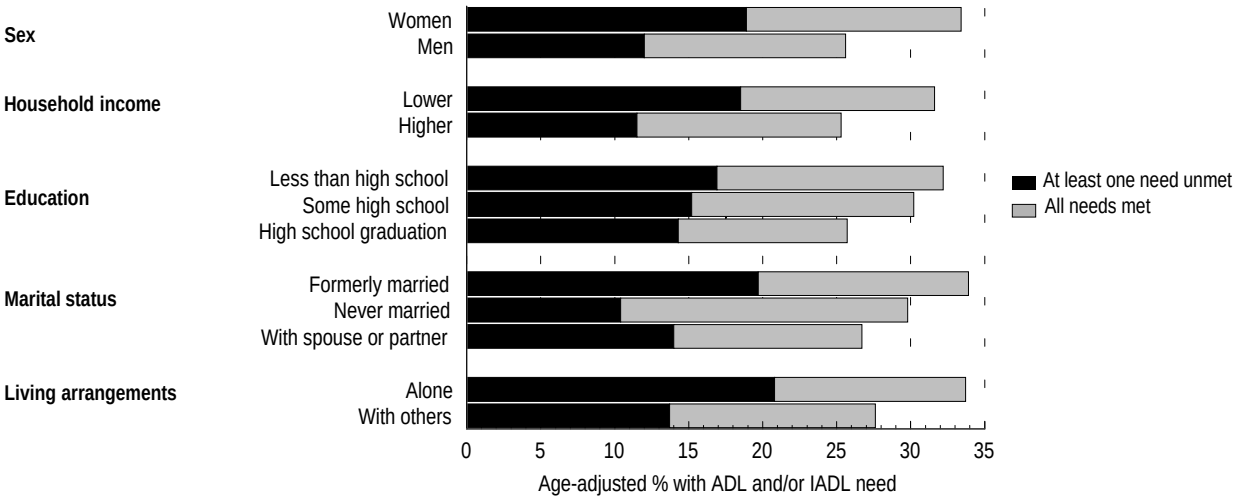
Indeed, the prevalence of unmet need was much higher among seniors living alone (21%) than among those living with others (14%). This mostly reflected unmet need for assistance with IADL. In fact, the prevalence of unmet need for help with ADL varied little by living arrangements. Once again, this may be, at least in part, because many seniors with ADL needs were no longer part of household population.

Help from a variety of sources

Earlier studies have found that among seniors living in private households who received help, the majority received it from informal sources.[20-24] According to the 1991 HALS, at least half of seniors receiving help relied on informal sources only, while another 28% for IADL and 17% for ADL received help from both formal and informal sources (Chart 2). However, this means that approximately half of all seniors receiving help got at least some of it from formal sources.

Older people with health-related needs for personal assistance tend to stitch together a support

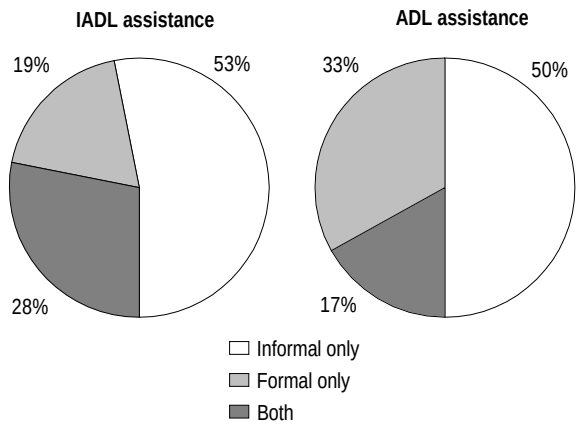
Chart 1
Prevalence of need and unmet need for health-related personal assistance among seniors, by selected characteristics, household population, Canada, 1991



Data source: *1991 Health and Activity Limitation Survey*

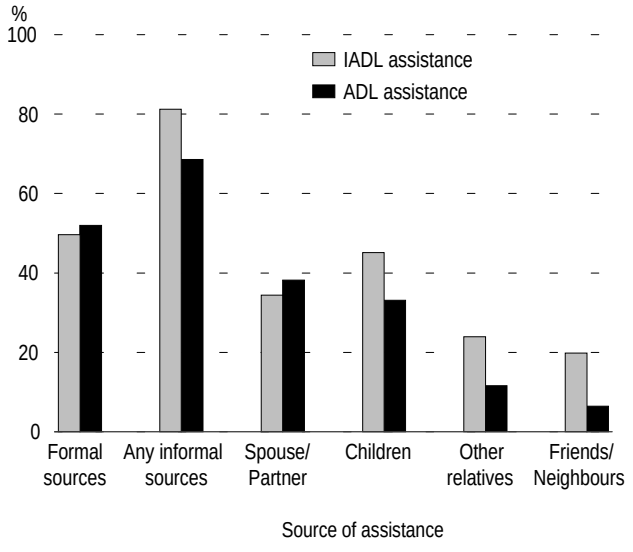
network. This support network consists of formal sources, spouse or partner, children, other relatives, and friends and neighbours (Chart 3). However, the specific components of this network varied with the sources of support available to individual seniors, which, in turn, were influenced by their socioeconomic characteristics.

Chart 2
Formal or informal character of health-related personal assistance received by seniors, by type of assistance, household population, Canada, 1991



Data source: *1991 Health and Activity Limitation Survey*

Chart 3
Sources of health-related personal assistance received by seniors, by type of assistance, household population, Canada, 1991



Data source: *1991 Health and Activity Limitation Survey*
Note: *Because individuals may receive help from more than one source, percentages receiving help from various sources total more than 100%.*

Sources of support differ

The association between household income and sources of support varied by sex and type of need (Table 3). Whether they were receiving assistance with ADL or IADL, over half of senior men relied exclusively on informal sources, regardless of their household income. However, among men receiving help with ADL, those in lower-income households were more dependent on formal sources only (27%) than were those in higher-income households (7%). Women in lower-income households, particularly those receiving help with ADL, also tended to rely on formal sources or on a combination of formal and informal help. This highlights the importance of formal sources in the provision of support to economically disadvantaged elderly people who need assistance with basic activities.

The relationship between education and sources of help was different from that for income. Both men and women with little education tended to rely most on informal support for health-related personal assistance. At higher levels of education, formal sources, either alone or combined with informal sources, accounted for larger shares of assistance received. This suggests the possibility that for seniors with little education, lack of knowledge of the availability of formal services, or assumed costs, may have been a barrier to access. Also, they may have been more reluctant to seek help from unknown persons.

Seniors with no spouse or partner were more likely than those who had a spouse or partner to depend exclusively on formal sources, particularly for assistance with ADL. About half of those with no spouse or partner who got help with ADL relied solely on formal sources. By comparison, whether they were receiving help with ADL or IADL, only about one in ten seniors with a spouse or partner depended exclusively on formal sources.

To a large extent, these variations by marital status in sources of support reflect seniors' living arrangements. Those who lived alone depended more heavily on formal support. Almost three-

quarters (73%) of women who lived alone and received ADL assistance relied on formal sources; just 16% received help only from informal sources. (Data for senior men living alone who reported sources of help with ADL are not shown because the sample size was too small to provide a reliable estimate.) For both men and women who lived alone and were receiving help with IADL, formal sources, exclusively or combined with informal help, still predominated, although informal sources played a somewhat larger role.

By contrast, as previously observed, the majority of seniors who lived with others and received help with IADL or ADL depended only on informal sources. For married seniors, when sources of support were classified into more detailed but overlapping categories, informal support, especially from a spouse or partner, predominated. This was true for men and women and for ADL and IADL assistance (Table 4). Moreover, the proportions of married men and women receiving at least some help from a spouse or partner was the same for IADL assistance. This does not imply that the

Table 3
Formal or informal character of health-related personal assistance received by seniors residing in private households, by sex, type of need and selected characteristics, Canada, 1991

Type of need and selected characteristics	Total receiving assistance		Sources of assistance					
			Informal only		Formal only		Both formal and informal	
	Men	Women	Men	Women	Men	Women	Men	Women
	'000		%					
Instrumental activities of daily living (IADL)								
Total†	**290**	**537**	**55**	**51**	**20**	**19**	**25**	**30**
Household income								
Lower	187	341	59	43	15	24	26	33
Higher	100	168	50	68	26	8	24	24
Education								
Elementary or less	125	250	64	59	9	17	27	23
At least some high school	165	287	48	44	28	20	24	35
Marital status								
Not with spouse or partner	70	342	46	45	26	24	28	31
With spouse or partner	220	195	58	61	18	11	24	28
Living arrangements								
Alone	44	216	35	29	35	33	30	38
With others	242	294	59	68	16	8	24	24
Activities of daily living (ADL)								
Total†	**52**	**100**	**56**	**47**	**20**	**38**	**24**	**14**
Household income								
Lower	31	69	56	43	27	41	17	16
Higher	19	21	57	69	7	20	37	11
Education								
Elementary or less	21	46	81	55	10	23	10	22
At least some high school	31	54	34	40	29	54	37	6
Marital status								
Not with spouse or partner	12	67	52	37	43	53	6	11
With spouse or partner	40	33	57	68	12	12	31	20
Living arrangements								
Alone	--	33	--	16	--	73	--	11
With others	46	56	57	69	17	14	26	17

Data source: *1991 Health and Activity Limitation Survey*
Note: *Percentages based on persons receiving help for whom source of assistance was known.*
† Includes persons with data missing on selected characteristics.
-- Number of respondents in cell is too small to provide reliable estimate.

amount of help provided was sufficient to meet the spouse's needs. As noted earlier, married women were considerably more likely than married men to have unmet needs.

In addition to receiving assistance with ADL from their spouse or partner, married seniors more commonly got such help from formal sources rather than from children. Thus, for ADL assistance, married seniors seemed to rely on formal support as a second alternative more than they did on children. However, for IADL support, married seniors were as likely to receive help from children as from formal sources.

Implications

According to the 1991 Health and Activity Limitation Survey, seniors who were formerly married (the majority of whom were widowed) and those who lived alone (often the same people) were the most likely to need health-related personal assistance. And perhaps because these were the groups who lacked easy access to informal sources of support (i.e., within the same household), they also had the highest levels of unmet need. Conversely, seniors whose needs were met tended to have a marital status and living arrangements that put informal sources of help in close proximity.

Widowhood, therefore, has serious consequences for elderly people who need health-related personal assistance, as it usually results in the creation of a one-person household. Living alone, particularly for women, was associated not only with relatively heavy dependence on formal sources for support, but also with a relatively higher likelihood that needs would not be met. Notably, widowed seniors were just as likely, if not more so, to mention receiving help from formal sources as from children.

To some degree, the importance of joint contributions of informal and formal support may have resulted from an emerging cultural norm in Western countries that "the aged as a rule do not wish to feel that they are dependent in this way on their offspring."[10,25] Preference for care from formal services rather than from children has been documented in Canada as well.[26,27] Moreover, smaller family size, greater geographic mobility, and women's increasing labour force participation may have reduced the number of family members available to provide informal care.[10,11,25,26,28-30]

Table 4
Sources of health-related personal assistance received by seniors residing in private households, by sex, marital status and type of need, Canada, 1991

Type of need and marital status	Total receiving assistance		Sources of assistance†											
			Spouse or partner		Children		Other relatives		Friends or neighbours		Any informal		Formal sources	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
	'000		%											
Instrumental activities of daily living (IADL)														
Total	**290**	**537**	**51**	**25**	**41**	**48**	**17**	**28**	**21**	**19**	**81**	**81**	**47**	**51**
Not with spouse or partner	70	342	...	...	35	51	39	32	31	23	78	77	56	58
With spouse or partner	220	195	63	63	42	42	9	20	18	12	82	89	44	40
Activities of daily living (ADL)														
Total	**52**	**100**	**61**	**27**	**27**	**36**	**12**	**11**	**13**	**3**	**82**	**62**	**50**	**53**
Not with spouse or partner	12	67	...	...	12	40	31	13	17	3	56	49	53	63
With spouse or partner	40	33	79	74	32	28	6	8	12	4	90	89	49	33

Data source: *1991 Health and Activity Limitation Survey*
† Because individuals may receive help from more than one source, percentages receiving help from various sources total more than 100%.
... Not applicable

It should be noted that some types of care may require more skill or strength than informal caregivers possess, so recourse to formal services may be necessary. Also, as well as the care that they do provide, informal caregivers may facilitate seniors' access to formal services for additional support, resulting in a greater likelihood of care being provided by a mix of formal and informal sources.

The importance of combinations of formal and informal support may also result, in part, from an increasing emphasis on community-based formal services that aim at mediating the pressures toward institutionalization and burdens on families.[6,28] The substantial proportion of care that was provided by a mix of formal and informal sources indicates that formal support has been widely used to *complement* rather than substitute for informal sources.

Differences in unmet need by marital status and living arrangements reflect the presence or absence of informal support. Without the assistance of spouses, children, relatives and friends, or if for any other reason informal care becomes less available in the future, the need for home care services and residential care institutions would be much greater.

