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Autumn 1999
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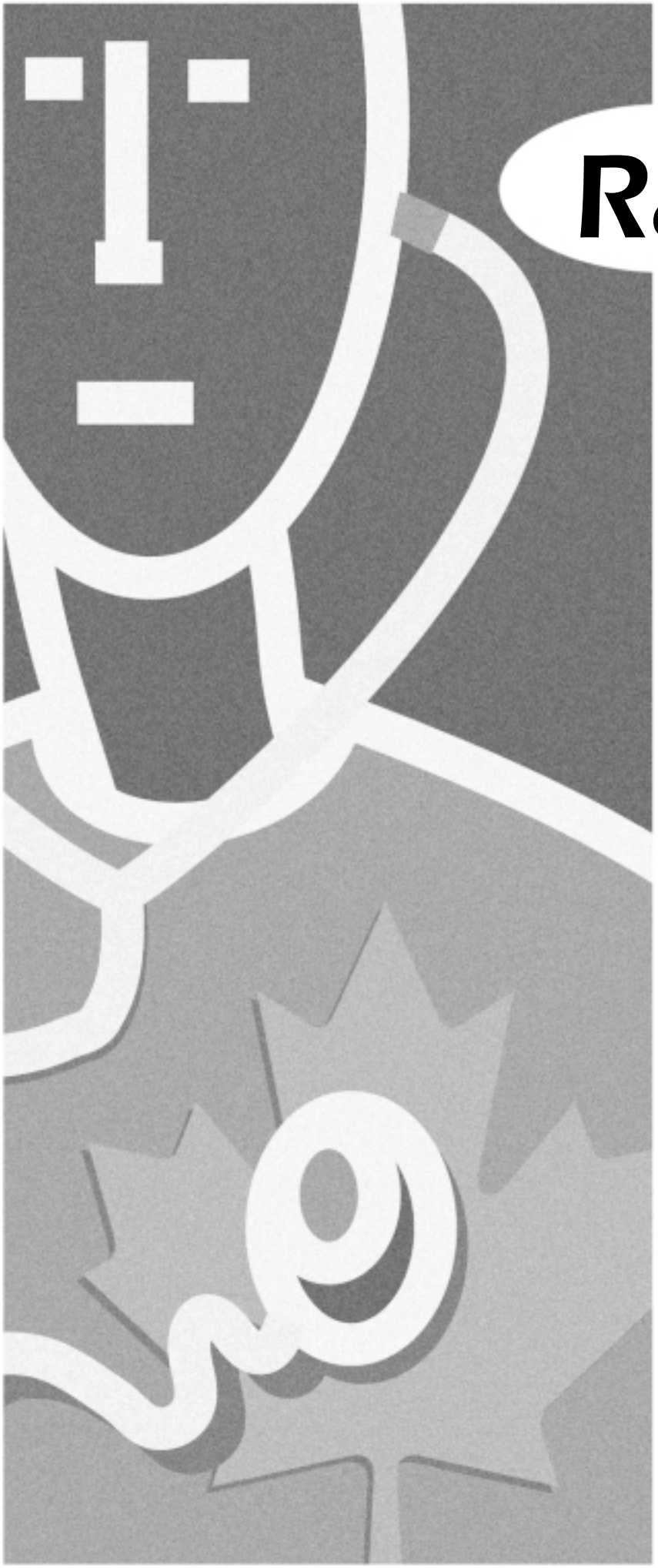

Research Articles

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

Changes in children's hospital use

Cathy Connors and Wayne J. Millar

Abstract

Objectives

This article examines changes in hospital separations of children aged 1 to 14 between 1986/87 and 1996/97. It focuses on four common causes of childhood hospitalization: asthma, chronic disease of tonsils and adenoids, fractures, and acute appendicitis.

Data sources

Hospital separation data are from the Hospital Morbidity File, from Statistics Canada for fiscal year 1986/87, and from the Canadian Institute for Health Information for fiscal year 1996/97.

Analytical techniques

Diagnoses were coded to the *International Classification of Diseases, Ninth Revision* and surgical procedures were coded to the *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures*. Population estimates for 1986 and 1996 were used to calculate hospital separation rates and surgical rates.

Main results

In 1986/87, there were 355,000 hospital separations of children aged 1 to 14; by 1996/97, the number of separations had fallen to just over 206,000. The hospital separation rate was 37.0 per 1,000 children in 1996/97, down from 69.7 ten years earlier. The average length of stay fell from 4.5 days to 3.8. The total annual number of days Canadian children stayed in hospital dropped from over 1.6 million to 788,700.

Key words

hospital separation records, hospital utilization, length of stay, pediatric hospitalization, surgical procedures

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Since the mid-1980s, there have been major changes in the delivery of health care in Canada. While every province has its own strategy for health care reform, most have started with hospital downsizing.[1-3] Hospital mergers and closures[4,5] have led to substantial reductions in the number of available beds.[1,3-9] Many conditions that would have previously justified hospital admission may now be managed partly or entirely on an outpatient basis or at home.[10] As a result, admission criteria have become more rigorous, thereby limiting inpatient services to the most seriously ill.[3] There has been a well-documented shift from inpatient to outpatient treatments,[4,8,9] most notably for surgical cases.[1,3,6,11-13] At the same time, the use of alternative care settings, such as community health care centres and home care programs, has increased.[7,14]

Recent trends in the hospitalization of children likely reflect not only the availability of hospital beds, but many other factors, such as the provision of ambulatory care services, improvements in medical technology, differences in the medical management of childhood illnesses, as well as changes in the incidence or prevalence of disease or changes in the natural history or severity of disease.

This article examines changes that have occurred in inpatient hospital use among children aged 1 to 14. Hospital records for 1986/87 and 1996/97 were used to compare hospital separation rates and average length of stay in the 10 provinces (see *Methods* and *Definitions*). The focus is on four common causes of childhood hospitalization: asthma, chronic disease of tonsils and adenoids, fractures, and acute appendicitis.

Provincial differences in hospital separation rates and average length of stay may be the result of many factors; for example, changes in the prevalence of childhood diseases, different start dates and approaches to restructuring, new or varying philosophies regarding the treatment of children, or the availability of clinical guidelines. However, it is beyond the scope of this study to explore or explain the reasons underlying observed differences between the provinces.

Methods

Data source

The data in this article are from the Hospital Morbidity File, from Statistics Canada for fiscal year 1986/87, and from the Canadian Institute for Health Information for fiscal year 1996/97. The information in this database comes from the admission/separation form completed by Canadian hospitals at the end of each patient's stay, when the patient is separated as a discharge or a death.

The File contains data on all inpatient cases that were separated from general and allied special hospitals (acute care, convalescent and chronic care hospitals) during the year. It includes information on patients treated in children's hospitals and in psychiatric units of general and allied special hospitals, but excludes outpatients and patients treated in psychiatric hospitals.

This article uses the hospital records for patients aged 1 to 14. Records for children younger than age 1 were excluded because of the unique conditions surrounding the hospitalization of this age group.

Adjusted population estimates for 1986 and 1996 are from Statistics Canada's Demography Division.[15]

Analytical techniques

Descriptive analyses present rates and percentages. Hospital separation rates were calculated by dividing the number of separations by the adjusted population estimate and multiplying by 1,000. Average length of stay was calculated by dividing the number of hospital days by the number of separations. Medical and surgical separations were analyzed separately (see *Definitions*).

Limitations

The Hospital Morbidity File for 1986/87 represented 93% of operating hospitals, or 1,134 out of 1,218.[16] Reporting hospitals accounted for more than 99% of all approved beds in Canada that year.[16] By the mid-1990s, the response rate was somewhat lower: over 80% of operating hospitals, which covered 90% of hospital beds.[17]

The information in this article is not entirely representative of the Canadian population: the Northwest and Yukon Territories were excluded because 1986/87 data were not available. However, the number of childhood hospital separations in the Territories is quite small and is not expected to substantially affect the results.

Since a patient may be admitted to and discharged from a hospital more than once in a given year, the data reflect the characteristics of cases, not individuals. It was not possible to determine the rate of hospital re-admission for this analysis.

During each hospital stay, a patient may receive more than one diagnosis or may undergo more than one surgical procedure. For this analysis, only the most serious diagnosis or procedure was considered. This could under-represent the frequency of less serious conditions or procedures.

Hospital records are based on fiscal years, but the population estimates used to calculate separation rates refer to a specific point in time during the calendar year. However, since the rate of population change in a single year is very small, any effect should be minimal and should not affect the validity of the results.

Causality cannot be determined from this type of analysis. The data analyzed here cannot be used to determine whether children have a greater or reduced health risk because of the changes in the delivery of hospital services. Many procedures that formerly required hospital admission are now performed on an outpatient basis. A more comprehensive picture of children's health care utilization would include data about outpatient services. Such information is not available in sufficient detail to permit analysis by age or by reason for treatment.

Hospitalization rate halved

In 1986/87, there were 355,000 hospital separations of Canadian children aged 1 to 14. By 1996/97, despite a 10% increase in the child population, the number of separations for this age group had fallen to just over 206,000 (data not shown). The hospitalization rate was almost halved, falling from 69.7 to 37.0 separations per 1,000 children (Table 1). Both medical and surgical hospitalization rates (see *Definitions*) decreased for children of all ages (Chart 1).

Children admitted to hospital in 1996/97 stayed, on average, about one-half day less than did those admitted in 1986/87 (3.8 versus 4.5 days). However, while the average length of stay for medical reasons fell by over one day, the average stay for surgical procedures actually increased slightly, by 0.2 days. This slight increase at the national level was largely the consequence of a substantial rise in the average length of surgical stays in Québec.