The prevalence of need and unmet need for personal assistance was greater among lower-income and less educated seniors, compared with those who lived in higher-income households and had more education. As well, seniors with lower income were more dependent on formal services than were higher-income seniors. Thus, without formal support, socioeconomic disparities in unmet needs might have been wider, with a consequent worsening of health for those not receiving necessary care.

With an aging population, Canada may see an increase in the demand for formal support, whether these services are institutional or community-based, provided by voluntary, private, or government sources. Financing community-based formal services has been suggested as a possible means of reducing long-term care costs associated with institutionalization. Consequently, it is becoming increasingly important to understand the relationship between formal and informal care.[24,28,30-32] Knowledge of these relationships is essential for planning health care services and long-term funding of personal assistance.

Acknowledgements

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Cancer incidence and mortality across Canada

Leslie A. Gaudette, Christopher A. Altmayer, Marek Wysocki and Ru-Nie Gao

Abstract

Objectives

This article analyses provincial and territorial patterns in incidence and mortality rates for selected cancer sites.

Data sources

Cancer incidence data were obtained from the National Cancer Incidence Reporting System and from the Canadian Cancer Registry. Mortality data are from the Canadian Vital Statistics Data Base.

Analytical techniques

Age-standardized incidence and mortality rates were calculated for Canada and each province/territory for men and women for major cancer sites for the 1991-1993 period.

Main results

Geographic variations in cancer incidence and mortality rates are strongly influenced by trends in the four leading cancers: lung, colorectal, prostate and breast. Cancer rates tended to be significantly high in Quebec and Nova Scotia and significantly low in the three westernmost provinces. These patterns generally reflect provincial/territorial variations in smoking prevalence, dietary habits, and the extent of cancer control programs, such as screening.

Key words

neoplasms, smoking, mass screening, geographic variation

Authors

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Cancer incidence and mortality rates are not uniform across Canada. Rates tend to be above average in Quebec and the Maritime provinces and low in the three westernmost provinces. To a large degree, these variations reflect geographic differences in the prevalence of risk factors and in the implementation of screening programs for various types of cancer.

This article uses three years of data (1991 to 1993) to analyze patterns of cancer incidence and mortality across Canada (see *Methods* and *Definitions*). Provincial and territorial rates that differ significantly from national levels may be used to stimulate further investigations of the impact of risks related to environmental or lifestyle factors and to monitor the impact of screening and treatment.[1-4]

Methods

Data sources

Cancer incidence data for 1991 were obtained from the National Cancer Incidence Reporting System, and for 1992 and 1993, from the Canadian Cancer Registry, as reported annually by the provincial and territorial cancer registries to the Health Statistics Division at Statistics Canada, which maintains these data bases.[5] Mortality data, compiled from the vital statistics registries in each province and territory, are from the Canadian Vital Statistics Data Base at Statistics Canada.[6]

Incidence and mortality rates are based on post-censal population estimates, adjusted for net census undercoverage, which were produced by the Demography Division at Statistics Canada.

Incidence and mortality rates are shown for selected cancer sites. Together, the sites analyzed account for almost 90% of all new cases and cancer deaths that occur each year. Most sites chosen for analysis are the more common forms of cancer. For some of the less common sites, the extent of geographic variation was also considered.

Analytical techniques

Both cancer incidence and mortality counts were modelled as Poisson random variables with the mean estimated as the product of the crude rate and the population count. This mean was assumed to be different for each specific combination of province, age group, sex, time period, and cancer site. The Poisson-distributed counts were assumed to be independent through time and between age groups and to be reasonably well approximated by a normal distribution.

Data for a three-year period were used to calculate standardized rates. This period was considered short enough to adequately reflect recent changes in rates occurring in some sites, but long enough to provide an acceptable degree of precision in the estimates. For each age group, the quotient of the standard population proportion and the population count was squared, then multiplied by the associated number of cases. These quantities were then summed over age groups to create the desired variance estimate for the standardized rate.

A *Z* test was used to determine whether the difference between a given provincial/territorial (x) and the national (y) age-standardized rate for a particular cancer site was statistically significant:

$$Z = (\text{rate}_x - \text{rate}_y) / \sqrt{\text{var}_x + \text{var}_y - 2\text{cov}(x,y)}$$

Because the rates for large provinces appreciably influence the national rate, an assumption of independence between these rates and the national rate is not tenable. To account for the degree of correlation between a given provincial/territorial rate and the national rate, estimated covariances were calculated between the two rates and entered into the variance formula for the difference between the rates.

The focus is on differences between national cancer incidence and mortality rates and those for each province and territory. Confidence intervals were calculated to assess the variation of each provincial/territorial rate.

This article presents recently revised data from the Nova Scotia Cancer Registry,[5] which may limit comparisons with previously published reports. These data include information on about 3% more cases, which were found by comparing information from the Nova Scotia registry against national mortality files.

Limitations

In general, registration procedures have improved to the point where cancer registration since 1984 is considered to be relatively consistent across Canada, and coverage for Canadian incidence data has been estimated to be 95% or more.[5] This is an overall estimate and may vary by province and site.[7] Because of the small number of cases in the less populous provinces and in the territories, it may not be possible to detect geographical differences, particularly for less common cancer sites.

Cancer incidence may be under- or over-reported as a result of variations in procedures and sources used to register cases.[5] Incidence might be low in a province where registration is based on pathology reports and high in another jurisdiction where hospital records are used without the confirmation of a histological diagnosis. For instance, variations in incidence rates for leukemia may be partly due to under- or over-registration of cases, either because only very precise methods of diagnosis were used or because of over-reliance on less dependable sources such as unconfirmed hospital records.[1,5]

As well, different definitions may be used to determine what is an invasive cancer.[8] For example, definitions used to register multiple primary cancers are not consistent across the country. This could affect the comparability of rates in Ontario and Quebec, both of which use the most restrictive definitions. Thus, low rates of breast cancer in Quebec may be influenced by reporting procedures, since registration is restricted to one breast cancer primary per woman. But the fact that Ontario also employs this rule argues against the hypothesis.[2]

Much of the geographical variation in bladder cancer incidence rates results from differing definitions. British Columbia, Ontario, and more recently, several other registries code non-invasive papillary transitional cell carcinomas of the bladder as in situ rather than invasive cancers.[2,5] Rates will be low for these provinces, as in situ cancers are not included in this analysis.

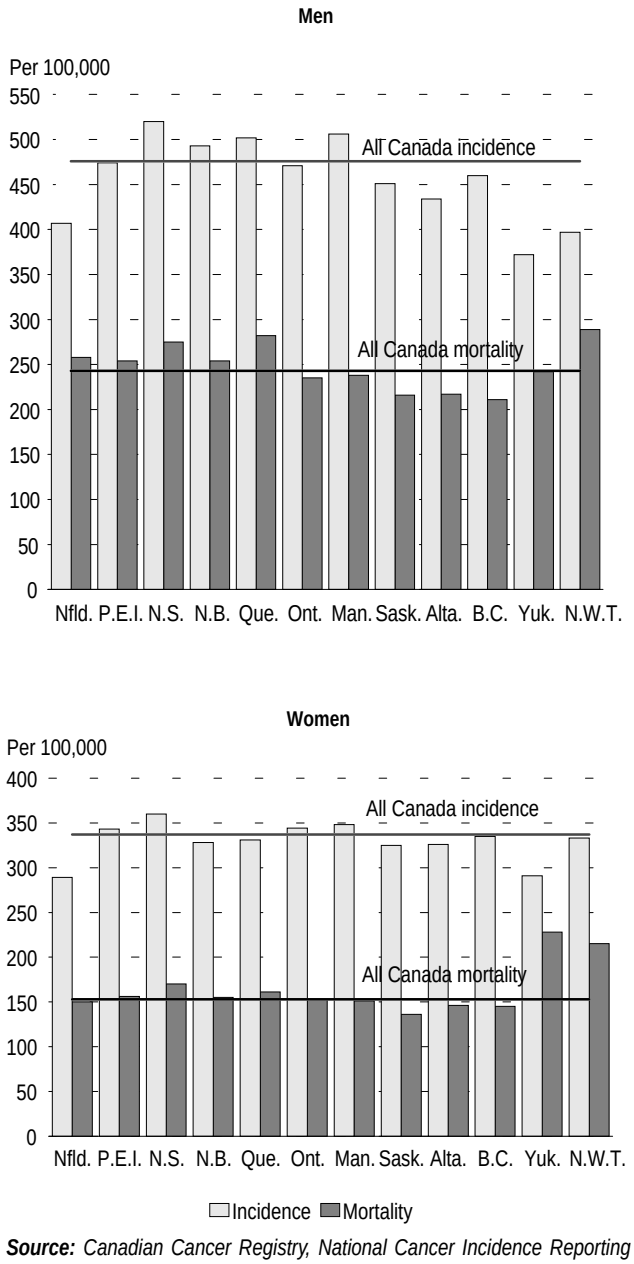
Rates vary across the country

For the 1991-1993 period, annual age-standardized cancer incidence rates for all sites combined were much higher among Canadian men than women: 476 new cases were diagnosed per 100,000 men, compared with 337 per 100,000 women. Similarly, the age-standardized male mortality rate exceeded the female rate: 243 versus 153 deaths per 100,000. These rates, however, varied considerably by province and territory (Chart 1).

For men, overall cancer incidence rates were significantly higher than the national rate in Nova Scotia, New Brunswick, Quebec and Manitoba (Table 1). Rates were significantly below the national level in Newfoundland, Ontario, the three westernmost provinces and the two territories.

The overall incidence of cancer among women showed less geographic variation. Rates were well above the national level in Nova Scotia, and slightly above it in Ontario and Manitoba. Rates were well

Chart 1
Annual age-standardized cancer incidence and mortality rates, all cancer sites, by sex, Canada, provinces and territories, 1991-1993



Source: *Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

Definitions

Cancer sites for the incidence and mortality data in this article were classified according to the International Classification of Diseases, Ninth Revision (ICD-9):[9]

All cancers (140-208, except 173)
Oral cavity (141-149)
Esophagus (150)
Stomach (151)
Colorectal (153-154)
Pancreas (157)
Larynx (161)
Lung (162)
Melanoma (172)
Breast (174)
Cervix (180)
Body of uterus (179, 182)
Ovary (183)
Prostate (185)
Bladder (188)
Kidney (189)
Non-Hodgkin's lymphoma (200, 202)
Leukemia (204-208)

Incidence: Number of new cases of a given type of cancer diagnosed during the year.

Mortality: Number of deaths during the year attributed to a particular type of cancer, based on the underlying cause of death.

Age-standardized rate: Cancer incidence or mortality per 100,000 that would have occurred in the standard population (1991 Canadian population) if the actual age-specific rates observed in a given population had prevailed in the standard population. In this article, age-specific rates used to calculate age-standardized incidence and mortality rates were calculated by aggregating counts of new cases or deaths for the 1991 to 1993 period and dividing by the correspondingly aggregated population for each geographical area and age group.

below average in Newfoundland and slightly below average in Quebec, Saskatchewan and Alberta.

A rather pronounced provincial east-to-west pattern emerges for mortality rates. The age-standardized cancer mortality rate among men was significantly high in Newfoundland, Nova Scotia, New Brunswick and Quebec, and significantly low in Ontario, Saskatchewan, Alberta and British Columbia

Geographic variations in female mortality rates were similar, with significantly high rates in Nova Scotia, Quebec and the two territories, and significantly low rates in Saskatchewan, Alberta and British Columbia.

Interprovincial differences in cancer incidence and mortality typically reflect patterns in the leading types of cancer—lung, colorectal, prostate and female breast—which together accounted for over half of total cancer incidence and mortality in the 1991-1993 period (Appendix Tables A to D).

Table 1
Annual age-standardized cancer incidence and mortality rates differing significantly from national rates, all sites, by province and sex, 1991-1993

		Significantly higher* than national rate		Significantly lower* than national rate	
		Incidence	Mortality	Incidence	Mortality
Newfoundland	Men		x	x	
	Women			x	
Prince Edward Island	Men				
	Women				
Nova Scotia	Men	x	x		
	Women	x	x		
New Brunswick	Men	x	x		
	Women				
Quebec	Men	x	x		
	Women		x	x	
Ontario	Men			x	x
	Women	x			
Manitoba	Men	x			
	Women	x			
Saskatchewan	Men			x	x
	Women			x	x
Alberta	Men			x	x
	Women			x	x
British Columbia	Men			x	x
	Women				x
Yukon	Men			x	
	Women		x		
Northwest Territories	Men			x	
	Women		x		

Source: *National Cancer Incidence Reporting System, Canadian Cancer Registry, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*
** $p < 0.05$*

Rates generally high in east

Quebec

In Quebec, cancer incidence and mortality rates among men were well above national levels, largely because of high rates of lung and colorectal cancer (Table 2). In fact, excess mortality from lung cancer among Quebec men accounted for more than half of their overall increased mortality. As well, male incidence and mortality rates were significantly elevated for several other smoking-related sites (kidney, oral cavity and larynx), for cancers of the bladder, pancreas and stomach, and for leukemia. The incidence rates for just two cancers—prostate and melanoma—were low among Quebec men, and mortality rates were low for melanoma and cancer of the esophagus.