As a result of the declining hospitalization rate, the total number of days Canadian children spent

Table 1
Hospital separations, children aged 1 to 14, by province, 1986/87 and 1996/97

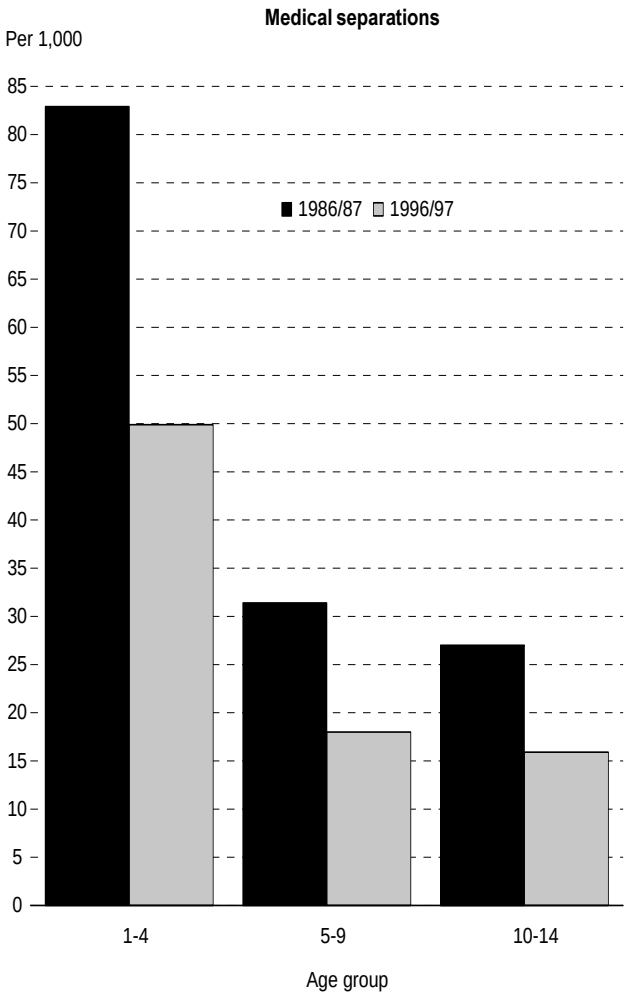
	Hospitalization rate (per 1,000)			Average length of stay (days)			Total number of days ('000)		
	1986/87	1996/97	% change†	1986/87	1996/97	Change‡	1986/87	1996/97	% change‡
Total									
Canada	**69.7**	**37.0**	**-46.9**	**4.5**	**3.8**	**-0.7**	**1,591.9**	**788.7**	**-50.5**
Newfoundland	79.8	50.6	-36.6	5.0	3.9	-1.1	55.7	20.8	-62.7
Prince Edward Island	100.2	54.2	-45.9	3.6	2.9	-0.8	10.0	4.3	-57.2
Nova Scotia	78.6	40.9	-48.0	4.9	4.3	-0.5	67.4	30.2	-55.3
New Brunswick	91.1	68.1	-25.2	4.3	3.0	-1.4	60.0	27.7	-53.9
Québec	48.2	36.3	-24.6	5.1	4.7	-0.4	315.4	221.6	-29.7
Ontario	70.8	32.0	-54.8	4.2	3.5	-0.7	526.1	232.5	-55.8
Manitoba	68.0	38.2	-43.8	4.5	4.1	-0.4	68.0	36.3	-46.7
Saskatchewan	121.5	62.3	-48.7	4.3	3.4	-1.0	120.8	45.7	-62.2
Alberta	90.2	37.7	-58.3	4.3	3.6	-0.7	206.0	79.4	-61.5
British Columbia	62.4	34.6	-44.6	4.6	3.7	-0.9	162.4	90.4	-44.3
Medical									
Canada	**44.6**	**26.3**	**-41.2**	**4.7**	**3.6**	**-1.1**	**1,070.9**	**530.5**	**-50.5**
Newfoundland	53.0	32.5	-38.6	4.9	4.3	-0.6	36.1	14.5	-59.8
Prince Edward Island	74.6	41.3	-44.7	3.7	3.1	-0.7	7.7	3.5	-54.7
Nova Scotia	54.1	25.6	-52.6	4.7	3.7	-1.0	45.1	16.1	-64.2
New Brunswick	66.0	49.9	-24.4	4.5	3.2	-1.4	45.6	21.5	-52.9
Québec	30.7	27.9	-8.9	5.1	3.9	-1.2	200.1	142.0	-29.0
Ontario	43.1	21.8	-49.4	4.5	3.3	-1.2	345.8	151.9	-56.1
Manitoba	45.4	27.1	-40.4	4.7	4.1	-0.6	47.6	25.7	-45.9
Saskatchewan	88.5	47.3	-46.5	4.6	3.4	-1.2	94.0	35.6	-62.1
Alberta	57.1	26.3	-54.0	4.6	3.6	-1.0	139.6	55.4	-60.3
British Columbia	38.5	23.7	-38.5	5.0	3.9	-1.2	109.3	64.3	-41.2
Surgical									
Canada	**25.1**	**10.7**	**-57.2**	**4.1**	**4.3**	**0.2**	**521.0**	**258.2**	**-50.4**
Newfoundland	26.8	18.1	-32.6	5.3	3.3	-1.9	19.6	6.3	-68.0
Prince Edward Island	25.7	13.0	-49.5	3.4	2.3	-1.1	2.4	0.8	-65.4
Nova Scotia	24.5	15.2	-37.8	5.2	5.4	0.2	22.3	14.0	-37.3
New Brunswick	25.1	18.3	-27.2	3.8	2.5	-1.3	14.4	6.2	-57.0
Québec	17.5	8.4	-52.0	5.2	7.3	2.1	115.3	79.6	-30.9
Ontario	27.6	10.2	-63.2	3.7	3.8	0.1	180.3	80.7	-55.3
Manitoba	22.6	11.1	-50.8	4.1	4.1	0.1	20.4	10.5	-48.3
Saskatchewan	33.0	15.0	-54.5	3.5	3.1	-0.5	26.8	10.0	-62.5
Alberta	33.1	11.4	-65.6	3.8	3.6	-0.2	66.5	24.0	-63.9
British Columbia	23.9	10.9	-54.5	3.9	3.4	-0.5	53.0	26.1	-50.8

Data source: *Hospital Morbidity File, 1986/87 and 1996/97*

† Based on unrounded rates. All differences between 1986/87 and 1996/97 are statistically significant ($p < 0.05$).

‡ Based on unrounded numbers.

Chart 1
Hospitalization rate, by type of separation and age group, Canada excluding territories, 1986/87 and 1996/97



***Data source**: Hospital Morbidity File, 1986/87 and 1996/97*

in hospital dropped sharply, from more than 1.6 million in 1986/97 to 788,700 in 1996/97. In both years, medical admissions represented just under two-thirds of these days.

Provincial declines

The child hospitalization rate fell in all provinces. However, the extent of the decline varied, from 25% in Québec and New Brunswick to 58% in Alberta. The drop in medical separation rates ranged from 9% in Québec to 54% in Alberta. The drop in surgical separation rates ranged from 27% in New Brunswick to 66% in Alberta.

By 1996/97, New Brunswick had the highest overall child hospitalization rate (68.1 separations per 1,000 children), followed by Saskatchewan (62.3). Ontario (32.0) and British Columbia (34.6) had the lowest.

It appears that hospitalization rates, both medical and surgical, are moving towards a common lower level. In 1996/97, rates for medical separations ranged from 21.8 per 1,000 children in Ontario to 49.9 in New Brunswick. For surgical separations, the range was from 8.4 per 1,000 children in Québec to 18.3 in New Brunswick.

The average length of stay in each province also tended to follow the national downturn. In 1996/97, all provinces had shortened stays for medical separations. But while some provinces had shorter average stays for surgical reasons, in others, the average actually rose. Most of these increases were slight (0.1 to 0.2 days), although in Québec, the average increased by 2.1 days.

By 1996/97, provincial differences in the average length of stay for medical reasons were relatively small. The average ranged from 3.1 days in Prince Edward Island to just over 4 days in Newfoundland and Manitoba. For surgical separations, average length of stay was comparatively short in Prince Edward Island and New Brunswick (2.3 and 2.5 days respectively), but much longer in Nova Scotia and Québec (5.4 and 7.3 days). The short stays in Prince Edward Island and New Brunswick may be the result of transferring some surgical cases to medical centres in Nova Scotia. The long average stay in Québec, where the surgical separation rate is very

low, may reflect a trend toward admitting only the most serious cases for surgery, while using outpatient surgical services for the less serious cases.

The top 10

The conditions that put children in hospital have changed very little over the past decade. In 1986/87, chronic disease of tonsils and adenoids had been the overall leading cause, followed by asthma (Table 2, Appendix Table A). Ten years later, the order was reversed, with asthma ranking first, and tonsils and adenoids second. In both years, fractures was third. For medical cases, asthma held first place in both years. Among surgical separations, operations on tonsils and adenoids, reduction of fracture and dislocation, and operations on appendix ranked first, second and third, respectively, in both years.