Quebec women had mortality rates well above the national average for colorectal cancer, for cancers of the larynx, uterus and stomach, and for leukemia. Their slightly, but significantly, elevated lung cancer incidence and mortality rates represent a change from previously below-average levels.[1,2,10] Incidence rates were substantially above the national level for cancers of the larynx, bladder, and stomach. Incidence rates were low for cancer of the cervix and oral cavity and for melanoma. Although the incidence rate for breast cancer was low, the mortality rate was significantly high. Quebec women had significantly low mortality rates for just four cancers—ovary, cervix, esophagus and melanoma.

Nova Scotia

High overall cancer incidence among men in Nova Scotia reflects rates well above average for lung, colorectal, bladder and kidney cancer, and for melanoma. Mortality rates were significantly high for lung, prostate, and kidney cancer. Despite the

significantly high incidence of colorectal cancer, the mortality rate was significantly low. Leukemia was the only cancer with a significantly low incidence among Nova Scotia men.

Like their male counterparts, Nova Scotia women had elevated incidence and mortality rates for a relatively large number of cancers. Their mortality rates for breast and cervical cancer were among the highest in Canada. Lung cancer mortality was also high. As well, incidence rates for lung, cervical, bladder and kidney cancer were well above the national rate. However, significantly high incidence rates for colorectal cancer and melanoma were accompanied by significantly low mortality rates.

New Brunswick

Among men in New Brunswick, somewhat higher overall cancer incidence and mortality rates were largely a result of significantly high lung cancer rates and a high incidence rate for prostate cancer. By contrast, the male incidence rate for leukemia and mortality rate for colorectal cancer were low.

Female mortality rates were neither significantly high nor low for any given type of cancer. Only one incidence rate—bladder cancer—was high, while incidence rates for leukemia and for uterine, ovarian, pancreatic and esophageal cancer were significantly low.

Prince Edward Island

In Prince Edward Island, few incidence and mortality rates differed significantly from national levels. The exceptions among men were the esophageal cancer incidence rate and the prostate cancer mortality rate, which were significantly high, while the incidence rate for bladder cancer and the mortality rate for leukemia were low. Among women, the incidence rate for colorectal cancer was high, and the mortality rate for esophageal cancer was significantly low. However, because of the small number of cases, rates for Prince Edward Island are subject to high variability and should be interpreted with caution.

Newfoundland

Newfoundland's pattern differed from the general picture of cancer in the eastern provinces. For both sexes, incidence rates for all sites combined were low, as were rates for many individual sites.

Among men, the overall cancer mortality rate was significantly high, and incidence and mortality rates for stomach and bladder cancer were among the highest in the country. As well, the incidence rate for colorectal cancer was elevated. On the other hand, incidence and mortality rates for leukemia and melanoma were low, as was the incidence of prostate, lung and pancreatic cancer and non-Hodgkin's lymphoma.

Among Newfoundland women, stomach cancer incidence and mortality rates were the highest of any province. Incidence rates for colorectal and cervical cancer were also well above average. By contrast, lung cancer incidence and mortality rates were the lowest in the country, and mortality rates were low for melanoma, non-Hodgkin's lymphoma and pancreatic cancer.

Close to national average

Ontario

Ontario residents' overall cancer incidence and mortality rates were close to the national average.

The slightly, but significantly, low overall cancer rates among men were largely attributable to low incidence and mortality rates for lung cancer, with smaller contributions from prostate and stomach cancer. Ontario men also had low incidence rates for cancers of the bladder and larynx, and low mortality rates for cancers of the pancreas, kidney and oral cavity. The mortality rate was elevated for non-Hodgkin's lymphoma. As well, both incidence and mortality rates were high for esophageal cancer and melanoma, as was the incidence rate for leukemia.

Ontario women's cancer incidence and mortality rates were significantly high for melanoma and for esophageal, cervical and ovarian cancer, and slightly above average for breast cancer. As well, incidence rates for non-Hodgkin's lymphoma, leukemia and cancer of the oral cavity were elevated. These high rates were counterbalanced by low incidence and mortality rates for lung and stomach cancer. Rates were also low for bladder cancer incidence and colorectal cancer mortality. An above-average

Table 2
Annual age-standardized cancer incidence and mortality rates differing significantly from national rates, by province, sex and site, 1991-1993

		Significantly higher* than national rate		Significantly lower* than national rate	
		Incidence	**Mortality**	**Incidence**	**Mortality**
Newfoundland	Men	colorectal, stomach, bladder	stomach, bladder	prostate, lung, non-Hodgkin's lymphoma, leukemia, pancreas, melanoma	leukemia, melanoma
	Women	colorectal, cervix, stomach	stomach	breast, lung, ovary, non-Hodgkin's lymphoma, leukemia, pancreas, oral cavity	lung, pancreas, non-Hodgkin's lymphoma, melanoma
Prince Edward Island	Men	esophagus	prostate	bladder	leukemia
	Women	colorectal	–	–	esophagus
Nova Scotia	Men	lung, colorectal, bladder, kidney, melanoma	lung, prostate, kidney	leukemia	colorectal
	Women	colorectal, lung, cervix, melanoma, kidney, bladder	lung, breast, cervix	–	colorectal, melanoma
New Brunswick	Men	prostate, lung	lung	leukemia	colorectal
	Women	bladder	–	uterus, ovary, leukemia, pancreas, esophagus	–
Quebec	Men	lung, colorectal, bladder, non-Hodgkin's lymphoma, kidney, stomach, leukemia, oral cavity, pancreas, larynx	lung, colorectal, pancreas, stomach, leukemia, bladder, kidney, oral cavity, larynx	prostate, melanoma	esophagus, melanoma
	Women	colorectal, lung, leukemia, bladder, stomach, larynx	lung, breast, colorectal, leukemia, stomach, uterus, larynx	breast, cervix, melanoma, oral cavity	ovary, cervix, esophagus, melanoma
Ontario	Men	leukemia, melanoma, esophagus	non-Hodgkin's lymphoma, esophagus, melanoma	prostate, lung, bladder,stomach, larynx	lung, prostate, pancreas, stomach, kidney, oral cavity
	Women	breast, uterus, ovary, non-Hodgkin's lymphoma, cervix, melanoma, leukemia, oral cavity, esophagus	breast, ovary, cervix, esophagus, melanoma	lung, bladder, stomach	lung, colorectal, stomach, uterus

Source: *National Cancer Incidence Reporting System, Canadian Cancer Registry, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*
– *No cancer rates significantly higher (or lower) than national rate*
* *$p < 0.05$*

Table 2, continued
Annual age-standardized cancer incidence and mortality rates differing significantly from national rate, by province, sex and site, 1991-1993

		Significantly higher* than national rate		Significantly lower* than national rate	
		Incidence	**Mortality**	**Incidence**	**Mortality**
Manitoba	Men	prostate, non-Hodgkin's lymphoma	prostate	lung, leukemia, oral cavity, larynx	lung, larynx
	Women	breast, uterus, non-Hodgkin's lymphoma	–	larynx	breast, melanoma
Saskatchewan	Men	prostate, bladder	–	lung, colorectal, stomach, oral cavity, larynx, esophagus,	lung, colorectal, bladder, esophagus, oral cavity, larynx
	Women	breast	non-Hodgkin's lymphoma	colorectal, lung, stomach, larynx	lung, breast, colorectal, stomach, uterus, bladder, oral cavity
Alberta	Men	–	–	lung,colorectal, bladder, non-Hodgkin's lymphoma, oral cavity, larynx, esophagus	lung, colorectal, bladder, non-Hodgkin's lymphoma, oral cavity, larynx, stomach
	Women	breast	–	colorectal, lung, non-Hodgkin's lymphoma, leukemia, stomach, esophagus, larynx	lung, colorectal, non-Hodgkin's lymphoma, leukemia, esophagus, larynx
British Columbia	Men	prostate, melanoma, esophagus	esophagus	lung, colorectal, bladder, kidney, stomach, pancreas, leukemia, larynx	lung, colorectal, pancreas, stomach, leukemia, bladder, kidney, oral cavity, larynx
	Women	breast, lung, melanoma, oral cavity	lung	colorectal, uterus, non-Hodgkin's lymphoma, cervix, leukemia, kidney, bladder, stomach, larynx	breast, colorectal, leukemia, stomach, uterus
Yukon	Men	–	–	non-Hodgkin's lymphoma, leukemia	colorectal
	Women	–	–	colorectal, uterus	–
Northwest Territories	Men	lung, stomach	lung	prostate, colorectal, non-Hodgkin's lymphoma, leukemia, esophagus	colorectal
	Women	–	lung	breast, uterus, ovary, bladder	non-Hodgkin's lymphoma

Source: *National Cancer Incidence Reporting System, Canadian Cancer Registry, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*
– *No cancer rates significantly higher (or lower) than national rate*
** $p < 0.05$*

incidence rate for uterine cancer was accompanied by a below-average mortality rate.

Manitoba

In Manitoba, the relatively high overall cancer incidence rate among men primarily resulted from their very high incidence of prostate cancer. Prostate cancer mortality was also above average, as was the incidence rate for non-Hodgkin's lymphoma. On the other hand, incidence and mortality rates for cancers of the lung and the larynx were low, as were incidence rates for leukemia and cancer of the oral cavity.

For Manitoba women, the incidence of breast cancer was high, but the mortality rate was low. Incidence rates for uterine cancer and non-Hodgkin's lymphoma were also elevated. By contrast, the incidence rate for cancer of the larynx was low, as was the melanoma mortality rate.

Low rates in west

Saskatchewan

In Saskatchewan, cancer incidence and mortality rates were generally much lower than national averages.

Among men, incidence rates were high only for prostate and bladder cancer, and mortality rates were not significantly high for cancer of any type. In fact, male mortality rates were among the lowest in Canada for cancer of the bladder. As well, both incidence and mortality rates were low for cancer of the lung, larynx, esophagus and oral cavity, and for colorectal cancer. The incidence of stomach cancer was also low.

Saskatchewan women had a high incidence of breast cancer, but a low mortality rate from the disease. Non-Hodgkin's lymphoma was the only cancer with a significantly high mortality rate. Mortality rates for cancers of the lung, uterus, bladder, and oral cavity were among the lowest in Canada. Both incidence and mortality rates for stomach and colorectal cancer were considerably below average.

Alberta

In Alberta, too, incidence and mortality rates for most cancers tended to be well below national rates. No sites had significantly high mortality rates for either sex. Among women, only breast cancer incidence was slightly above average.

For both men and women, incidence and mortality rates were low for lung, colorectal and larangeal cancer, and non-Hodgkin's lymphoma. Alberta men had among the country's lowest mortality rates for lung, stomach and bladder cancer, and very low incidence and mortality rates for cancer of the oral cavity. Among women, incidence and mortality rates were very low for cancer of the esophagus, as were mortality rates for leukemia and cancer of the larynx.

British Columbia

Low overall rates of cancer in British Columbia reflect significantly low incidence and mortality rates for most sites, with many being well below the national average. Male mortality rates for pancreatic and kidney cancer and female mortality rates for breast and colorectal cancer were among the country's lowest. However, there were some exceptions to this trend toward low rates.

Male incidence and mortality rates were high for esophageal cancer. Their incidence rates for prostate cancer and melanoma were also above average.

Women had high lung cancer incidence and mortality rates. The incidence of melanoma and cancer of the oral cavity and of the breast was high. Breast cancer mortality, however, was significantly low.

Mixed pattern in north

Yukon

For men in the Yukon, no cancer site had incidence or mortality rates significantly above the national level. The colorectal cancer mortality rate was very low, as were the incidence rates for leukemia and non-Hodgkin's lymphoma.

Women had a significantly high mortality rate for all sites combined, but not for any specific cancer. Their incidence rates for colorectal and uterine cancer, in fact, were significantly low.

These rates should be regarded with caution. They are based on a small number of cases and are subject to high variability.

Northwest Territories

In the Northwest Territories, lung cancer incidence and mortality rates for both sexes far exceeded the national level.

Among men, the incidence rate was also very high for stomach cancer, and the mortality rate fell just short of statistical significance. On the other hand, incidence and mortality rates were significantly low for colorectal cancer, and incidence rates for prostate cancer, esophageal cancer, non-Hodgkin's lymphoma and leukemia were low.

Women's incidence rates were well below national averages for breast, ovarian, uterine and bladder cancer. Their mortality rate for non-Hodgkin's lymphoma was one of the lowest in the country.

To a considerable degree, many of these rates reflect the distinctive patterns of cancer incidence and mortality among the Inuit,[11] who comprised 32% of the population of the Northwest Territories in 1991.[12]

Again, the small number of cases means that rates for the Northwest Territories are subject to high variability.

Effects of smoking

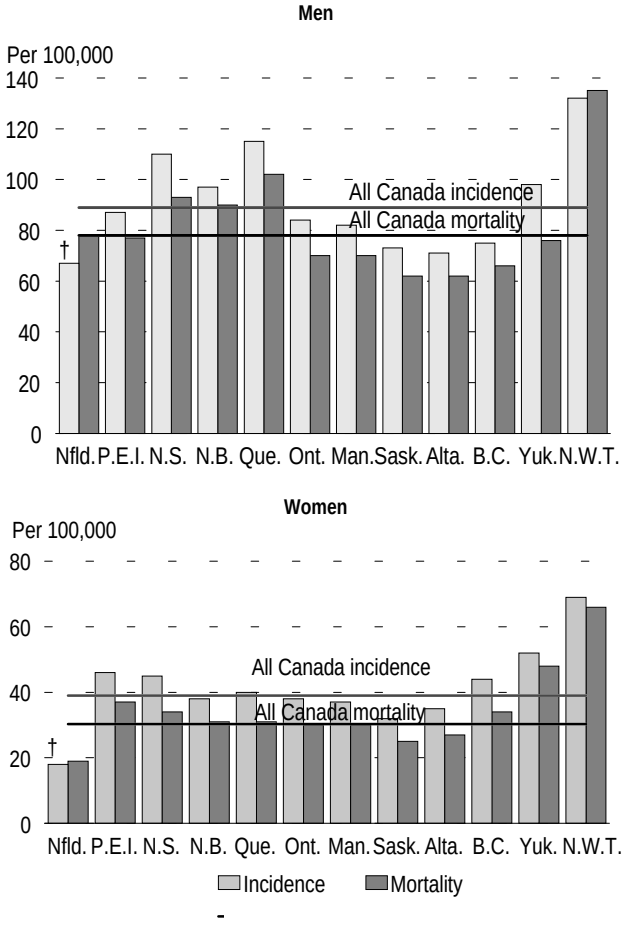
Much of the geographic variation in overall cancer rates mirrors lung cancer incidence and mortality, which can be largely attributed to patterns of tobacco use.[10] It is estimated that more than 30% of all cancer and 85% of lung cancer, results from cigarette smoking.[3,13]

High smoking prevalence in Quebec and the Maritime provinces[14] coincides with high rates of lung cancer and other smoking-related cancers (Chart 2). And while low rates of lung cancer in Newfoundland reflect a previously low smoking prevalence, this pattern can be expected to change, since a relatively high proportion of the residents of the province currently smoke.[14] Low lung cancer rates among both sexes in Ontario, Manitoba, Saskatchewan and Alberta, and among men in British Columbia, can largely be ascribed to low to average smoking prevalence over the past three decades.[10]

Lung cancer mortality rates in the Northwest Territories were about than twice the Canadian

Chart 2

Annual age-standardized lung cancer incidence and mortality rates, by sex, Canada, provinces and territories, 1991-1993



Source: *Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Data Base*

Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

† Incidence rates may be lower than mortality rates because of incomplete reporting of new cases.

average, a result of high incidence rates among the Inuit,[11] and a high prevalence of smoking among Aboriginal people in the North.[15]

The relationship between smoking and lung cancer in women is a particular concern. Female lung cancer incidence and mortality rates are rising substantially,[5,16] while reductions in the prevalence of smoking among women lag behind those of men.[14] Moreover, between 1984 and 1993, lung cancer incidence rates rose more rapidly among women in Quebec and the Atlantic provinces than among those in western Canada.[5] Significantly high

rates of lung cancer among Quebec women are a change from previous below-average rates.[1,2] This is associated with their high prevalence of smoking from the mid-1960s to the mid-1980s. As well, the significantly high rates of lung cancer in British Columbia women have been associated with high smoking rates in the 1960s.[10]

Diet

Diet may also contribute to geographic variations in cancer across Canada, as an estimated 35% of all cancers are linked to dietary factors.[3,13]

High fat consumption has been associated with colorectal cancer risk, while dietary fibre is protective.[13] Quebec residents, who have high colorectal cancer incidence and mortality rates, tend to consume more fat and more total calories than other Canadians,[17] and also have the highest levels of blood cholesterol.[18] In the Atlantic provinces, too, higher colorectal cancer incidence rates may be associated with high fat diets,[17] although mortality rates were low or average (Chart 3).

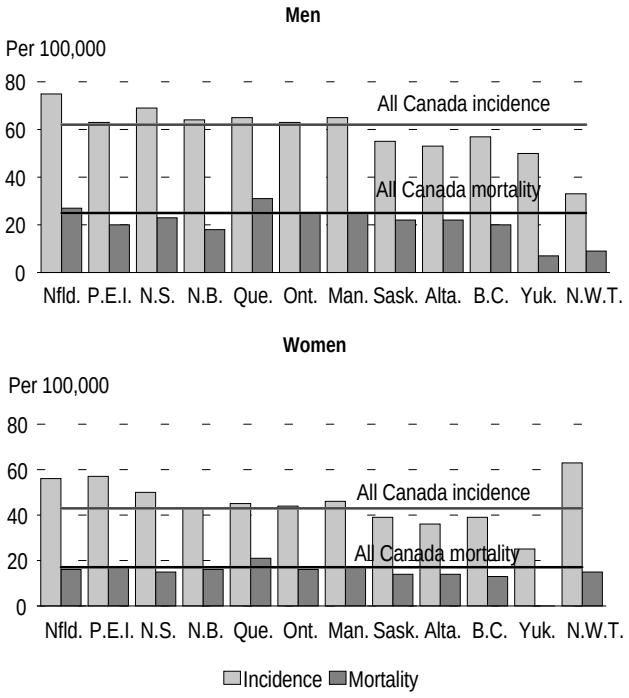
Stomach cancer is associated with diets high in smoked, salted and pickled foods and low in fresh fruit and vegetables.[11] The significantly high rates of stomach cancer in Newfoundland likely reflect such diets, which are deficient in Vitamin C.[1,2] Similar dietary factors could contribute to the high rates for stomach cancer in the Northwest Territories.[19]

Screening and early detection

Provincial/territorial differences in incidence and mortality rates for some cancer sites likely reflect variations in the establishment of early detection programs.[1,2,20] This is particularly true for breast, cervical and prostate cancer.

Implementation of a screening program can initially result in higher than normal incidence rates, because many cancers are diagnosed earlier than they would otherwise have been. As the program becomes fully operational, incidence rates may fall to pre-screening levels, and eventually, mortality rates may also decline. Thus, well-established screening programs may be contributing to the relatively favourable pattern of cancer mortality in the three

Chart 3
Annual age-standardized colorectal cancer incidence and mortality rates, by sex, Canada, provinces and territories, 1991-1993



Source: *Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*
- Nil

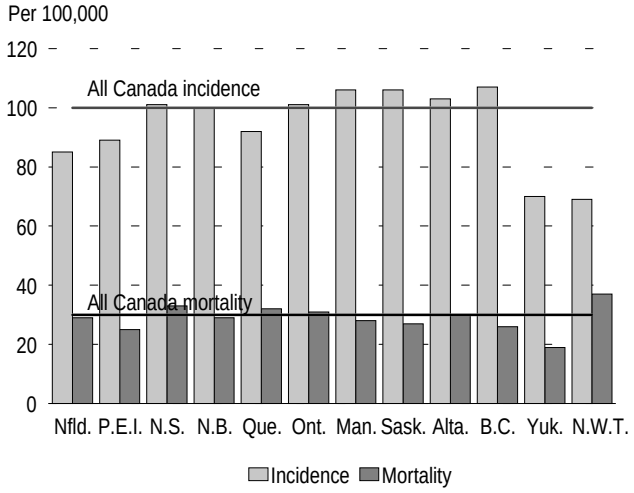
westernmost provinces.

For instance, variations in breast cancer incidence may be due to the availability of screening programs.[21] All provinces with higher incidence rates, except Manitoba, had provincially organized screening mammography programs during the 1991 to 1993 period, while those with lower rates did not. The pattern of high incidence and low mortality rates in British Columbia and Saskatchewan suggests that earlier detection, together with effective treatment guidelines, may be reducing breast cancer mortality (Chart 4).[22]

In addition, comparatively low rates of cervical cancer in British Columbia may be influenced by the well-established Pap test program in that province.[2,23]

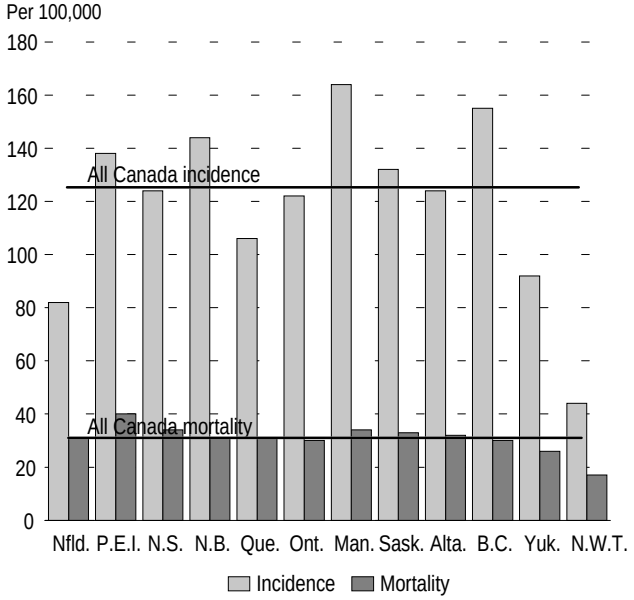
Variations in prostate cancer incidence may reflect differential rates of use of PSA (prostate-specific antigen) screening and other forms of early

Chart 4
Annual age-standardized breast cancer incidence and mortality rates, women, Canada, provinces and territories, 1991-1993



Source: *Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

Chart 5
Annual age-standardized prostate cancer incidence and mortality rates, men, Canada, provinces and territories, 1991-1993



Source: *Canadian Cancer Registry, National Cancer Incidence Reporting System, Canadian Vital Statistics Data Base*
Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

detection. That the east-to-west gradient in cancer incidence is less marked than in previous years[1,2] suggests that early detection is now practised more uniformly across Canada. However, mortality rates varied much less than incidence rates, and mortality did not always follow the pattern of incidence (Chart 5). It is too early to determine whether increased early detection of this cancer has resulted in declining mortality rates. This pattern of wide variations in incidence rates, accompanied by a narrower range of mortality rates, has been observed in other countries, indicating that earlier detection of prostate cancer may have little impact on mortality.[24]

Concluding remarks

Provincial and territorial cancer incidence and mortality rates vary considerably from national levels. Much of the variation appears to be associated with differences in risk factors such as smoking and diet, and in cancer control practices, such as screening.

Acknowledgement

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Appendix

Table A

Annual age-standardized cancer incidence rates, selected sites, men, Canada, provinces and territories, 1991-1993