Asthma leading cause

In 1996/97, asthma accounted for 20,128 hospital separations of children aged 1 to 14, down from 28,888 a decade earlier (data not shown). Thus, despite the increasing prevalence of childhood asthma,[18] the hospitalization rate for this condition fell from 5.7 to 3.6 separations per 1,000 children (Table 3). Even so, by 1996/97, asthma had overtaken chronic disease of tonsils and adenoids as the overall leading cause of childhood hospitalization and remained the leading cause of medical separations. Over the decade, the average length of stay for asthma dropped from 3.6 to 2.3

Table 2
Hospital separations, by type, 10 leading causes, children aged 1 to 14, Canada excluding territories, 1986/87 and 1996/97

1986/87	Rank	1996/97
Total (ICD-9 code)		
Chronic disease of tonsils and adenoids (474)	1	Asthma (493)
Asthma (493)	2	Chronic disease of tonsils and adenoids (474)
Fractures (800-829)	3	Fractures (800-829)
Other noninfective gastroenteritis and colitis (558)	4	Other noninfective gastoenteritis and colitis (558)
General symptoms (780)	5	General symptoms (780)
Acute laryngitis and tracheitis (464)	6	Pneumonia, organism unspecified (486)
Pneumonia, organism unspecified (486)	7	Acute appendicitis (540)
Other symptoms involving abdomen and pelvis (789)	8	Acute bronchitis and bronchiolitis (466)
Acute bronchitis and bronchiolitis (466)	9	Acute laryngitis and tracheitis (464)
Acute upper respiratory infections of multiple or unspecified site (465)	10	Intestinal infections due to other organisms (008)
Medical (ICD-9 code)		
Asthma (493)	1	Asthma (493)
Other noninfective gastroenteritis and colitis (558)	2	Other noninfective gastroenteritis and colitis (558)
General symptoms (780)	3	General symptoms (780)
Acute laryngitis and tracheitis (464)	4	Pneumonia, organism unspecified (486)
Pneumonia, organism unspecified (486)	5	Acute bronchitis and bronchiolitis (466)
Other symptoms involving abdomen and pelvis (789)	6	Acute laryngitis and tracheitis (464)
Acute bronchitis and bronchiolitis (466)	7	Intestinal infections due to other organisms (008)
Acute upper respiratory infections of multiple or unspecified sites (465)	8	Other symptoms involving abdomen or pelvis (789)
Fractures (800-829)	9	Fractures (800-829)
Intracranial injury of other and unspecified nature (854)	10	Disorders of fluid, electrolyte and acid-base balance (276)
Surgical (CCP code)		
Operations on tonsils and adenoids (40)	1	Operations on tonsils and adenoids (40)
Reduction of fracture and dislocation (91)	2	Reduction of fracture and dislocation (91)
Operations on appendix (59)	3	Operations on appendix (59)
Other operations on middle and inner ear (32)	4	Operations on skin and subcutaneous tissue (98)
Operations on skin and subcutaneous tissue (98)	5	Operations on spinal cord and spinal canal structures (16)
Repair of hernia (65)	6	Operations on muscles, tendons, fascia, and bursa, except hand (95)
Operations on penis (76)	7	Incision, excision, and division of other bones (89)
Operations on testes (74)	8	Repair of hernia (65)
Operations on spinal cord and spinal canal structures (16)	9	Operations on testes (74)
Removal and restoration of teeth (35)	10	Other operations on middle and inner ear (32)

Data source: *Hospital Morbidity File, 1986/87 and 1996/97*

days. The declines in the number of hospital separations and in length of stay could be attributable to a combination of improved treatment of childhood asthma with medications and greater use of ambulatory care services.[18] The declining hospitalization rates and shorter stays resulted in a

Table 3
Hospital separations for four common causes, children aged 1 to 14, by province, 1986/87 and 1996/97

	Hospitalization rate (per 1,000)			Average length of stay (days)			Total number of days ('000)		
Cause (ICD-9 code)	1986/87	1996/97	% change†	1986/87	1996/97	Change‡	1986/87	1996/97	% change‡
Asthma (493)									
Canada	**5.7**	**3.6**	**-36.4**	**3.6**	**2.3**	**-1.3**	**105.1**	**47.2**	**-55.1**
Newfoundland	4.7	3.5	-26.9	3.8	2.5	-1.3	2.5	0.9	-64.0
Prince Edward Island	9.6	9.2	-4.7	4.0	3.2	-0.8	1.1	0.8	-23.5
Nova Scotia	6.9	4.8	-30.4	4.0	2.8	-1.2	4.9	2.3	-53.5
New Brunswick	6.4	5.4	-14.7	4.7	2.9	-1.8	4.6	2.2	-52.1
Québec	5.4	4.2	-21.6	3.4	2.3	-1.1	23.2	12.5	-46.4
Ontario	6.3	3.3	-47.8	3.7	2.2	-1.5	41.6	15.4	-63.0
Manitoba	3.9	3.0	-22.3	3.0	2.6	-0.4	2.6	1.8	-29.7
Saskatchewan	6.3	4.8	-22.7	3.9	2.8	-1.1	5.7	3.0	-47.2
Alberta	6.2	3.4	-45.6	3.8	2.3	-1.5	12.4	4.6	-63.2
British Columbia	3.7	2.5	-30.8	3.2	2.2	-1.0	6.5	3.9	-41.1
Chronic disease of tonsils and adenoids (474)									
Canada	**8.5**	**2.3**	**-73.2**	**1.7**	**1.1**	**-0.6**	**75.1**	**14.5**	**-80.7**
Newfoundland	7.0	8.5	20.6	2.8	1.1	-1.7	2.8	1.0	-64.6
Prince Edward Island	10.9	6.7	-38.7	2.8	1.3	-1.5	0.8	0.2	-72.5
Nova Scotia	5.9	4.5	-24.3	1.7	1.4	-0.4	1.8	1.0	-41.8
New Brunswick	9.3	8.5	-8.9	2.0	1.1	-0.9	2.8	1.2	-56.1
Québec	3.8	0.4	-88.4	1.4	1.5	0.1	6.8	0.9	-87.2
Ontario	11.5	2.0	-82.5	1.6	1.1	-0.5	32.7	4.7	-85.7
Manitoba	8.0	2.7	-66.6	2.0	1.2	-0.8	3.5	0.7	-79.3
Saskatchewan	11.6	4.7	-59.6	2.1	1.1	-0.9	5.6	1.2	-79.1
Alberta	10.3	2.6	-75.2	1.9	1.1	-0.8	10.6	1.7	-84.3
British Columbia	7.7	2.5	-67.7	1.8	1.1	-0.7	7.7	1.9	-75.4
Fractures (800-829)									
Canada	**3.4**	**2.1**	**-36.4**	**5.7**	**3.7**	**-2.0**	**98.5**	**44.1**	**-55.2**
Newfoundland	4.3	2.6	-39.9	6.2	4.3	-1.9	3.7	1.2	-68.7
Prince Edward Island	2.5	2.1	-14.3	4.2	3.6	-0.6	0.3	0.2	-27.1
Nova Scotia	2.7	1.9	-29.5	5.7	4.0	-1.7	2.8	1.3	-52.0
New Brunswick	3.5	2.8	-20.0	5.7	3.5	-2.2	3.1	1.4	-56.2
Québec	2.2	1.8	-17.8	6.4	4.8	-1.5	18.3	11.6	-36.7
Ontario	3.1	1.8	-41.0	5.3	3.4	-1.9	29.1	13.1	-55.0
Manitoba	4.0	2.5	-37.7	12.4	4.8	-7.6	10.9	2.7	-75.2
Saskatchewan	4.9	3.3	-31.7	5.0	3.6	-1.5	5.6	2.6	-54.2
Alberta	4.8	2.3	-52.5	5.1	3.2	-1.9	13.0	4.3	-67.2
British Columbia	4.6	2.9	-36.6	4.5	2.8	-1.7	11.8	5.9	-50.2
Acute appendicitis (540)									
Canada	**1.3**	**1.0**	**-22.7**	**4.9**	**3.7**	**-1.2**	**31.5**	**20.0**	**-36.5**
Newfoundland	2.2	1.1	-48.6	4.6	3.8	-0.8	1.4	0.4	-68.6
Prince Edward Island	1.6	0.7	-55.7	5.0	3.2	-1.8	0.2	0.1	-71.8
Nova Scotia	1.6	1.1	-34.7	4.6	4.0	-0.6	1.3	0.7	-45.5
New Brunswick	1.5	1.0	-32.8	5.1	3.7	-1.4	1.2	0.5	-56.5
Québec	1.1	1.2	2.6	5.0	3.8	-1.2	7.2	5.7	-20.0
Ontario	1.1	0.8	-30.2	5.0	3.6	-1.4	10.1	5.9	-41.1
Manitoba	1.3	1.1	-19.4	5.1	4.3	-0.7	1.5	1.1	-28.5
Saskatchewan	1.4	1.0	-22.5	5.1	3.9	-1.3	1.6	0.9	-44.7
Alberta	1.4	1.1	-24.0	5.0	3.4	-1.6	3.7	2.1	-42.3
British Columbia	1.4	1.0	-24.6	4.5	3.5	-0.9	3.4	2.6	-25.2

Data source: *Hospital Morbidity File, 1986/87 and 1996/97*
† Based on unrounded rates. All differences between 1986/87 and 1996/97 are statistically significant ($p < 0.05$).
‡ Based on unrounded numbers.

55% decrease in the total number of days children spent in hospital for asthma treatment between 1986/87 and 1996/97.

Child hospitalization rates for asthma fell in all provinces. However, the percentage decline ranged from a minimal 5% in Prince Edward Island to 48% in Ontario.

Provincial hospitalization rates reflected the regional patterns of asthma prevalence noted in an earlier study.[18] Prince Edward Island had the highest rates in both 1986/87 and 1996/97, while British Columbia had the lowest. In 1996/97, Prince Edward Island's rate was 9.2 per 1,000 children, more than three times the rate in British Columbia (2.5). If the unusually high rate in Prince Edward Island were excluded, provincial rates would have been more similar in 1996/97 than they had been 10 years earlier.

The average length of stay for asthma also declined in all provinces. As well, in 1996/97, the range in average stays for asthma was narrower than in 1986/87. In 1996/97, Prince Edward Island had the longest average stay (3.2 days); the shortest stays were in Ontario and British Columbia (2.2 days).

Sharp drop for tonsils and adenoids

Chronic disease of tonsils and adenoids (medical and surgical combined) had been the leading overall cause of hospitalization of children in 1986/87. However, in the next decade, the number of separations for this condition fell dramatically, from 43,213 to 12,680 (data not shown).

In fact, of the 10 leading causes of child hospitalization, chronic disease of tonsils and adenoids showed the largest decrease in rates over the decade. The national rate fell from 8.5 to 2.3 separations per 1,000 children. The main reason for this decline seems to be a shift from inpatient to day surgery procedures.[12,13] For instance, it is estimated that in Ontario over half of all operations on tonsils and adenoids are now performed on an outpatient basis.[13] Improvements in anaesthetics for children may contribute to even more acceptance of such procedures.[13] And for those children who were admitted to hospital for tonsils and adenoids, the average length of stay fell from 1.7 to 1.1 days.

Definitions

Hospital refers to general and allied special hospitals, including acute care, convalescent, and chronic care hospitals. It includes patients treated in children's hospitals and in psychiatric units of general and allied special hospitals, but excludes outpatients and patients treated in psychiatric hospitals.