	All sites		Prostate		Lung		Colorectal	
	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval
Canada	**475.6**	**473.4 - 477.8**	**124.9**	**123.7 - 126.1**	**89.4**	**88.4 - 90.4**	**62.0**	**61.2 - 62.8**
Newfoundland	406.6**	391.6 - 421.6	82.0**	75.1 - 88.9	66.9**	60.9 - 72.9	75.0**	68.5 - 81.5
Prince Edward Island	473.7	443.0 - 504.4	138.3	121.7 - 154.9	87.0	73.8 -100.2	63.4	52.1 - 74.7
Nova Scotia	519.8**	507.3 - 532.3	123.6	117.5 - 129.7	109.6**	103.9 -115.3	69.0**	64.4 - 73.6
New Brunswick	493.0**	479.4 - 506.6	144.2**	136.8 - 151.6	96.8**	90.8 -102.8	63.6	58.7 - 68.5
Quebec	501.8**	497.1 - 506.5	105.6**	103.4 - 107.8	115.0**	112.8 -117.2	65.0**	63.3 - 66.7
Ontario	470.7**	467.1 - 474.3	121.5**	119.6 - 123.4	83.5**	82.0 - 85.0	62.9	61.6 - 64.2
Manitoba	506.3**	495.4 - 517.2	163.6**	157.4 - 169.8	81.9**	77.5 - 86.3	64.6	60.7 - 68.5
Saskatchewan	451.0**	440.5 - 461.5	132.1**	126.5 - 137.7	72.5**	68.3 - 76.7	55.4**	51.7 - 59.1
Alberta	433.8**	426.3 - 441.3	124.3	120.2 - 128.4	71.3**	68.2 - 74.4	53.0**	50.3 - 55.7
British Columbia	460.1**	454.2 - 466.0	155.0**	151.6 - 158.5	74.6**	72.2 - 77.0	57.2**	55.1 - 59.3
Yukon	371.9*	283.9 - 459.9	92.1	47.3 - 136.9	98.0	52.5 -143.5	50.3	19.0 - 81.6
Northwest Territories	396.5*	322.8 - 470.2	44.0**	16.6 - 71.4	132.2*	90.7 -173.7	33.2**	12.2 - 54.2
	Bladder		**Non-Hodgkin's lymphoma**		**Kidney**		**Stomach**	
Canada	**26.9**	**26.4 - 27.4**	**17.8**	**17.4 - 18.2**	**14.9**	**14.5 - 15.3**	**14.7**	**14.3 - 15.1**
Newfoundland	35.1**	30.6 - 39.6	11.4**	9.0 - 13.8	13.2	10.6 - 15.8	24.0**	20.3 - 27.7
Prince Edward Island	18.3**	12.3 - 24.3	16.7	10.9 - 22.5	15.2	9.7 - 20.7	10.5	5.9 - 15.1
Nova Scotia	33.7**	30.5 - 36.9	17.1	14.9 - 19.3	18.8**	16.4 - 21.2	16.8	14.5 - 19.1
New Brunswick	29.6	26.2 - 33.0	17.3	14.8 - 19.8	15.2	12.8 - 17.6	14.9	12.5 - 17.3
Quebec	35.8**	34.5 - 37.1	18.5**	17.6 - 19.4	15.7*	14.9 - 16.5	17.3**	16.4 - 18.2
Ontario	24.3**	23.5 - 25.1	18.1	17.4 - 18.8	14.6	14.0 - 15.2	13.5**	12.9 - 14.1
Manitoba	25.6	23.1 - 28.1	20.6**	18.4 - 22.8	15.8	13.9 - 17.7	15.2	13.3 - 17.1
Saskatchewan	31.5**	28.8 - 34.2	16.8	14.7 - 18.9	15.7	13.7 - 17.7	11.8**	10.1 - 13.5
Alberta	24.6**	22.8 - 26.4	15.9**	14.5 - 17.3	15.9	14.5 - 17.3	13.9	12.5 - 15.3
British Columbia	15.4**	14.3 - 16.5	17.5	16.4 - 18.6	12.5**	11.5 - 13.5	12.3**	11.3 - 13.3
Yukon	17.8	0.0 - 36.3	5.7 *	0.0 - 16.9	17.5	0.0 - 43.2	6.1	0.0 - 15.3
Northwest Territories	13.5	0.0 - 27.8	5.0**	0.6 - 9.4	18.3	1.3 - 35.3	40.2*	15.6 - 64.8
	Leukemia		**Oral cavity**		**Pancreas**		**Melanoma**	
Canada	**13.6**	**13.2 - 14.0**	**12.2**	**11.9 - 12.5**	**10.9**	**10.6 - 11.2**	**9.8**	**9.5 - 10.1**
Newfoundland	5.6**	3.9 - 7.3	10.5	8.1 - 12.9	5.0**	3.4 - 6.6	5.3**	3.7 - 6.9
Prince Edward Island	11.1	6.4 - 15.8	12.1	7.2 - 17.0	13.3	8.2 - 18.4	10.0	5.5 - 14.5
Nova Scotia	11.5*	9.6 - 13.4	13.9	11.9 - 15.9	12.0	10.1 - 13.9	13.8**	11.8 - 15.8
New Brunswick	10.9**	8.9 - 12.9	11.8	9.7 - 13.9	10.0	8.1 - 11.9	11.3	9.3 - 13.3
Quebec	15.3**	14.5 - 16.1	14.1**	13.3 - 14.9	12.4**	11.7 - 13.1	4.9**	4.5 - 5.3
Ontario	15.0**	14.4 - 15.6	12.3	11.7 - 12.9	10.6	10.1 - 11.1	11.5**	11.0 - 12.0
Manitoba	11.4**	9.8 - 13.0	10.0**	8.5 - 11.5	10.7	9.1 - 12.3	10.6	9.0 - 12.2
Saskatchewan	15.1	13.2 - 17.0	7.1**	5.8 - 8.4	11.2	9.5 - 12.9	10.4	8.8 - 12.0
Alberta	12.7	11.4 - 14.0	10.0**	8.9 - 11.1	11.3	10.1 - 12.5	10.5	9.4 - 11.6
British Columbia	10.4**	9.5 - 11.3	12.2	11.3 - 13.1	9.5**	8.6 - 10.4	13.3**	12.3 - 14.3
Yukon	4.7**	0.0 - 11.5	17.0	0.0 - 36.8	10.3	0.0 - 22.2	11.0	0.0 - 29.2
Northwest Territories	3.0**	0.0 - 7.1	17.9	4.6 - 31.2	12.1	0.0 - 26.4	-	...
	Larynx		**Esophagus**					
Canada	**7.9**	**7.6 - 8.2**	**5.8**	**5.6 - 6.0**				
Newfoundland	7.8	5.8 - 9.8	6.6	4.7 - 8.5				
Prince Edward Island	8.2	4.2 - 12.2	10.5 *	5.9 - 15.1				
Nova Scotia	7.5	6.0 - 9.0	6.4	5.0 - 7.8				
New Brunswick	9.4	7.5 - 11.3	5.0	3.6 - 6.4				
Quebec	11.6**	10.9 - 12.3	5.7	5.2 - 6.2				
Ontario	7.2**	6.8 - 7.6	6.2**	5.8 - 6.6				
Manitoba	6.0**	4.8 - 7.2	5.3	4.2 - 6.4				
Saskatchewan	4.6**	3.5 - 5.7	4.6 *	3.5 - 5.7				
Alberta	4.9**	4.1 - 5.7	3.9**	3.2 - 4.6				
British Columbia	6.1**	5.4 - 6.8	6.7**	6.0 - 7.4				
Yukon	-	...	10.3	0.0 - 27.6				
Northwest Territories	5.0	0.0 - 12.3	1.7 *	0.0 - 5.1				

Source: *National Cancer Incidence Reporting System, Canadian Cancer Registry*

Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

\- *Nil or zero*

... *Not applicable*

* *Significantly different from national rate ($p < 0.05$)*

** *Significantly different from national rate ($p < 0.01$)*

Table B

Annual age-standardized cancer mortality rates, selected sites, men, Canada, provinces and territories, 1991-1993

	All sites		Lung		Prostate		Colorectal	
	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval
Canada	**243.1**	**241.5 - 244.7**	**77.9**	**77.0 - 78.8**	**31.0**	**30.4 - 31.6**	**25.2**	**24.7 - 25.7**
Newfoundland	257.8*	245.5 - 270.1	77.8	71.2 - 84.4	30.5	26.0 - 35.0	27.3	23.3 - 31.3
Prince Edward Island	254.3	231.8 - 276.8	77.3	64.9 - 89.7	39.7*	30.8 - 48.6	19.6	13.4 - 25.8
Nova Scotia	275.2**	266.0 - 284.4	92.6**	87.3 - 97.9	34.2*	30.9 - 37.5	22.6*	20.0 - 25.2
New Brunswick	253.8*	243.9 - 263.7	90.3**	84.5 - 96.1	30.9	27.4 - 34.4	18.4**	15.7 - 21.1
Quebec	281.8**	278.2 - 285.4	102.0**	99.9 - 104.1	31.1	29.8 - 32.4	31.3**	30.1 - 32.5
Ontario	234.8**	232.2 - 237.4	70.4**	69.0 - 71.8	30.3*	29.3 - 31.3	25.1	24.2 - 26.0
Manitoba	237.6	230.1 - 245.1	70.1**	66.0 - 74.2	33.7*	30.9 - 36.5	25.2	22.8 - 27.6
Saskatchewan	215.5**	208.3 - 222.7	62.0**	58.1 - 65.9	33.0	30.2 - 35.8	22.4*	20.1 - 24.7
Alberta	217.0**	211.6 - 222.4	61.6**	58.7 - 64.5	32.0	29.8 - 34.2	22.2**	20.5 - 23.9
British Columbia	211.2**	207.1 - 215.3	65.8**	63.6 - 68.0	29.7	28.1 - 31.3	19.6**	18.4 - 20.8
Yukon	242.2	164.6 - 319.8	75.8	38.0 - 113.6	26.1	0.0 - 56.8	7.3**	0.0 - 17.6
Northwest Territories	288.9	223.9 - 353.9	135.3**	92.3 - 178.3	16.5	0.1 - 32.9	9.3**	0.0 - 20.9

	Pancreas		Stomach		Leukemia		Non-Hodgkin's lymphoma	
Canada	**11.0**	**10.7 - 11.3**	**10.2**	**9.9 - 10.5**	**8.6**	**8.3 - 8.9**	**7.9**	**7.6 - 8.2**
Newfoundland	9.9	7.6 - 12.2	21.5**	17.9 - 25.1	5.9**	4.1 - 7.7	6.4	4.6 - 8.2
Prince Edward Island	14.9	9.5 - 20.3	7.9	3.9 - 11.9	4.5**	1.6 - 7.4	7.3	3.5 - 11.1
Nova Scotia	12.6	10.7 - 14.5	10.7	8.9 - 12.5	9.4	7.7 - 11.1	7.5	6.0 - 9.0
New Brunswick	10.8	8.8 - 12.8	11.1	9.0 - 13.2	7.7	6.0 - 9.4	8.9	7.1 - 10.7
Quebec	11.8**	11.1 - 12.5	12.9**	12.1 - 13.7	10.0**	9.3 - 10.7	8.3	7.7 - 8.9
Ontario	10.7*	10.1 - 11.3	8.9**	8.4 - 9.4	8.8	8.3 - 9.3	8.3**	7.8 - 8.8
Manitoba	10.6	9.0 - 12.2	10.8	9.2 - 12.4	9.1	7.6 - 10.6	8.0	6.6 - 9.4
Saskatchewan	10.7	9.1 - 12.3	9.1	7.6 - 10.6	8.6	7.2 - 10.0	8.2	6.8 - 9.6
Alberta	11.7	10.5 - 12.9	8.3**	7.2 - 9.4	8.3	7.2 - 9.4	6.9*	6.0 - 7.8
British Columbia	9.9**	9.0 - 10.8	8.5**	7.7 - 9.3	6.4**	5.7 - 7.1	7.3	6.5 - 8.1
Yukon	7.3	0.0 - 17.6	7.8	0.0 - 17.6	23.9	2.0 - 45.8	3.0	0.0 - 8.9
Northwest Territories	7.5	0.0 - 18.5	26.6	6.6 - 46.6	5.7	0.0 - 15.7	–	...

	Bladder		Esophagus		Kidney		Oral cavity	
Canada	**7.3**	**7.0 - 7.6**	**6.2**	**5.9 - 6.5**	**5.8**	**5.6 - 6.0**	**5.5**	**5.3 - 5.7**
Newfoundland	11.2**	8.6 - 13.8	6.2	4.3 - 8.1	5.6	3.8 - 7.4	3.9	2.4 - 5.4
Prince Edward Island	5.0	1.9 - 8.1	8.3	4.2 - 12.4	9.3	5.0 - 13.6	6.3	2.7 - 9.9
Nova Scotia	7.5	5.9 - 9.1	7.4	5.9 - 8.9	7.2*	5.7 - 8.7	6.3	4.9 - 7.7
New Brunswick	6.9	5.2 - 8.6	6.9	5.3 - 8.5	6.3	4.8 - 7.8	4.7	3.4 - 6.0
Quebec	8.1**	7.5 - 8.7	5.2**	4.7 - 5.7	6.4**	5.9 - 6.9	7.9**	7.3 - 8.5
Ontario	7.3	6.8 - 7.8	6.7**	6.3 - 7.1	5.2**	4.8 - 5.6	5.0**	4.6 - 5.4
Manitoba	7.6	6.3 - 8.9	6.0	4.8 - 7.2	6.7	5.4 - 8.0	4.5	3.5 - 5.5
Saskatchewan	6.0*	4.8 - 7.2	4.5**	3.5 - 5.5	6.2	5.0 - 7.4	3.1**	2.2 - 4.0
Alberta	6.2*	5.3 - 7.1	5.4	4.6 - 6.2	6.0	5.1 - 6.9	3.8**	3.1 - 4.5
British Columbia	6.6*	5.9 - 7.3	7.1**	6.4 - 7.8	5.0*	4.4 - 5.6	4.7*	4.1 - 5.3
Yukon	–	...	20.4	0.0 - 49.0	11.8	0.0 - 34.9	–	...
Northwest Territories	–	...	7.5	0.0 - 18.5	11.2	0.0 - 24.0	6.8	0.0 - 17.3

	Larynx		Melanoma	
Canada	**3.3**	**3.1 - 3.5**	**2.5**	**2.3 - 2.7**
Newfoundland	2.4	1.2 - 3.6	1.1**	0.4 - 1.8
Prince Edward Island	3.0	0.6 - 5.4	3.3	0.6 - 6.0
Nova Scotia	3.2	2.2 - 4.2	3.1	2.1 - 4.1
New Brunswick	2.9	1.9 - 3.9	2.7	1.7 - 3.7
Quebec	5.4**	4.9 - 5.9	1.8**	1.5 - 2.1
Ontario	3.1	2.8 - 3.4	3.0**	2.7 - 3.3
Manitoba	1.8**	1.1 - 2.5	2.3	1.6 - 3.0
Saskatchewan	2.5*	1.7 - 3.3	2.4	1.6 - 3.2
Alberta	1.8**	1.3 - 2.3	2.6	2.0 - 3.2
British Columbia	2.1**	1.7 - 2.5	2.7	2.3 - 3.1
Yukon	1.7	0.0 - 5.0	9.1	0.0 - 26.9
Northwest Territories	2.4	0.0 - 7.1	–	...

Source: *Canadian Vital Statistics Data Base*

Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

\- *Nil or zero*

... *Not applicable*

* *Significantly different from national rate ($p < 0.05$)*

** *Significantly different from national rate ($p < 0.01$)*

Table C

Annual age-standardized cancer incidence rates, selected sites, women, Canada, provinces and territories, 1991-1993

	All sites		Breast		Colorectal		Lung		Body of uterus	
	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval
Canada	336.5	334.8 - 338.2	99.5	98.6 - 100.4	43.2	42.6 - 43.8	38.8	38.2 - 39.4	19.1	18.7 - 19.5
Newfoundland	288.7**	277.0 - 300.4	84.6**	78.2 - 91.0	55.6**	50.4 - 60.8	18.2**	15.2 - 21.2	16.9	14.0 - 19.8
Prince Edward Island	343.3	318.8 - 367.8	88.5	75.9 - 101.1	57.0**	47.4 - 66.6	45.6	36.5 - 54.7	16.3	11.1 - 21.5
Nova Scotia	360.4**	351.0 - 369.8	100.7	95.7 - 105.7	50.1**	46.7 - 53.5	44.5**	41.2 - 47.8	18.1	15.9 - 20.3
New Brunswick	328.2	318.0 - 338.4	99.9	94.3 - 105.5	43.3	39.7 - 46.9	38.1	34.6 - 41.6	16.3**	14.0 - 18.6
Quebec	330.7**	327.5 - 333.9	91.7**	90.0 - 93.4	45.3**	44.1 - 46.5	39.9**	38.8 - 41.0	18.5	17.7 - 19.3
Ontario	343.7**	341.0 - 346.4	101.0**	99.5 - 102.5	43.5	42.5 - 44.5	38.1**	37.2 - 39.0	20.0**	19.3 - 20.7
Manitoba	348.1**	339.7 - 356.5	106.3**	101.6 - 111.0	45.8	42.8 - 48.8	37.1	34.4 - 39.8	22.8**	20.6 - 25.0
Saskatchewan	324.9*	316.2 - 333.6	106.2**	101.2 - 111.2	39.1**	36.2 - 42.0	32.2**	29.5 - 34.9	18.5	16.4 - 20.6
Alberta	325.7**	319.8 - 331.6	103.3**	100.0 - 106.6	36.1**	34.1 - 38.1	35.0**	33.0 - 37.0	19.2	17.7 - 20.7
British Columbia	335.3	330.6 - 340.0	106.5**	103.8 - 109.2	38.8**	37.2 - 40.4	43.9**	42.2 - 45.6	18.1*	17.0 - 19.2
Yukon	290.7	213.9 - 367.5	70.0	34.5 - 105.5	25.2*	7.3 - 43.1	52.4	17.0 - 87.8	6.5*	0.0 - 16.2
Northwest Territories	333.3	267.3 - 399.3	68.5*	41.8 - 95.2	62.9	30.6 - 95.2	69.2	38.5 - 99.9	5.7**	0.0 - 11.4

	Ovary		Non-Hodgkin's lymphoma		Cervix		Melanoma		Leukemia	
	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval
Canada	**13.7**	**13.4 - 14.0**	**12.5**	**12.2 - 12.8**	**9.5**	**9.2 - 9.8**	**8.7**	**8.4 - 9.0**	**8.4**	**8.1 - 8.7**
Newfoundland	9.3**	7.2 - 11.4	8.3**	6.3 - 10.3	13.8**	11.2 - 16.4	6.8	5.0 - 8.6	5.2**	3.6 - 6.8
Prince Edward Island	11.8	7.1 - 16.5	15.1	9.9 - 20.3	11.2	6.6 - 15.8	11.3	6.8 - 15.8	5.5	2.3 - 8.7
Nova Scotia	13.3	11.5 - 15.1	12.2	10.5 - 13.9	12.7**	10.9 - 14.5	11.5**	9.8 - 13.2	8.2	6.8 - 9.6
New Brunswick	11.8*	9.9 - 13.7	12.1	10.2 - 14.0	8.4	6.7 - 10.1	10.0	8.2 - 11.8	6.0**	4.7 - 7.3
Quebec	13.6	12.9 - 14.3	12.7	12.1 - 13.3	8.4**	7.9 - 8.9	4.5**	4.1 - 4.9	9.0**	8.5 - 9.5
Ontario	14.5**	13.9 - 15.1	12.8*	12.3 - 13.3	10.0**	9.5 - 10.5	9.8**	9.3 - 10.3	9.1**	8.7 - 9.5
Manitoba	12.6	11.0 - 14.2	14.7**	13.0 - 16.4	10.1	8.6 - 11.6	9.0	7.6 - 10.4	7.6	6.4 - 8.8
Saskatchewan	13.5	11.7 - 15.3	12.4	10.7 - 14.1	9.6	8.0 - 11.2	9.6	8.0 - 11.2	9.8	8.3 - 11.3
Alberta	13.5	12.3 - 14.7	11.1**	10.0 - 12.2	10.2	9.2 - 11.2	9.2	8.2 - 10.2	7.5*	6.6 - 8.4
British Columbia	13.3	12.4 - 14.2	11.6*	10.7 - 12.5	8.1**	7.3 - 8.9	12.6**	11.7 - 13.5	6.9**	6.2 - 7.6
Yukon	20.7	0.0 - 42.9	6.0	0.0 - 12.8	4.7	0.0 - 11.3	4.4	0.0 - 10.5	–	...
Northwest Territories	4.5**	0.0 - 11.1	9.3	0.0 - 19.6	13.5	1.4 - 25.6	6.4	0.0 - 15.5	6.7	0.0 - 16.9

	Pancreas		Kidney		Bladder		Stomach		Oral cavity	
	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval
Canada	**8.2**	**7.9 - 8.5**	**7.7**	**7.4 - 8.0**	**7.0**	**6.8 - 7.2**	**6.4**	**6.2 - 6.6**	**4.8**	**4.6 - 5.0**
Newfoundland	4.3**	2.9 - 5.7	6.4	4.6 - 8.2	6.7	4.9 - 8.5	11.7**	9.3 - 14.1	3.0**	1.8 - 4.2
Prince Edward Island	9.7	5.8 - 13.6	6.5	3.1 - 9.9	6.4	3.1 - 9.7	8.1	4.6 - 11.6	5.4	2.3 - 8.5
Nova Scotia	9.2	7.8 - 10.6	9.6**	8.1 - 11.1	9.9**	8.4 - 11.4	6.2	5.0 - 7.4	4.4	3.4 - 5.4
New Brunswick	6.9*	5.5 - 8.3	9.2	7.5 - 10.9	9.8**	8.1 - 11.5	6.6	5.2 - 8.0	3.9	2.8 - 5.0
Quebec	8.5	8.0 - 9.0	8.1	7.6 - 8.6	8.8**	8.3 - 9.3	7.8**	7.3 - 8.3	4.0**	3.6 - 4.4
Ontario	8.3	7.9 - 8.7	7.6	7.2 - 8.0	6.1**	5.7 - 6.5	5.8**	5.5 - 6.1	5.2**	4.9 - 5.5
Manitoba	8.2	7.0 - 9.4	8.4	7.1 - 9.7	7.3	6.1 - 8.5	6.5	5.4 - 7.6	4.6	3.7 - 5.6
Saskatchewan	7.6	6.4 - 8.8	7.8	6.5 - 9.1	8.2	6.9 - 9.5	5.0**	4.0 - 6.0	4.0	3.0 - 5.0
Alberta	8.8	7.8 - 9.8	8.0	7.1 - 8.9	6.4	5.6 - 7.2	5.7*	4.9 - 6.5	4.4	3.7 - 5.1
British Columbia	7.8	7.1 - 8.5	6.4**	5.8 - 7.1	4.4**	3.9 - 4.9	5.4**	4.8 - 6.0	6.1**	5.5 - 6.7
Yukon	–	...	–	...	3.6	0.0 - 10.6	–	...	16.5	0.0 - 37.0
Northwest Territories	7.6	0.9 - 14.3	14.0	0.9 - 27.1	0.9**	0.0 - 2.7	12.0	0.0 - 26.8	10.1	0.0 - 20.4

	Esophagus		Larynx	
	Rate	95% confidence interval	Rate	95% confidence interval
Canada	**2.0**	**1.9 - 2.1**	**1.4**	**1.3 - 1.5**
Newfoundland	2.0	1.0 - 3.0	1.0	0.3 - 1.7
Prince Edward Island	2.1	0.2 - 4.0	0.9	0.0 - 2.1
Nova Scotia	2.3	1.6 - 3.0	1.3	0.7 - 1.9
New Brunswick	1.1**	0.5 - 1.7	1.1	0.5 - 1.7
Quebec	1.9	1.7 - 2.1	2.0**	1.7 - 2.3
Ontario	2.2*	2.0 - 2.4	1.3	1.1 - 1.5
Manitoba	2.0	1.4 - 2.6	0.9*	0.5 - 1.3
Saskatchewan	1.6	1.0 - 2.2	0.9*	0.4 - 1.4
Alberta	1.6*	1.2 - 2.0	1.0**	0.7 - 1.3
British Columbia	2.1	1.7 - 2.5	1.0**	0.7 - 1.3
Yukon	–	...	–	...
Northwest Territories	1.1	0.0 - 3.2	–	...

Source: *National Cancer Incidence Reporting System, Canadian Cancer Registry*

Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

\- *Nil or zero*

... *Not applicable*

* *Significantly different from national rate ($p < 0.05$)*

** *Significantly different from national rate ($p < 0.01$)*

Table D

Annual age-standardized cancer mortality rates, selected sites, women, Canada, provinces and territories, 1991-1993

	All sites		Lung		Breast		Colorectal		Pancreas	
	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval	Rate	95% confidence interval
Canada	**153.2**	**152.1 - 154.3**	**30.3**	**29.8 - 30.8**	**29.9**	**29.4 - 30.4**	**16.6-**	**16.2 - 17.0**	**8.1**	**7.8 - 8.4**
Newfoundland	150.3	141.8 - 158.8	19.1**	16.1 - 22.1	29.1	25.4 - 32.8	16.3	13.5 - 19.1	5.9**	4.2 - 7.6
Prince Edward Island	156.3	140.1 - 172.5	37.0	28.9 - 45.1	25.4	18.7 - 32.1	17.0	11.9 - 22.1	9.4	5.7 - 13.1
Nova Scotia	170.0**	163.6 - 176.4	34.4**	31.5 - 37.3	32.9*	30.1 - 35.7	14.5*	12.7 - 16.3	9.3	7.9 - 10.7
New Brunswick	154.5	147.7 - 161.3	30.5	27.4 - 33.6	29.0	26.0 - 32.0	15.8	13.7 - 17.9	7.4	5.9 - 8.9
Quebec	160.7**	158.5 - 162.9	31.1**	30.1 - 32.1	31.6**	30.6 - 32.6	21.4**	20.6 - 22.2	8.2	7.7 - 8.7
Ontario	152.9	151.1 - 154.7	29.6**	28.8 - 30.4	30.5**	29.7 - 31.3	16.0**	15.4 - 16.6	7.9	7.5 - 8.3
Manitoba	151.2	145.8 - 156.6	29.6	27.2 - 32.0	27.5*	25.2 - 29.8	17.2	15.4 - 19.0	8.1	6.9 - 9.3
Saskatchewan	135.7**	130.3 - 141.1	25.1**	22.7 - 27.5	26.9*	24.4 - 29.4	13.8**	12.2 - 15.4	7.6	6.4 - 8.8
Alberta	146.0**	142.0 - 150.0	26.7**	25.0 - 28.4	29.9	28.1 - 31.7	13.5**	12.3 - 14.7	8.5	7.5 - 9.5
British Columbia	145.1**	142.1 - 148.1	34.3**	32.8 - 35.8	26.0**	24.7 - 27.3	12.5**	11.6 - 13.4	8.0	7.3 - 8.7
Yukon	227.9*	154.4 - 301.4	47.9	15.8 - 80.0	18.8	0.7 - 36.9	-	...	22.8	0.0 - 48.8
Northwest Territories	214.5*	156.5 - 272.5	66.0*	34.2 - 97.8	37.0	12.9 - 61.1	14.7	0.0 - 29.8	11.3	0.0 - 23.3

	Ovary		Non-Hodgkin's lymphoma		Leukemia		Stomach		Body of uterus	
Canada	**7.9**	**7.6 - 8.2**	**5.6**	**5.4 - 5.8**	**5.1**	**4.9 - 5.3**	**4.7**	**4.5 - 4.9**	**3.4**	**3.2 - 3.6**
Newfoundland	7.6	5.7 - 9.5	3.4**	2.1 - 4.7	4.3	2.9 - 5.7	11.2**	8.9 - 13.5	3.5	2.2 - 4.8
Prince Edward Island	5.6	2.4 - 8.8	4.6	1.8 - 7.4	4.1	1.6 - 6.6	6.6	3.5 - 9.7	3.9	1.4 - 6.4
Nova Scotia	6.8	5.5 - 8.1	6.2	5.0 - 7.4	5.4	4.3 - 6.5	5.5	4.4 - 6.6	3.0	2.2 - 3.8
New Brunswick	7.1	5.6 - 8.6	5.6	4.3 - 6.9	4.3	3.2 - 5.4	4.5	3.4 - 5.6	3.6	2.6 - 4.6
Quebec	7.4*	6.9 - 7.9	5.7	5.3 - 6.1	5.8**	5.4 - 6.2	5.7**	5.3 - 6.1	4.3**	3.9 - 4.7
Ontario	8.3*	7.9 - 8.7	5.7	5.4 - 6.0	5.1	4.8 - 5.4	4.1**	3.8 - 4.4	3.2*	2.9 - 3.5
Manitoba	7.5	6.3 - 8.7	6.5	5.4 - 7.6	4.5	3.6 - 5.4	5.2	4.2 - 6.2	3.3	2.5 - 4.1
Saskatchewan	7.0	5.8 - 8.3	6.7*	5.5 - 7.9	5.0	4.0 - 6.0	3.6**	2.7 - 4.5	2.4**	1.7 - 3.1
Alberta	8.1	7.2 - 9.0	4.7*	4.0 - 5.4	4.2**	3.5 - 4.9	4.8	4.1 - 5.5	3.7	3.1 - 4.3
British Columbia	8.5	7.8 - 9.2	5.1	4.5 - 5.7	4.6*	4.1 - 5.1	3.6**	3.1 - 4.1	2.7**	2.3 - 3.1
Yukon	20.3	0.0 - 43.5	10.3	0.0 - 26.8	5.5	0.0 - 13.5	-	...	-	...
Northwest Territories	-	...	1.2**	0.0 - 3.5	5.1	0.0 - 15.1	12.8	0.0 - 29.3	-	...