Separation refers to the discharge or death of an inpatient. *Medical separations* are those that did not involve a surgical procedure during the hospital stay. *Surgical separations* represent information on patients who underwent a surgical procedure during a hospital stay.

The medical diagnoses used in the tabulations were based on the most serious condition that caused the hospital stay, or the condition that required the greatest amount of medical resources. The medical conditions used for this article are coded to the three-digit level of the *International Classification of Diseases, Ninth Revision (ICD-9)*:[19] Intestinal infections due to other organisms (008), Disorders of fluid, electrolyte and acid-base balance (276), Acute laryngitis and tracheitis (464), Acute upper respiratory infections of multiple or unspecified site (465), Acute bronchitis and bronchiolitis (466), Chronic disease of tonsils and adenoids (474), Pneumonia, organism unspecified (486), Asthma (493), Acute appendicitis (540), Other noninfective gastroenteritis and colitis (558), General symptoms (780), Other symptoms involving abdomen and pelvis (789), Fractures (800-829), and Intracranial injury of other and unspecified nature (854).

The surgical procedures in the tabulations were based on the most serious procedure. Those used for this analysis were coded to the two-digit level of the *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures (CCP)*:[20] Operations on spinal cord and spinal canal structures (16), Other operations on middle and inner ear (32), Removal and restoration of teeth (35), Operations on tonsils and adenoids (40), Operations on appendix (59), Repair of hernia (65), Operations on testes (74), Operations on penis (76), Incision, excision, and division of other bones (89), Reduction of fracture and dislocation (91), Operations on muscles, tendons, fascia, and bursa, except hand (95), and Operations on skin and subcutaneous tissue (98).

Hospital records that did not have a CCP code of 14 or over were considered to be medical; those with a CCP code of 14 or over were considered to be surgical.

For the analysis of leading causes, conditions were considered regardless of whether a surgical procedure was performed, thereby combining medical and surgical separations.

The sharp drops in the hospitalization rate and length of stay resulted in an 81% decline in the number of days children spent in hospital because of tonsils and adenoids between 1986/87 and 1996/97.

Hospitalization rates for tonsils and adenoids decreased in all provinces except Newfoundland, where the rate rose from 7.0 to 8.5 separations per 1,000 children. By 1996/97, Newfoundland and New Brunswick had the highest rates (8.5 per 1,000 children). Québec had the lowest, recording only 0.4 separations per 1,000 children that year. Not only did hospitalization rates show substantial differences between provinces, but such differences increased slightly during the 10-year period.

Between 1986/87 and 1996/97, the average length of hospital stay for tonsils and adenoids fell in all provinces except Québec, where there was virtually no change. Provincial differences in average stays narrowed during this period so that by 1996/97, there was little difference between the provinces. That year, Québec had the longest average stay, at 1.5 days. In Newfoundland, New Brunswick, Ontario, Saskatchewan, Alberta and British Columbia, the average was 1.1 days.

Hospitalization rates down for fractures

In 1996/97, almost 12,000 separations of children aged 1 to 14 were attributable to fractures (medical and surgical combined), down considerably from 17,170 in 1986/87 (data not shown). While fractures were the third leading cause of child hospitalization in both years, there was a substantial reduction in the hospitalization rate during the period, from 3.4 to 2.1 separations per 1,000 children. As well, the average length of stay fell from 5.7 to 3.7 days.

The reduction in the hospitalization rate and length of stay may reflect a trend toward treating less serious fractures on an outpatient basis. However, there may also be a drop in the incidence of fractures among children, attributable to greater use of and improvements in the design of safety equipment for sports and recreational activities.[21-23] Motor vehicle accidents tend to result in more serious fractures, so an additional factor in lower hospitalization rates may be fewer motor vehicle injuries. Between 1988 and 1992, motor vehicle injuries among children declined 25%.[24]

The decline in the hospitalization rate, together with the drop in the average length of stay, produced a 55% decrease in the total number of days that children spent in hospital for fractures.

Hospitalization rates were down in all provinces, with declines ranging from 14% in Prince Edward Island to 53% in Alberta. In 1996/97, Saskatchewan had the highest rate (3.3 separations per 1,000 children); Québec and Ontario, the lowest (1.8).

While the average length of stay for fractures decreased in all provinces, the drop was particularly pronounced in Manitoba (7.6 days). Even so, Manitoba still tied with Québec for the longest average stay in 1996/97. Children in these two provinces averaged 4.8 days per visit for fractures. The shortest average stay was 2.8 days in British Columbia.

Acute appendicitis now in top 10

Acute appendicitis (medical and surgical combined) was not among the 10 leading causes of child hospitalization in 1986/87, but by 1996/97, it ranked seventh. Nonetheless, in 1996/97, there were fewer separations of children for acute appendicitis (5,450) than there had been in 1986/87 (6,431) (data not shown). The hospitalization rate fell slightly over the decade, from 1.3 to 1.0 separations per 1,000 children, and the average length of stay dropped from 4.9 to 3.7 days.

Some researchers have attributed the lower hospitalization rate to a decline in the incidence of appendicitis as a result of changes in dietary habits, with the young preferentially affected.[25] However, it has also been argued that the decline may reflect an increase in surgical conservatism.[25] That is, the severity of appendicitis is variable, and some cases resolve spontaneously without rupture. Improved diagnostic techniques may also have contributed to lower hospitalization rates.

The drop of more than one day in average length of stay and the decline in the hospitalization rate

meant that the total number of days children spent in hospital for acute appendicitis fell by 37% between 1986/87 and 1996/97.

The hospitalization rate decreased in all provinces except Québec, where there was a small increase. Consequently, by 1996/97, Québec's rate was the highest (1.2 separations per 1,000 children). The lowest rates were in Prince Edward Island (0.7) and Ontario (0.8).

The average length of stay for acute appendicitis also fell in all provinces over the 10-year period. By 1996/97, Manitoba had the longest average stay (4.3 days), and Alberta (3.4) and Prince Edward Island (3.2), the shortest.

Concluding remarks

Between 1986/87 and 1996/97, all provinces experienced a sharp drop in child hospitalization rates and a trend toward shorter stays overall and for the four causes examined in this article: asthma, tonsils and adenoids, fractures, and acute appendicitis. These declines may reflect the growing tendency to hospitalize only the most serious cases.

While there has been a narrowing of provincial differences in patterns of hospital use, variations persist. These variations may partly reflect the pace of health care reform, which began at different times and proceeded at a different rate in each province.

Provincial variations may also result from the extent to which ambulatory care and day surgery are used. The hospital bed supply and the availability of alternative care may differ greatly from province to province. As well, there may be provincial differences in hospital re-admission rates, which cannot be determined with the data used in this analysis.

To get a complete picture of hospital use, it would be necessary to look at changes in the use of outpatient services. An earlier study of all age groups found that between 1986/87 and 1993/94, total inpatient days decreased by 17%, but total outpatient hospital visits increased by 15%.[9] A Winnipeg study found that when inpatients and outpatients were considered together, hospitals in that city treated just as many residents in 1997/98 as they had before downsizing.[6]

The decline in inpatient hospital use does not necessarily indicate lower pediatric health care costs. Nonetheless, between 1991/92 and 1994/95, annual operating expenses for Canadian hospitals showed an average decline of 2.4%.[9]

However, greater use of outpatient services may actually increase costs for individuals. For example, the cost of prescription medications, which would be borne by the hospital if the child were admitted, is passed on to the family. Since lower income households are less likely to be covered by prescription drug insurance,[26] and members of such households use proportionally more hospital services,[1,3,6,11,27] the shift toward outpatient care may have a greater economic impact on such households.

As well, families increasingly face the necessity of caring for their sick children at home and so may need to make costly alternative care arrangements. This can be particularly difficult for dual-earner or lone-parent families.

It may, however, be in a child's best interest to be admitted to hospital only when absolutely necessary, to reduce trauma and family disruption. Additional health risks, such as infection, may also be reduced if a child is cared for at home.

Hospital statistics are only part of the total health care picture. More information on related areas, such as the use of day surgery and ambulatory care, could place hospital utilization patterns in sharper focus. ●

References

1 Roos NP, Brownell M, Shapiro E. Good news about difficult decisions: The Canadian approach to hospital cost control. *Health Affairs* 1998; 17(5): 239-46.

2 Shamian J, Lightstone EY. Hospital restructuring initiatives in Canada. *Medical Care* 1997; 35(10): OS62-9.

3 Roos NP, Shapiro E. Using the information system to assess change: The impact of downsizing the acute sector. *Medical Care* 1995; 33(12): DS109-26.

4 Burke M, Stevenson HM. Fiscal crisis and restructuring in medicare: The politics of health in Canada. In: Coburn D, D'Arcy C, Torrance G, eds. *Health and Canadian Society: Sociological Perspectives*, 3rd ed. Toronto: University of Toronto Press, 1998: 597-618.

5 Decter MB. Canadian hospitals in transformation. *Medical Care* 1997; 35(10): OS70-5.

6 Brownell M, Hamilton C. *Winnipeg Hospital Bed Closures: Problem or Progress?* Winnipeg, Manitoba: The Manitoba Centre for Health Policy and Evaluation, 1999.

7 Reamy J. Health service regionalization in New Brunswick, Canada: A bold move. *International Journal of Health Services* 1995; 25(2): 271-82.

8 Sochalski J, Aiken LH, Fagin CM. Hospital restructuring in the United States, Canada, and Western Europe. An outcomes research agenda. *Medical Care* 1997; 35(10): OS13-25.

9 Tully P, Saint-Pierre E. Downsizing Canada's hospitals, 1986/87 to 1994/95. *Health Reports* (Statistics Canada, Catalogue 82-003) 1997; 8(4): 33-9.

10 Dougherty G. When should a child be in the hospital? A. Frederick North, Jr, MD, Revisited. *Pediatrics* 1998; 101(1): 19-24.

11 Anderson GM. Hospital restructuring and the epidemiology of hospital utilization: Recent experience in Ontario. *Medical Care* 1997; 35(10): OS93-101.