	Kidney		Cervix		Bladder		Esophagus		Oral cavity	
Canada	**2.7**	**2.6 - 2.8**	**2.6**	**2.5 - 2.7**	**2.1**	**2.0 - 2.2**	**1.9**	**1.8 - 2.0**	**1.7**	**1.6 - 1.8**
Newfoundland	3.2	2.0 - 4.4	3.4	2.1 - 4.7	1.9	0.9 - 2.9	1.6	0.8 - 2.4	1.6	0.7 - 2.5
Prince Edward Island	2.8	0.6 - 5.0	4.9	1.8 - 8.0	1.7	0.1 - 3.3	0.3**	0.0 - 0.9	2.0	0.1 - 3.9
Nova Scotia	3.1	2.3 - 3.9	4.0**	3.0 - 5.0	2.1	1.4 - 2.8	2.0	1.3 - 2.7	1.5	0.9 - 2.1
New Brunswick	3.3	2.3 - 4.3	2.1	1.3 - 2.9	2.1	1.3 - 2.9	1.5	0.8 - 2.2	1.3	0.7 - 1.9
Quebec	2.8	2.5 - 3.1	2.1**	1.8 - 2.4	2.2	1.9 - 2.5	1.7*	1.5 - 1.9	1.7	1.5 - 1.9
Ontario	2.5	2.3 - 2.7	2.8**	2.6 - 3.1	2.1	1.9 - 2.3	2.1*	1.9 - 2.3	1.8	1.6 - 2.0
Manitoba	3.0	2.2 - 3.8	3.2	2.4 - 4.0	2.2	1.6 - 2.8	2.5	1.8 - 3.2	1.7	1.1 - 2.3
Saskatchewan	2.7	1.9 - 3.5	2.9	2.0 - 3.8	1.5*	1.0 - 2.0	1.6	1.0 - 2.2	1.2*	0.8 - 1.7
Alberta	2.9	2.3 - 3.5	2.7	2.2 - 3.2	2.0	1.5 - 2.5	1.4*	1.0 - 1.8	1.9	1.5 - 2.3
British Columbia	2.6	2.2 - 3.0	2.3	1.9 - 2.7	2.0	1.7 - 2.3	2.1	1.7 - 2.5	1.8	1.5 - 2.1
Yukon	12.3	0.0 - 29.4	2.8	0.0 - 8.4	-	...	8.6	0.0 - 25.4	-	...
Northwest Territories	5.3	0.0 - 15.8	5.1	0.0 - 15.1	-	...	7.7	0.0 - 18.3	1.2	0.0 - 3.5

	Melanoma		Larynx
Canada	**1.5**	**1.4 - 1.6**	**0.5**	**0.4 - 0.6**
Newfoundland	0.2**	0.0 - 0.5	0.5	0.0 - 1.0
Prince Edward Island	0.9	0.0 - 2.2	-	...
Nova Scotia	0.7**	0.3 - 1.1	0.4	0.1 - 0.7
New Brunswick	1.0	0.5 - 1.5	0.6	0.2 - 1.0
Quebec	1.2**	1.0 - 1.4	0.8**	0.6 - 1.0
Ontario	1.8**	1.6 - 2.0	0.5	0.4 - 0.6
Manitoba	0.9*	0.5 - 1.3	0.4	0.1 - 0.7
Saskatchewan	1.3	0.7 - 1.9	0.4	0.1 - 0.7
Alberta	1.6	1.2 - 2.0	0.3*	0.1 - 0.5
British Columbia	1.7	1.4 - 2.0	0.4	0.2 - 0.6
Yukon	-	...	8.2	0.0 - 24.2
Northwest Territories	-	...	-	...

Source: *Canadian Vital Statistics Data Base*

Note: *Rates are age-standardized to the 1991 Canadian population adjusted for net census undercoverage.*

\- *Nil or zero*

... *Not applicable*

* *Significantly different from national rate ($p < 0.05$)*

** *Significantly different from national rate ($p < 0.01$)*

Data Releases

Synopses of recent health information produced by Statistics Canada

Canadian cancer statistics, 1998

An estimated 129,200 cases of cancer will be diagnosed in Canadians of all ages in 1998, and about 62,700 individuals will die from the disease.

Lung cancer will kill 10,600 men and 6,500 women, more than any other form of cancer. Almost a third of cancer deaths in men and one-fifth in women are due to lung cancer alone.

The most frequent diagnosis among women will be breast cancer, at 19,300 new cases. Prostate cancer will be the most commonly diagnosed cancer among men, with an anticipated 16,100 new cases.

The total number of new cases and deaths for all cancers has risen largely as a result of the growth and aging of the population. Cancer is primarily a disease of older Canadians: 71% of new cases and 80% of deaths in 1998 will occur among those who are at least 60 years old.

However, most encouraging is the steady decline since 1969 in cancer mortality rates among men and women in all age groups under 60.

Women's overall cancer mortality rate has remained relatively stable. Increases in the lung cancer mortality rate were counterbalanced by declining or stable rates for most other forms of cancer. If the lung cancer mortality rate were excluded, women's overall cancer mortality rate would have fallen by 15% since 1971.

As a result of steady increases, female lung cancer incidence and mortality rates are now nearly a third higher than they were a decade ago. Lung cancer has the highest mortality rate of any cancer among women. However, the lung cancer incidence rate is still less than half that of breast cancer.

Men's overall cancer mortality rate declined moderately because of decreasing rates for colorectal, lung and other cancers. The rate has fallen by about 9% from its peak a decade ago.

Although incidence rates for prostate cancer have risen rapidly over the past decade, there has been no associated change in mortality rates. There is now an indication that incidence rates may begin to decline.

Lung cancer has a poor prognosis, meaning that the probabilities of developing and dying of the disease are close. Over a lifetime, 1 in 11 men will develop lung cancer and almost as many, 1 in 12, will die of it. Among women, 1 in 21 will develop lung cancer, and 1 in 24 will die of it.

Prostate cancer and breast cancer have a better prognosis. That is, the probability of developing the disease far exceeds the probability of dying of it. During their lifetime, 1 in 8 men will develop prostate cancer, but only 1 in 26 will die of it. Similarly, about 1 in 9 women is expected to develop breast cancer, and 1 in 25 will die of it.

The pattern of cancer incidence in Canada is similar to the United States and Europe, but quite different from Asia, South America and Africa. Lung, prostate and colorectal cancers are the top three cancers among men in both Canada and the United States. Among women, breast, colorectal and lung cancer are the top three cancers in both countries. In Japan and China, the most common cancers among men are stomach, liver and lung, and among women, stomach, breast and colorectal. Some cancer registries in South America and Africa have much lower lung and colorectal cancer rates than in Canada. Cervical cancer is the most common cancer among women recorded by these registries.

Canadian cancer statistics 1998 is a collaborative effort of Statistics Canada, the National Cancer Institute of Canada, Health Canada, the Canadian Cancer Society and the provincial/territorial cancer registries. Limited copies of **Canadian cancer statistics 1998** are available from the Canadian Cancer Society (Suite 200, 10 Alcorn Avenue, Toronto, Ontario, M4V 3B1; phone 416-961-7223), the Health Statistics Division of Statistics Canada (613-951-1746), local offices of the Canadian Cancer Society, and Statistics Canada's Regional Reference Centres. **Canadian cancer statistics 1998** can be viewed on the Internet at: www.cancer.ca/stats/.

For further information on this release, contact Judy Lee (613-951-1775) or Ghislaine Villeneuve (613-951-1641), Health Statistics Division; Kerstin Ring or David Stones (416-961-7223), Canadian Cancer Society / National Cancer Institute of Canada; or Monette Haché (613-957-2988), Health Canada.

Registered nurses, 1997

The number of registered nurses in Canada declined marginally between 1992 and 1997, although the number actually employed in nursing decreased at a much faster pace from 234,128 to 229,990. Close to half (47%) of them worked part time, compared with 34% in 1992.

The decline in registered nurses working in nursing, combined with population growth, has increased the ratio of nurses to population. In 1997, the ratio was 1 nurse for every 131 people, compared with 1 for every 122 people in 1992. The ratio rose in all provinces and territories except Newfoundland, New Brunswick, Quebec and Manitoba.

In 1997, 63% of all registered nurses were working in hospitals, down from 66% in 1992. During the same period, the proportion working in community health care (home care) grew from 4% to 7%, and the proportion working in nursing homes increased from 9% to 12%.

These changes reflect the move toward an expanded role for community-based care, resulting from health care reform initiatives and from the needs created by the aging population.

For further information on this release, contact Jill Strachan (613-241-7860, ext. 4027), Canadian Institute for Health Information; Susan Hicks (613-237-2159, ext. 219), Canadian Nurses Association; or Cyril Nair (613-951-8387), Health Statistics Division, Statistics Canada.

Deaths, 1996

Canadians' life expectancy increased in 1996, particularly among men. Life expectancy at birth rose because of declines in the mortality rates for the leading causes of death.

In 1996, life expectancy reached 81.4 years for women and 75.7 for men, up 0.1 and 0.3 years over 1995, respectively. The gap between men's and women's life expectancy continues to narrow: from 7.5 years in 1978 to 5.9 in 1995 and 5.7 in 1996.

Life expectancy increased the most in New Brunswick, Quebec, Ontario, Manitoba and Newfoundland, with gains of 0.3 to 0.4 years. It stayed about the same in Nova Scotia, Saskatchewan, Alberta and British Columbia. (Variations in Prince Edward Island, the Yukon and the Northwest Territories should be interpreted with caution, given the small number of deaths involved.)

In 1996, in most provinces life expectancy for both sexes combined was 78 years. In Newfoundland, Prince Edward Island and Nova Scotia, it was marginally shorter at 77 years. Life expectancy in the two territories was below that in the provinces.

Over time, the annual number of deaths has risen because of growth in both the total population and the number of elderly persons. 1996 was no exception: the total number of deaths increased 1% to 212,881, up from 210,733 in 1995. However, there was virtually no change in the number of deaths among men, whereas the number of deaths among women increased 2.2%.

For men, the mortality rate (adjusted to remove the effect of the growing population of elderly persons) declined for all major causes of death: cancer (in particular, lung, prostate and colorectal), heart disease, cerebrovascular disease, accidents, suicide and HIV infection.

The picture for women was somewhat less favourable. Declines were observed in mortality from heart disease, cerebrovascular disease and accidents, but cancer mortality rose. In particular, mortality from lung cancer, the most lethal form of cancer for women since 1993, continued to climb. The suicide rate among women also increased in 1996.

The number of deaths from HIV infection dropped substantially (-26%): 1,306 Canadians died in 1996, compared with 1,764 in 1995 and 1,358 in 1992. This was the first significant drop in HIV-related mortality.

The age-standardized suicide rate fell in all provinces except Saskatchewan and Quebec. Quebec's suicide rate was the highest in Canada in 1996, by an even larger margin than in 1995. The suicide rate also rose in both territories, but again, these figures should be interpreted with caution, since they are based on relatively few deaths.

Cancer and heart disease combined accounted for over half (55%) of all deaths in 1996.

Cerebrovascular disease, the third leading cause of death, made up an additional 7%.

For both men and women, the 10 leading causes of death represented 84% of all deaths in 1996. Together, cancer and heart disease accounted for a marginally higher share of deaths among men (56%) than among women (54%). Women were more likely to die from cerebrovascular disease (9% versus 6%).

Other leading causes were generally the same for both sexes, although the ranking differed. For example, deaths due to pneumonia and influenza ranked fourth among women, but sixth among men. Deaths from hereditary and degenerative diseases of the central nervous system (such as Alzheimer's disease) were also more common among women. Suicide, the seventh leading cause of death among men, did not register among the top 10 for women. Conversely, deaths traced to psychotic mental disorders were frequent enough among women to rank among the top 10.

For further information on this release, contact François Nault (613-951-1764) or Doreen Duchesne (613-951-6379), Health Statistics Division. To order custom tabulations, contact Client Custom Services (613-951-1746).