12 To T, Feldman W, Dick PT, et al. Pediatric health service utilization: Hospitalization among children in Ontario. In: Goel V, Williams IJ, Anderson GM, et al., eds. *Patterns of Health Care in Ontario*, 2nd ed. Ottawa: Canadian Medical Association, 1996: 290-2.

13 To T, Feldman W, Dick PT, et al. Pediatric health service utilization: Tonsil and adenoid surgery. In: Goel V, Williams IJ, Anderson GM, et al., eds. *Patterns of Health Care in Ontario*, 2nd ed. Ottawa: Canadian Medical Association, 1996: 300-6.

14 Shah CP. *Public Health and Preventive Medicine in Canada*, 4th ed. Toronto: University of Toronto Press, 1998.

15 Statistics Canada. *Annual Demographic Statistics, 1998* (Catalogue 91-213-XPB) Ottawa: Minister of Industry, 1999.

16 Statistics Canada. *Hospital Statistics: Preliminary Annual Report, 1986/87* (Catalogue 83-217) Ottawa: Minister of Supply and Services Canada, 1988.

17 Statistics Canada. *Hospital Statistics: Preliminary Annual Report, 1994/95* (Catalogue 83-241-XPB) Ottawa: Minister of Industry, 1996.

18 Millar WJ, Hill GB. Childhood asthma. *Health Reports* (Statistics Canada, Catalogue 82-003) 1998; 10(3): 9-21.

19 World Health Organization. *Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, Volume 1*. Based on the Recommendations of the Ninth Revision Conference, 1975. Geneva: World Health Organization, 1977.

20 Statistics Canada. *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures* (Catalogue 82-562E) Ottawa: Minister of Industry, Science and Technology, 1993.

21 Goulet C, Regnier G. Other sports and recreation activity injuries. In: Beaulne G, ed. *For the Safety of Canadian Children and Youth* (Catalogue H39-412/1997E) Ottawa: Minister of Public Works and Government Services Canada, 1997: 220-30.

22 Janda DH, Wojtys EM, Hankin FM, et al. A three-phase analysis of the prevention of recreational softball injuries. *The American Journal of Sports Medicine* 1990; 18(6): 632-5.

23 Millar WJ, Pless IB. Factors associated with bicycle helmet use. *Health Reports* (Statistics Canada, Catalogue 82-003-XPB) 1997; 9(2): 31-9.

24 Choinière R, Doval D. General profile of injuries related to motor vehicles and other road vehicles. In: Beaulne G, ed. *For the Safety of Canadian Children and Youth* (Health Canada, Catalogue H39-412/1997E) Ottawa: Minister of Public Works and Government Services Canada: 57-62.

25 Naylor CD, DeBoer DP, Hernandez RP. Primary and incidental appendectomy. In: Goel V, Williams JI, Anderson GM, et al., eds., *Patterns of Health Care in Ontario. The ICES Practice Atlas,* 2nd Edition. Ottawa: Canadian Medical Association, 1996: 70-9.

26 Millar WJ. Disparities in prescription drug insurance coverage. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 11-31.

27 Roos NP, Mustard CA. Variation in health and health care use by socioeconomic status in Winnipeg, Canada: Does the system work well? Yes and no. *The Milbank Quarterly* 1997; 75(1): 89-111.

Appendix

Table A

Hospital separations for 10 leading causes, children aged 1 to 14, Canada excluding territories, 1986/87 and 1996/97

	Hospitalization rate (per 1,000)			Average length of stay (days)			Total number of days ('000)		
Leading causes in 1996/97	**1986/87**	**1996/97**	**% change†**	**1986/87**	**1996/97**	**Change‡**	**1986/87**	**1996/97**	**% change‡**
Total (ICD-9 code)	**69.7**	**37.0**	**-46.9**	**4.5**	**3.8**	**-0.7**	**1,591.9**	**788.7**	**-50.5**
Asthma (493)	5.7	3.6	-36.4	3.6	2.3	-1.3	105.1	47.2	-55.1
Chronic disease of tonsils and adenoids (474)	8.5	2.3	-73.2	1.7	1.1	-0.6	75.1	14.5	-80.7
Fractures (800-829)	3.4	2.1	-36.4	5.7	3.7	-2.0	98.5	44.1	-55.2
Other noninfective gastroenteritis and colitis (558)	2.6	1.7	-37.4	3.3	2.1	-1.2	43.9	19.0	-56.7
General symptoms (780)	2.5	1.5	-42.0	3.2	2.2	-1.0	40.4	17.4	-56.9
Pneumonia, organism unspecified (486)	1.7	1.3	-20.6	5.0	3.4	-1.7	43.0	25.1	-41.7
Acute appendicitis (540)	1.3	1.0	-22.7	4.9	3.7	-1.2	31.5	20.0	-36.5
Acute bronchitis and bronchiolitis (466)	1.5	0.8	-44.1	4.2	2.8	-1.4	31.7	13.0	-58.9
Acute laryngitis and tracheitis (464)	1.9	0.8	-57.4	2.5	1.5	-1.0	24.1	6.9	-71.4
Intestinal infections due to other organisms (008)	0.8	0.8	-7.6	3.2	2.4	-0.8	13.1	10.0	-24.2
Total medical (ICD-9 code)	**44.6**	**26.3**	**-41.2**	**4.7**	**3.6**	**-1.1**	**1,070.9**	**530.5**	**-50.5**
Asthma (493)	5.7	3.6	-36.3	3.6	2.3	-1.3	104.4	47.0	-55.0
Other noninfective gastroenteritis and colitis (558)	2.6	1.6	-37.2	3.2	2.0	-1.2	42.6	18.5	-56.6
General symptoms (780)	2.4	1.4	-41.6	3.1	2.1	-1.0	37.1	16.1	-56.6
Pneumonia, organism unspecified (486)	1.7	1.3	-20.4	5.0	3.3	-1.7	41.7	24.2	-41.9
Acute bronchitis and bronchiolitis (466)	1.5	0.8	-44.1	4.2	2.8	-1.4	31.5	12.9	-59.0
Acute laryngitis and tracheitis (464)	1.9	0.8	-57.3	2.5	1.5	-1.0	23.9	6.8	-71.4
Intestinal infections due to other organisms (008)	0.8	0.7	-7.6	3.1	2.3	-0.8	12.8	9.5	-26.0
Other symptoms involving abdomen and pelvis (789)	1.5	0.6	-58.4	2.5	1.9	-0.6	19.0	6.7	-64.9
Fractures (800-829)	1.0	0.5	-51.3	8.1	6.1	-2.1	40.4	16.1	-60.1
Disorders of fluid, electrolyte and acid-base balance (276)	0.1	0.5	558.7	5.1	2.2	-2.8	1.8	5.8	218.3
Total surgical (CCP code)	**25.1**	**10.7**	**-57.2**	**4.1**	**4.3**	**0.2**	**521.0**	**258.2**	**-50.4**
Operations on tonsils and adenoids (40)	8.8	2.5	-71.9	1.8	1.4	-0.4	82.1	19.9	-75.8
Reduction of fracture and dislocation (91)	2.3	1.6	-29.1	4.5	2.8	-1.7	53.0	25.3	-52.4
Operations on appendix (59)	1.5	1.1	-27.3	4.9	3.7	-1.2	37.1	22.1	-40.4
Operations on skin and subcutaneous tissue (98)	1.1	0.5	-52.0	6.5	8.1	1.7	35.3	23.5	-33.5
Operations on spinal cord and spinal canal structures (16)	0.5	0.3	-37.8	5.8	5.5	-0.3	15.4	9.9	-35.3
Operations on muscles, tendons, fascia, and bursa, except hand (95)	0.5	0.3	-48.4	5.7	3.5	-2.2	14.9	4.9	-66.8
Incision, excision, and division of other bones (89)	0.4	0.3	-42.7	6.5	4.4	-2.2	14.6	6.1	-58.1
Repair of hernia (65)	1.0	0.2	-80.7	2.9	4.3	1.4	14.9	4.7	-68.5
Operations on testes (74)	0.6	0.2	-68.2	2.8	1.3	-1.5	8.7	1.4	-84.0
Other operations on middle and inner ear (32)	1.2	0.2	-84.6	2.1	2.4	0.2	13.0	2.4	-81.5

Data source: *Hospital Morbidity File, 1986/87 and 1996/97*

† Based on unrounded rates. All differences between 1986/87 and 1996/97 are statistically significant ($p < 0.05$).

‡ Based on unrounded numbers.

The health of lone mothers

Claudio Pérez and Marie P. Beaudet

Abstract

Objectives

This article focuses on differences in the health status and health care utilization patterns of mothers in two-parent families, women who recently became lone parents, and women who had been lone parents for a longer period. Changes in the health of these women and their health care use over time are also explored.

Data source

The findings are based on the longitudinal component of the first two cycles (1994/95 and 1996/97) of the National Population Health Survey (NPHS). The sample analyzed consisted of 1,805 women in the 10 provinces who had at least one child younger than 18 at home.

Analytical techniques

Measures of self-reported health status and health care use for the three types of mothers were compared, using unadjusted and adjusted means. Multiple regression models were used to determine if lone motherhood was significantly associated with measures of health status and health care utilization after accounting for selected factors.

Main results

Lone mothers generally had poorer health status than mothers in two-parent families, as measured by self-reported health, happiness, and distress scores. Between the first two cycles of the NPHS, the health status of longer-term lone mothers did not improve significantly. No differences were found on measures of health care utilization.

Key words

single parent, longitudinal studies, self-perceived health, health care utilization, happiness, distress

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The number of lone-parent families in Canada has risen steadily in past decades. In 1995, lone-parent families numbered over 1.1 million, an increase of 60% from 1981[1]. Women headed the vast majority of these families.

Even if the transition to lone parenthood is a choice, it can be stressful.[2-8] Depending on their path to lone parenthood, lone mothers may feel pressure brought on not only by the loss of a partner, but also by changes such as a move, a decrease in financial and emotional support, the loss of a job or the start of a new one, and perhaps even the departure of one or more children from the household.

The advent of one or more of these stressful circumstances can affect physical and psychological health, and may result in increased health care utilization. It is expected, therefore, that when they become lone parents, such women will not be as healthy as those who live with a partner.

The health status of longer-term lone mothers is more difficult to anticipate. Over time, lone mothers may learn to cope, their health may improve, and their use of health

services may decrease. Some studies have reported that after a two- or three-year adjustment period, the health of many lone mothers recovers to levels comparable with mothers in two-parent families.[11,12]

But it can also be argued that prolonged exposure to the difficult circumstances typical of lone

Methods

Data source

This article is based on Statistics Canada's National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, Canadian Forces bases, and in some remote areas. The NPHS has a longitudinal and a cross-sectional component. Respondents in the longitudinal component will be followed for up to 20 years.

NPHS data consist of socio-demographic and some health information obtained for each member of participating households. These data are found in the General file. In addition, in-depth health information was collected for one randomly selected household member. The in-depth health information, as well as the information in the General file pertaining to that individual, is found in the Health file.

Among individuals in the longitudinal component in 1996/97, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for the household in cycle 1 (1994/95) and was usually the person who provided information on all household members for the General file in cycle 2.

The 1994/95 provincial, non-institutional sample consisted of 27,263 households, of which 88.7% agreed to participate in the survey. After the application of a screening rule, 20,725 households remained in scope. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents. Of these 17,626 randomly selected respondents, 14,786 were eligible members of the NPHS longitudinal panel, along with 468 persons for whom only general information was collected. And 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible. Thus, 17,276 respondents were eligible for re-interview in 1996/97.

A response rate of 93.6% was achieved for the longitudinal panel in 1996/97. Of these 16,168 respondents, 15,670 provided full information; that is, general and in-depth health information for both cycles of the survey. More detailed descriptions of the NPHS design, sample, and interview procedures can be found in published reports.[9,10]

This analysis is based on longitudinal data from the household component of the 1994/95 and 1996/97 cycles of the NPHS for the 10 provinces. It focusses on 1,805 women who, in 1996/97, had at least one child younger than 18 at home and who were living with a partner or who were lone parents: 1,374 women in two-parent families, 367 longer-term lone mothers, and 64 new lone mothers (see *Definitions*).

Analytical techniques

Average scores for self-perceived health, happiness and distress and for average number of consultations with selected health care professionals were estimated and compared for mothers living with a partner and all lone mothers. Averages were also calculated and compared between these two groups after controlling for their 1994/95 health status or health care utilization scores on the respective indicators (Tables 1 and 3).

Repeated measures analysis of variance was used to compare self-perceived health status and health care utilization among mothers in two-parent households, new lone mothers, and longer-term lone mothers (Tables 2 and 4). This approach uses the individual as her own control.

Multiple linear regression was used to examine whether lone motherhood was significantly associated with selected health status and health care use measures, after accounting for other factors believed to be associated with these variables.

Data were weighted to represent the target population in 1994/95, the first cycle of NPHS data collection. The significance level was set at $p = 0.05$. The bootstrap technique was used to account for the design effect of the survey in variance estimations and significance tests.[13,14] When pairwise comparisons of means were performed for more than two categories (Tables 2, 4 and 5), the significance level was adjusted to take into account multiple comparisons.

Distributions of the number of consultations with health care professionals are often not normal. They tend to peak at zero and to be positively skewed. With this type of distribution, the mean is a poor indicator of central tendency, so results from the multivariate analysis may be distorted. A common approach to correct this problem is to add 1 to the values when the distribution includes zero and transform these to the natural log. However, results based on scores that were transformed to their natural log equivalent are difficult to conceptualize. In the case of consultations about emotional or mental health, where the distribution was positively skewed, the two extreme values were capped at the next-highest score. Multiple linear regression analysis with the recoded values and with scores that were transformed to their natural log equivalent yielded similar results.

parenthood may threaten health and increase the use of health services. Therefore, it is expected that the health of women who have been lone parents for a longer time will differ from that of women who live with a partner or who have recently become lone parents. It is unclear, though, which group of lone parents will be in relatively better or worse health and which will use health care services more frequently.

Many studies have reported overall poorer levels of mental or physical health and higher levels of health care utilization among lone mothers than among women who live with a partner.[4,6,8,15-20] However, relatively little research has traced changes in the health of lone mothers over time. Longitudinal data from cycles 1 (1994/95) and 2 (1996/97) of the National Population Health Survey (NPHS) offer an opportunity to examine such changes and to explore some of the factors associated with them (see *Methods* and *Limitations*).

Lone mothers less healthy

In 1996/97, lone mothers did not rate their overall health as favourably as did mothers in two-parent families (Table 1) (see *Health characteristics*). It has been suggested that some less healthy women "select" themselves into lone parenthood, since their poorer health could strain their relationships.[16,19] To partially account for this possibility, 1996/97 health ratings were compared after they were adjusted for the women's 1994/95 standing.

Table 1
Mothers' average scores on selected health status indicators, by family type, Canada excluding territories, 1996/97

	Mothers in two-parent families (T)	All lone mothers (A)	Significant differences
Self-perceived health	7.35	6.57	T>A*
Adjusted for 1994/95 score	7.27	6.79	T>A*
Happiness	9.62	8.94	T>A*
Adjusted for 1994/95 score	9.56	9.11	T>A*
Distress	1.11	1.93	T<A*
Adjusted for 1994/95 score	1.20	1.65	T<A*

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Note**: All variables were coded from low to high and rescaled from 0 to 10.*
** p = 0.05, two-tailed test*

Even when lone mothers' 1994/95 self-perceived health scores were taken into account, their average rating in 1996/97 was lower than that of mothers

Limitations

To ensure that new lone mothers were not new to parenting, but in fact, new to *lone* parenting, only respondents who were mothers in both cycles were considered. Consequently, all new lone mothers had previously lived with a partner (that is, in cycle 1). Longer-term lone mothers, however, include women who had never lived with a partner, since it was not possible to distinguish between these two groups (in 1995, almost one in four female lone parents was single and had never married).[1,21] This inconsistency must be kept in mind when comparing new and longer-term lone mothers, since different paths to lone parenthood may have different effects on health.

The definitions of new lone mothers, longer-term lone mothers and mothers in two-parent families are based on the household composition at the time of data collection for cycles 1 and 2 of the National Population Health Survey (see *Definitions*). No information is available on the living arrangements of respondents before cycle 1 or between cycles 1 and 2. Thus, changes in household composition (including a change in partner or the presence of an interim partner) in those periods would not be detected. The duration of the living arrangements is also unknown.

The multiple regression models were not constructed as forecasting tools, but rather to examine if new or longer-term lone mother status was significantly associated with health after controlling for other variables believed to be associated with health status. Causality cannot be inferred.

Since the number of women who become lone mothers over a two-year period is likely to be small, so is the sample size of new lone mothers (64), resulting in some loss of statistical power.

Attrition may be high for new lone mothers, because their change in circumstances may affect their willingness to participate in subsequent survey cycles. And if those who participated in cycle 2 have different health outcomes than those who did not, this may bias the results.

In addition to income adequacy in cycle 2, it would have been desirable to explore the associations between a *drop* in income between cycle 1 and 2 and health indicators. However, household income is only available in broad categories, and it was not possible to derive a sensitive "change of income" variable.

The extent of the overlap in the reporting of physician consultations and consultations for mental or emotional health cannot be determined.

Health characteristics

Respondents to the National Population Health Survey were asked about their *self-perceived health*. Interviewers read the question and recorded one response. The scores were re-scaled from 0 to 10. "In general, would you say your health is:

- excellent?" [score 4; rescaled to 10.0]
- very good?" [score 3; rescaled to 7.5]
- good?" [score 2; rescaled to 5.0]
- fair?" [score 1; rescaled to 2.5]
- poor?" [score 0]

A *happiness* rating (re-scaled from 0 to 10) was obtained from the question, "Would you describe yourself as being usually ...

- happy and interested in life?" [score 4; rescaled to 10.0]
- somewhat happy?" [score 3; rescaled to 7.5]
- somewhat unhappy?" [score 2; rescaled to 5.0]
- unhappy with little interest in life?" [score 1; rescaled to 2.5]
- so unhappy that life is not worthwhile?" [score 0]

Interviewers read the responses and marked only one.

To measure psychological *distress*, respondents answered six questions related to symptoms of depression and anxiety, ranked on a five-point scale from "none of the time" to "all the time": "During the past month, that is, from (one month ago) to yesterday, about how often did you feel:

- so sad that nothing could cheer you up?"
- nervous?"
- restless or fidgety?"
- hopeless?"
- worthless?"
- that everything was an effort?"

The responses to all items were summed (final score re-scaled from 0 to 10); higher scores indicated more distress. Cronbach's alpha for the entire NPHS sample was estimated at .77 in 1994/95 and .80 in 1996/97.

The number of *physician consultations* was obtained from the question: "[Not counting when you were an overnight patient] In the past 12 months, how many times have you seen or talked on the telephone with (a/an/any) [fill category] about your physical, emotional or mental health?" Two categories were combined for physician consultations: family doctor/general practitioner and other medical doctor (surgeon, allergist, gynecologist or psychiatrist, for example).

To measure the number of *consultations for mental or emotional health*, respondents were asked: "In the past 12 months, have you seen or talked on the telephone to a health professional about your emotional or *mental health*?" Those who answered "yes" were then asked: "How many times (in the past 12 months)?" Respondents who answered "no" were coded 0 consultations.

who lived with a partner. This pattern also holds for happiness and distress: lone mothers had significantly lower self-perceived happiness and higher distress in 1996/97, even after the scores were adjusted for 1994/95 levels.

Gap persists

Dividing lone mothers into new (became a lone mother since 1994/95) and longer-term (lone mother in both 1994/95 and 1996/97) provides insight into how their health status may change over time.