Hospital utilization, 1995/96

In 1995/96, the rate at which Canadians were hospitalized reached an all-time low. The hospital discharge rate fell for a ninth consecutive year to its lowest level since 1961, when such data were first collected. This decrease continues the general decline since the mid-1970s. The trend toward more frequent use of ambulatory care and day surgery, improved medical technologies and treatments, and new pharmaceuticals may have reduced the need for hospitalization or surgical intervention.

The 1995/96 discharge rate (the number of hospital discharges or deaths per 100,000 population) was 11,165—the lowest since 1961 and well below the peak of 16,802 in 1973.

The hospital discharge rate declined in most provinces and territories in 1995/96. The largest drops occurred in Prince Edward Island, Alberta and Quebec. However, in both Newfoundland and the Yukon, the rate increased 5%.

Even so, rates continued to be lowest in the Yukon at 9,192 per 100,000 population. Quebec and Ontario followed at 10,548 and at 10,623, respectively. Saskatchewan recorded the highest discharge rate (15,638), followed by New Brunswick (15,383) and Prince Edward Island (13,633).

Hospitals reported 3.3 million discharges in 1995/96, 14% of which were related to pregnancy and childbirth. Another 14% were related to the circulatory system (for example, heart disease), 11% to the digestive system (such as hernias or ulcers), and 9% to asthma, pneumonia and other respiratory illnesses.

Men and women were admitted to hospital for much different reasons. Among male patients, diseases of the heart accounted for the largest share of discharges in 1995/96, followed by diseases of the digestive system and the respiratory system. For women, pregnancy and childbirth represented by far the largest proportion of discharges, followed by diseases of the heart and the digestive system.

In 1995/96 the average patient spent 10.7 days in hospital, about a day less than a decade earlier. The 3.3 million hospital discharges in 1995/96 represented 35.5 million patient-days, down 5% from the previous year and 17% lower than a decade earlier.

Contributing to this decline is that many services which formerly required hospitalization, such as cataract surgery, are shifting to out-patient programs. In other instances, patients are having minimally invasive surgery and are discharged sooner. Patients who years ago would have spent 10 days in hospital for gallbladder removal are now discharged within days of being admitted. New mothers, who used to remain in hospital up to a week after giving birth, now typically go home within 48 hours.

The elderly accounted for 60% of total hospital days in 1995/96, although they represented only 12% of the population. As the number of people aged 65 and older and their share of the total population rise over the next several decades, total hospital bed requirements are expected to increase.

Declines in hospital discharge rates, length of stay and patient-days were accompanied by a decrease in the number of patients having surgery. In 1995/96, 1.9 million hospital discharges involved surgery, down 5% from the previous year and 16% lower than a decade earlier. Just over half of all hospital discharges involved surgery. Women were considerably more likely than men to undergo surgery: 62% compared with 38%. Obstetrical procedures, which accounted for nearly one in three surgical procedures performed on women, explain most of this difference.

These discharge data do not indicate the number of individuals using hospital services. For instance, one person could be included several different times in annual discharge totals. As well, counts of surgical discharges refer to the primary surgical procedure undertaken. Thus, a patient having two kinds of surgery during a single hospital stay would be counted as having one procedure.

The figures refer to in-patient events only and exclude newborns and patients treated on an out-patient basis in, for example, emergency wards or day-surgery programs.

The 1995/96 data on hospital discharges were collected by the Canadian Institute for Health Information. For further information on the data, contact Sherry Kennedy (416-429-0477, ext. 3532; fax: 416-429-1953), Canadian Institute for Health Information.

For further information on trends in hospital discharges, contact Peter Morrison (613-951-1637), Health Statistics Division, Statistics Canada.

Preliminary data from the 1995/96 Annual Hospital Survey are now available from the Canadian Institute for Health Information. For further information on the 1995/96 data, contact Terry Campbell (613-241-7860, ext. 4006; fax: 613-241-8120), Canadian Institute for Health Information.

Postcensal Population Estimates

Each issue of *Health Reports* includes current quarterly population estimates. July 1, 1997 (preliminary) estimates are shown on the following page.

Preliminary postcensal population estimates, by sex and age group, Canada, provinces and territories, July 1, 1997

	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T.
							'000						
Both sexes	**30,286.6**	**563.6**	**137.2**	**947.9**	**762.0**	**7,419.9**	**11,407.7**	**1,145.2**	**1,023.5**	**2,847.0**	**3,933.3**	**31.6**	**67.5**
<1	363.2	5.6	1.7	10.3	8.1	82.9	139.2	15.5	13.0	38.1	46.9	0.5	1.5
1-4	1,552.6	24.3	7.1	44.1	35.4	362.2	594.4	65.2	56.3	159.3	196.5	1.9	5.9
5-9	2,049.4	35.4	9.9	63.0	48.8	474.0	777.5	83.5	79.3	214.6	253.1	2.4	8.0
10-14	2,027.1	41.2	10.1	64.1	51.5	456.8	758.5	81.5	81.8	215.7	257.2	2.4	6.4
15-19	2,024.1	43.2	10.0	63.4	52.3	502.0	731.8	78.7	77.3	203.3	254.5	2.3	5.3
20-24	2,034.5	43.7	9.7	65.1	55.3	485.5	750.8	79.7	70.5	202.6	264.0	2.2	5.4
25-29	2,203.0	44.3	9.7	68.3	57.0	503.9	851.3	81.0	64.0	218.5	296.2	2.4	6.3
30-34	2,564.4	45.7	10.7	77.9	62.5	619.3	1,003.7	90.0	73.8	243.8	327.4	3.1	6.5
35-39	2,706.0	47.5	11.0	82.9	64.6	674.3	1,024.0	95.2	82.7	267.1	347.3	3.3	5.9
40-44	2,465.9	47.0	10.2	76.3	62.2	626.5	905.8	86.9	78.0	242.2	323.2	2.9	4.8
45-49	2,183.8	43.1	9.6	69.4	57.2	560.0	809.3	76.3	63.8	195.1	293.3	2.8	3.8
50-54	1,794.1	34.8	8.0	57.7	45.6	478.7	666.0	62.7	51.0	151.4	233.7	2.0	2.5
55-59	1,382.6	25.2	6.1	44.3	34.6	365.6	520.5	48.9	42.3	113.9	178.6	1.0	1.8
60-64	1,210.0	21.0	5.6	38.6	29.5	310.9	463.2	43.8	40.0	98.6	156.5	0.8	1.4
65-69	1,141.3	18.7	5.0	35.0	28.5	294.0	438.0	42.5	39.5	89.1	149.3	0.8	1.0
70-74	986.1	15.9	4.4	30.4	25.0	246.2	381.9	39.5	36.6	73.4	131.9	0.5	0.6
75-79	743.0	13.0	3.7	26.0	20.3	177.8	278.6	32.6	31.2	55.9	103.4	0.2	0.2
80-84	476.6	8.1	2.6	17.3	13.1	111.1	174.3	22.8	22.8	35.9	68.4	0.1	0.2
85-89	251.6	4.1	1.4	9.2	7.1	58.7	92.1	12.2	12.9	18.5	35.3	0.0	0.1
90+	127.1	1.8	0.8	4.7	3.5	29.6	46.8	6.6	6.7	10.0	16.7	0.0	0.1
Males	**14,999.7**	**281.3**	**67.8**	**466.7**	**376.9**	**3,657.2**	**5,636.3**	**567.8**	**508.3**	**1,432.5**	**1,953.6**	**16.3**	**35.0**
<1	186.0	2.8	0.9	5.2	4.2	42.5	71.4	7.9	6.5	19.5	24.2	0.2	0.7
1-4	795.8	12.5	3.7	22.8	18.1	185.2	304.5	33.4	28.6	81.8	101.3	0.9	3.0
5-9	1,049.5	18.2	5.1	32.4	24.9	242.7	398.3	42.9	40.4	109.9	129.2	1.3	4.2
10-14	1,035.4	21.0	5.2	32.6	26.2	232.8	388.2	42.0	41.4	110.4	131.0	1.2	3.3
15-19	1,037.3	21.7	4.9	31.9	26.9	257.2	375.9	39.9	40.1	104.1	130.8	1.2	2.7
20-24	1,032.1	22.3	5.0	33.1	28.1	247.2	380.2	40.8	36.0	103.4	132.2	1.1	2.7
25-29	1,110.4	22.7	5.0	34.9	29.0	256.6	425.8	41.2	32.0	110.8	148.0	1.2	3.3
30-34	1,298.2	22.7	5.2	39.5	31.6	316.0	507.0	45.7	36.7	124.4	164.5	1.6	3.4
35-39	1,364.7	23.7	5.4	40.9	32.3	341.0	516.6	48.6	41.8	136.1	173.6	1.6	3.0
40-44	1,231.0	23.3	5.1	37.5	30.8	313.7	449.1	43.6	40.1	123.4	160.5	1.4	2.5
45-49	1,096.0	21.7	4.9	34.6	28.9	280.4	402.7	38.5	32.8	99.5	148.4	1.4	2.1
50-54	899.1	17.7	4.1	29.2	23.2	237.5	332.0	31.6	25.7	77.1	118.4	1.1	1.4
55-59	687.3	12.9	3.1	22.1	17.4	180.0	257.5	24.1	20.8	58.2	89.6	0.7	1.0
60-64	593.7	10.6	2.7	19.0	14.5	149.3	226.5	21.7	19.9	49.3	79.1	0.4	0.7
65-69	544.9	9.2	2.5	16.4	13.3	135.8	209.6	20.1	19.2	43.7	74.2	0.5	0.5
70-74	439.0	7.5	2.0	13.4	11.0	106.2	169.5	17.6	16.9	33.9	60.5	0.3	0.3
75-79	305.6	5.7	1.5	10.6	8.5	69.7	114.9	13.4	13.3	23.8	44.1	0.1	0.1
80-84	177.9	3.2	0.9	6.5	5.0	38.7	65.2	8.7	9.1	13.8	26.8	0.0	0.1
85-89	81.9	1.4	0.5	3.0	2.3	17.5	29.6	4.2	4.7	6.4	12.3	0.0	0.1
90+	33.7	0.5	0.2	1.1	0.9	7.2	11.8	1.8	2.1	3.1	5.0	0.0	0.0
Females	**15,286.9**	**282.3**	**69.4**	**481.2**	**385.1**	**3,762.7**	**5,771.4**	**577.4**	**515.2**	**1,414.5**	**1,979.7**	**15.3**	**32.5**
<1	177.2	2.8	0.8	5.1	3.9	40.5	67.8	7.6	6.5	18.6	22.6	0.2	0.7
1-4	756.8	11.8	3.4	21.3	17.3	177.0	289.9	31.9	27.7	77.5	95.2	1.0	2.8
5-9	999.9	17.2	4.8	30.5	23.9	231.2	379.2	40.6	38.8	104.7	123.9	1.1	3.9
10-14	991.8	20.3	4.9	31.5	25.3	223.9	370.3	39.5	40.4	105.3	126.1	1.2	3.1
15-19	986.8	21.5	5.0	31.5	25.4	244.9	355.9	38.8	37.2	99.3	123.8	1.1	2.6
20-24	1,002.4	21.4	4.7	32.1	27.2	238.2	370.6	38.9	34.5	99.2	131.8	1.1	2.7
25-29	1,092.6	21.6	4.8	33.5	28.0	247.3	425.5	39.8	32.0	107.7	148.2	1.2	3.1
30-34	1,266.2	23.0	5.5	38.5	30.9	303.2	496.7	44.3	37.1	119.4	162.9	1.5	3.1
35-39	1,341.3	23.8	5.6	42.0	32.3	333.4	507.4	46.6	40.9	131.0	173.7	1.7	2.9
40-44	1,234.9	23.6	5.0	38.8	31.4	312.7	456.6	43.4	38.0	118.8	162.7	1.5	2.3
45-49	1,087.8	21.5	4.7	34.7	28.3	279.7	406.6	37.8	31.0	95.6	144.9	1.4	1.6
50-54	895.0	17.1	3.9	28.6	22.4	241.2	333.9	31.1	25.2	74.3	115.3	0.9	1.1
55-59	695.3	12.3	3.0	22.2	17.2	185.6	263.0	24.8	21.5	55.7	89.0	0.4	0.8
60-64	616.2	10.4	2.9	19.6	15.0	161.6	236.7	22.1	20.1	49.3	77.4	0.4	0.7
65-69	596.4	9.5	2.5	18.5	15.2	158.2	228.4	22.3	20.3	45.5	75.2	0.3	0.5
70-74	547.1	8.4	2.3	17.0	14.0	140.0	212.3	21.9	19.7	39.5	71.4	0.2	0.3
75-79	437.4	7.3	2.2	15.3	11.8	108.1	163.7	19.2	17.9	32.1	59.4	0.1	0.2
80-84	298.7	4.9	1.7	10.9	8.1	72.4	109.2	14.1	13.8	22.0	41.5	0.1	0.1
85-89	169.7	2.6	1.0	6.2	4.8	41.2	62.5	8.0	8.2	12.1	23.0	0.0	0.0
90+	93.4	1.3	0.6	3.6	2.6	22.3	35.0	4.8	4.6	6.9	11.7	0.0	0.0

Source: *Demography Division, Population Estimates Section*
Note: *The population estimates are adjusted for net census undercoverage and include non-permanent residents.*

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