The average self-perceived health scores of longer-term lone mothers were significantly lower than those of mothers in two-parent families in both 1994/95 and 1996/97. As well, the averages for

Table 2
Mothers' average scores on selected health status indicators, by family type, Canada excluding territories, 1994/95 and 1996/97

	Average scores			
	Mothers in two-parent families (T)	New lone mothers† (N)	Long-term lone mothers (L)	Significant differences
Self-perceived health				
Cycle 1 (1994/95)	7.33	7.27	6.62	T1 > L1*
Cycle 2 (1996/97)	7.35	6.72	6.53	T2 > L2*
Across cycles	...	...	...	n.s.
Happiness				
Cycle 1 (1994/95)	9.42	9.15	8.57	T1 > L1*
Cycle 2 (1996/97)	9.62	9.21	8.86	T2 > L2*
Across cycles	...	...	...	T1 < T2*
Distress				
Cycle 1 (1994/95)	1.34	2.25	2.27	T1 < N1* T1 < L1*
Cycle 2 (1996/97)	1.11	1.75	1.99	T2 < L2*
Across cycles	...	...	...	T1 > T2*

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Note**: Comparisons are done using repeated measures analysis of variance. All variables were coded from low to high and rescaled from 0 to 10.*
† Became lone mother after their cycle 1 interview.
T1 – average cycle 1 score for mothers in two-parent families
T2 – average cycle 2 score for mothers in two-parent families
N1 – average cycle 1 score for new lone mothers
N2 – average cycle 2 score for new lone mothers
L1 – average cycle 1 score for long-term lone mothers
L2 – average cycle 2 score for long-term lone mothers
** p = 0.05; two-tailed test with adjustment for multiple comparisons*
··· Not applicable
n.s. Not significant

these two groups did not change significantly during that two-year period (Table 2).

The average self-perceived health score of new lone mothers was close to that of mothers in two-parent families at cycle 1 when their living arrangements were similar; by cycle 2, the average score of new lone mothers resembled that of longer-term lone mothers. However, this apparently substantial decrease in self-rated health was not statistically significant. The drop in the average score of this group (that is, after becoming lone mothers) contrasts with the stability observed among the other two groups. The lack of significance may be due to the lack of statistical power resulting from the small sample of new lone mothers.

The average happiness score of mothers in two-parent families was higher than that of longer-term lone mothers in both 1994/95 and 1996/97. As well, by 1996/97, mothers in two-parent families were the only group whose happiness score had risen significantly.

A comparison of cycle 1 respondents who participated in cycle 2 with those who did not participate revealed significantly higher happiness scores among the former (data not shown). Therefore, attrition cannot be discounted as an explanation for the increase in happiness scores of mothers in two-parent families.

At both cycles, longer-term lone mothers had higher distress scores than did mothers in two-parent families. And in cycle 1, the distress level of new lone mothers was significantly higher than that of mothers in two-parent families. At that time, the women who would become new lone mothers were still living with a partner. Their high distress levels may reflect problems that existed before the dissolution of their relationship.

By 1996/97, there was a significant drop in average distress scores for mothers in two-parent families, but not for longer-term lone mothers. The significant decrease in distress scores among the former may reflect the likelihood that such families would be best positioned to benefit from the improved economic conditions[22] in that period. An attrition effect for distress scores could not be detected.

The moderate stability coefficients of these health status measures (Appendix Table A) indicate that the overall averages mask substantial intra-individual change (across cycles). In addition, these three indicators may differ in their reliability and validity (for example, the happiness score is based on one item and may be highly influenced by mood). However, one observation persists. At cycle 1, on all three measures, the health of longer-term lone mothers was consistently worse than that of mothers in two-parent families and remained so at cycle 2.

Health care use similar

It might be expected that the poorer health of lone mothers would be associated with greater use of health care services, yet the average number of self-reported physician consultations did not differ significantly between lone mothers overall and mothers in two-parent families (Table 3). And while statistical differences were found between these two groups for the average number of consultations for mental or emotional health, the differences disappeared when the number of consultations reported in cycle 1 was taken into account.

When the results for new and longer-term lone mothers were examined separately, no significant differences in average number of physician consultations were detected among the three groups (Table 4). However, by 1996/97, mothers in two-parent families and longer-term lone mothers reported a significant drop in consultations.

Table 3
Mothers' average number of health care consultations, by family type, Canada excluding territories, 1996/97

	Mothers in two-parent families (T)	All lone mothers (A)	Significant differences
Physician consultations	5.81	4.73	n.s.
Adjusted for 1994/95	4.90	5.29	n.s.
Consultations for mental or emotional health	0.54	1.88	T<A*
Adjusted for 1994/95	0.65	1.15	n.s.

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Note**: All variables coded from low to high*
** p = 0.05; two-tailed test*
n.s. = difference not statistically significant

Definitions

Three types of mothers are analyzed: (1) *new lone mothers,* who shared a household with their partner and one or more children younger than 18 in 1994/95, but lived only with one or more children in 1996/97; (2) *longer-term lone mothers,* who lived only with one or more children at both collection periods; and (3) *mothers in two-parent families,* who lived with a partner and one or more children at both collection periods. A fourth group—women who had been lone parents in cycle 1, but by cycle 2 were members of two-parent families—comprised too few respondents (46) to include in the analysis. The exact duration of the living arrangements of any group is unknown, as no information is available about the starting time of their current situation. Respondents were excluded from the analysis if their household contained someone other than the respondent, her children and, if applicable, her partner.

Respondents were classified as having *inadequate income* if they were in either of the two lowest income quintiles, defined according to total household income and household size, as follows:

Household Income group	Persons in household	Household income
Lowest	1 to 4	Less than $10,000
	5 or more	Less than $15,000
Lower-middle	1 or 2	$10,000 to $14,999
	3 or 4	$10,000 to $19,999
	5 or more	$15,000 to $29,999
Middle	1 or 2	$15,000 to $29,999
	3 or 4	$20,000 to $39,999
	5 or more	$30,000 to $59,999
Upper-middle	1 or 2	$30,000 to $59,999
	3 or 4	$40,000 to $79,999
	5 or more	$60,000 to $79,999
Highest	1 or 2	$60,000 or more
	3 or more	$80,000 or more

Respondents were classified as receiving *social assistance* if they reported that one of their sources of income was provincial or municipal social assistance or welfare.

A respondent was classified as having *low education* if she had secondary graduation or less.

Labour force status was divided into: *full-time employed* (normally works 30 hours per week or more for all current jobs combined), *part-time employed* (normally works less than 30 hours per week for all current jobs combined), *unemployed* (not currently working because of temporary seasonal or non-seasonal layoff, permanent layoff, resignation, or stated that she is looking for work), *not in labour force* (not working because of illness, pregnancy, caring for own children, caring for elder relative, other personal/family responsibilities, school or education leave, retired, disabled or recovering from illness, or "other"). Respondents not currently working because of a labour dispute, or on unpaid or partially paid leave are considered employed. A fifth category, *missing,* was created if number of hours currently working or if reason for not working was unknown. A respondent was flagged as having a *new employer* only if she was working at both cycles, and her employer in 1996/97 was different from her employer in 1994/95.

Marital status was not considered in this analysis, as the interest lies in household composition, not the legal status of the mother's relationship. However, "separated" marital status was included in the multivariate models, as it may indicate further instability not experienced by mothers in two-parent families or lone mothers who are divorced or widowed.

A respondent was flagged as experiencing a *loss of one or more children* if the number of children in the household decreased (for any reason) between 1994/95 and 1996/97.

Movers were respondents who had a change of postal code between 1994/95 and 1996/97.

Four "yes/no" questions measured emotional support. Respondents were asked if they had someone they could confide in, count on, who could give them advice, and who made them feel loved. A score of 1 was given to each "yes" answer. A higher score indicates greater perceived emotional support. Change in emotional support was defined as the difference between 1994/95 and 1996/97 scores.

NPHS asked respondents if they had "long-term chronic conditions that have lasted or are expected to last 6 months or more." The interviewer read a list that included a wide range of specific *chronic conditions.*

Respondents who stayed in bed or cut down in activities at least one day in the two weeks before the interview because of illness or injury were considered to have had *disability days in the last 2 weeks.*

Respondents were asked if they were limited in the kind or amount of activity they could do at home, at school, or at work because of a long-term physical or mental condition or a health problem, or if they were limited in activities such as transportation to or from work or leisure time activities. They were also asked if they had any long-term disabilities or handicaps. Those who answered "yes" to any of those were classified as having *activity restrictions*.

Table 4
Mothers' average number of health care consultations, by family type, Canada excluding territories, 1994/95 and 1996/97

	Average number of consultations			
	Mothers in two-parent families (T)	New lone mothers† (N)	Long-term lone mothers (L)	Significant differences
Physician consultations				
Cycle 1 (1994/95)	5.40	6.06	8.07	n.s.
Cycle 2 (1996/97)	4.73	7.71	5.28	n.s.
Across cycles	...	...	...	T1 > T2* L1 > L2*
Consultations for mental or emotional health				
Cycle 1 (1994/95)	0.60	2.36	3.07	T1 < L1*
Cycle 2 (1996/97)	0.55	2.86	1.59	n.s.
Across cycles	...	...	...	n.s.

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Note**: Comparisons are done using repeated measures analysis of variance.*
† Became lone mother after their cycle 1 interview.
T1 – average cycle 1 score for mothers in two-parent families
T2 – average cycle 2 score for mothers in two-parent families
N1 – average cycle 1 score for new lone mothers
N2 – average cycle 2 score for new lone mothers
L1 – average cycle 1 score for long-term lone mothers
L2 – average cycle 2 score for long-term lone mothers
** p = 0.05; two-tailed test with adjustment for multiple comparisons*
··· Not applicable
n.s. Not significant

The only significant difference in consultations for mental or emotional health was in 1994/95 when mothers in two-parent families reported fewer consultations, on average, than did longer-term lone mothers.

Socioeconomic status and health

To understand the relatively poorer health of lone mothers, a number of other variables related to physical and mental well-being were examined (see *Definitions*).

The association between poor health and low socioeconomic status has been documented repeatedly.[23-25] It is also well known that families headed by lone mothers are often economically disadvantaged,[3,5,6,8,15,26-33] and conversely, that people with low socioeconomic status have a greater risk of becoming lone parents.[34] It is not surprising, then, that NPHS data show that both new and longer-term lone mothers were more likely than mothers in two-parent families to live in households with inadequate income (Table 5).

Having a job may relieve financial stress, and it may also promote feelings of self-sufficiency. Both usually contribute to better psychological and physical health. At the same time, people in better physical and psychological health are more likely to find or keep employment.

Although the proportions working full time did not differ, the proportion of longer-term lone mothers working part time was smaller than that of mothers in two-parent households. For lone mothers, part-time work may be impractical. For instance, the income from a part-time job might not offset the expenses associated with working.

New lone mothers had the highest probability of moving, a stressful experience that may be associated with their recent transition to lone parenthood.

Between the two survey cycles, mothers in two-parent families experienced, on average, a slight positive change in emotional support, and longer-term lone mothers, a significantly higher increase than all other mothers. By contrast, new lone mothers experienced, on average, a decrease in emotional support. It is widely acknowledged that social networks are disrupted when partners decide to live apart.[2,3] In addition, a break-up may enhance feelings of being alone and not having someone on whom to rely.[5,30] Over time, the feeling of a lack of emotional support may lessen, or lone mothers may be able to reconstruct networks that provide such support.

The association of each of these factors with self-perceived health status and health care utilization cannot be examined in isolation, as many of these characteristics are interrelated. For instance, full-time employment tends to be associated with higher levels of education. And moving may entail a loss of emotional support. However, with multivariate analysis, it is possible to assess the contribution of each factor, and various combinations of these factors, to health status and the use of health care services.

After the effects of other variables were controlled, as expected, chronic conditions, activity

restrictions and recent disability days were significantly associated with self-perceived health, distress and happiness (Appendix Table B). As well, these three variables were the only ones related to increased physician consultations (Appendix Table C). And only activity restrictions were associated with increased consultations for mental or emotional health.

Table 5
Selected characteristics of mothers, by family type, Canada excluding territories, 1996/97

	Mothers in two-parent families (T)	Lone mothers New (N)	Lone mothers Longer-term (L)	Significant pairwise comparisons
Personal characteristics				
Mean age of mother (years)	38	34	37	T>N*
Socioeconomic characteristics				
Inadequate household income (%)	9	46	49	T<N* T<L*
Social assistance (%)	4	40†	45	T<N* T<L*
Low education (%)	33	43†	36	n.s.
Full-time employed (%)	47	48†	50	n.s.
Part-time employed (%)	27	--	16	T>L*
Unemployed (%)	3†	--	--	--
Not in labour force (%)	22	24†	29	n.s.
Family characteristics				
Legally separated (%)	···	58	22	N>L*
Mean number of children in household (%)	2.1	1.8	1.8	T>L* T>N*
Child aged 5 or younger in household (%)	40	49†	29	T>L*
Changes§				
Child loss (%)	4†	--	--	--
Moved (%)	16	64	39	T<N* T<L* N>L*
New employer (%)	20	21‡	19	n.s.
Mean change in emotional support	.04††	- .11††	.20††	T<L* N<L*
Health indicators				
Chronic conditions (%)	56	72	64	n.s.
Disability days in last two weeks (%)	13	--	18	n.s.
Activity restrictions (%)	13	--	19	n.s.

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Note:** All variables coded " no/yes" except age of mother, number of children in household, and change in emotional support.*
† Coefficient of variation between 16.6% and 25.0%
‡ Coefficient of variation between 25.1% and 33.3%
§ Based on data from cycle 1 (1994/95) and cycle 2 (1996/97)
†† Coefficient of variation greater than 33.3% because of small magnitude of estimates (within-group differences between cycle 1 and 2 averages are close to 0)
-- Coefficient of variation greater than 33.3%
** p = 0.05; two-tailed test with adjustment for multiple comparisons*
··· Not applicable
n.s. Not significant

Education, income crucial

Even after health ratings on each indicator in 1994/95 were taken into account, low education significantly contributed to lower self-perceived health, decreased happiness and increased distress levels in 1996/97. Receiving social assistance was associated with lower self-perceived health, and inadequate household income contributed to higher distress levels. While this suggests that, to a great degree, lone mothers' poorer health is attributable to low education and inadequate income, it would be an oversimplification to conclude that these factors "explain away" the poorer health experienced by this group. A substantial amount of the variance explained by the model is accounted for solely by the respondents' health status at cycle 1, and most of the variance remains unexplained.

Neither low education nor inadequate income was significantly associated with health care utilization. For physician consultations, this is not surprising, given Canada's universal health care system. The lack of such a relationship for consultations about mental or emotional health is more puzzling, because such services are often provided on a fee-for-service basis. However, for low-income individuals, these services may be available along with other social assistance.

Lone parenting and health

When other determinants of health and 1994/95 health status were taken into account, being a lone parent per se was not a significant factor for any of the three health indicators (Appendix Table B).

Unexpectedly, being separated was associated with lower distress levels overall. But for new lone mothers who were separated, distress levels were increased. Thus, the instability of being separated seems to be particularly distressing for new lone mothers, but seems not to affect this group's self-perceived health or happiness level.

In the self-perceived health status model, the positive coefficient associated with the interaction of being both a longer-term lone mother and having inadequate income is counterintuitive. In this model, it serves to correct the strong negative main effect associated with being a longer-term lone mother only, which, in conjunction with inadequate income, underestimates the average self-perceived health of this group.

Concluding remarks

According to the National Population Health Survey, lone mothers reported consistently worse health status than did mothers in two-parent families. As well, longitudinal data indicate that between 1994/95 and 1996/97, the self-perceived health of longer-term lone mothers did not improve. Nor was the health of longer-term lone mothers significantly different from that of women who had recently become lone parents. These findings suggest that prolonged exposure to the circumstances typical of lone parenthood threatens self-perceived health status. No significant difference was found in health care utilization, except for consultations about mental or emotional health in cycle 1, which was higher for longer-term lone mothers than for mothers in two-parent families.

Lone parenthood alone was not a significant predictor of health outcomes. However, a combination of many explanatory variables, such as low education and inadequate household income, reduced the contribution of type of mother in these models. Assessing all of the factors that tend to be associated with lone parenthood, including those that occur over time, may be a crucial starting point in dealing with the health issues that lone mothers are likely to confront. ●

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References

1 Statistics Canada. *Canadian Families: Diversity and Change*. Statistics Canada staff paper (Statistics Canada, Catalogue 12F0061XPE) Ottawa: Statistics Canada, 1996.

2 Weinraub M, Wolf BM. Stressful life events, social supports, and parent-child interactions: Similarities and differences in single-parent and two-parent families. In: Boukydis CF, ed. *Research on Support for Parents and Infants in the Postnatal Period*. Norwood, New Jersey: Ablex Publishing Corporation, 1987: 114-35.

3 Simons RL, Johnson C, Lorenz FO. Family structure differences in stress and behavioral predispositions. In: Simmons RL and Associates, eds. *Understanding Differences between Divorced and Intact Families: Stress, Interaction and Child Outcome*. Thousand Oaks, California: Sage Publications, Inc., 1996: 45-64.

4 Avison WR. Single motherhood and mental health: implications for primary prevention [editorial; comment] [Review]. *Canadian Medical Association Journal* 1997; 156(5): 661-3.

5 Friedemann M-L, Andrews M. Family support and child adjustment in single-parent families. *Issues in Comprehensive Pediatric Nursing* 1990; 13(4): 289-301.

6 Compas BE, Williams RA. Stress, coping, and adjustment in mothers and young adolescents in single- and two-parent families. *American Journal of Community Psychology* 1990; 18(4): 525-45.

7 Beck J. Problems encountered by the single working mother. *Ergonomics* 1984; 27(5): 577-84.

8 Mednick MT. Single mothers: A review and critique of current research. *Applied Social Psychology Annual* 1987; 7: 184-201.

9 Tambay J-L, Catlin G. Sample design of the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 29-38.

10 Swain L, Catlin G, Beaudet MP. The National Population Health Survey—its longitudinal nature. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 69-82.

11 Hetherington EM. Coping with family transitions: Winners, losers, survivors. In: Handel G, Whitchurch GG, eds. *The Psychosocial Interior of the Family,* 4th ed. New York, New York: Aldine De Gruyter, 1994: 537-59.

12 Kazac AE, Linney JA. Stress, coping and life change in the single-parent family. *American Journal of Community Psychology* 1983; 11(2): 207-20.

13 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18: 209-17.

14 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 283-310.

15 Lipman EL, Offord DR, Boyle MH. Single mothers in Ontario: sociodemographic, physical and mental health characteristics. *Canadian Medical Association Journal* 1997; 156(5): 639-45.

16 McLanahan, S. Single mothers and psychological well-being: A test of the stress and vulnerability hypotheses. *Research in Community and Mental Health* 1985; 5: 253-66.

17 Beatson-Hird P, Yuen P, Balarajan R. Single mothers: their health and health service use. *Journal of Epidemiology and Community Health* 1989; 43(4): 385-90.

18 Langlois J, Fortin D. Single-parent mothers, poverty and mental health: review of the literature. *Santé Mentale au Québec* 1994; 19(1): 157-73.

19 Benzeval M. The self-reported health status of lone parents. *Social Science and Medicine* 1998; 46(10): 1337-53.

20 Fulmer RH. A structural approach to unresolved mourning in single parent family systems. *Journal of Marital and Family Therapy* 1983; 9(3): 259-69.

21 Statistics Canada. 1996 Census: Marital status, common-law unions and families. *The Daily* (Catalogue 11-001E) Tuesday, October 14, 1997.

22 Statistics Canada. *Canadian Economic Observer, Statistical Summary* (Catalogue 11-010-XPB) Ottawa: Statistics Canada, October 1996 and April 1998.

23 Millar W, Beaudet MP, Chen J, et al. *National Population Health Survey Overview 1994-95* (Statistics Canada, Catalogue 82-567) Ottawa: Minister of Industry, 1995.

24 Beaudet MP, Chen J, Pérez C, et al. *National Population Health Survey Overview 1996-97* (Statistics Canada, Catalogue 82-567-XPB) Ottawa: Minister of Industry, 1998.

25 Roberge R, Berthelot J-M, Wolfson M. The Health Utility Index: Measuring health differences in Ontario by socioeconomic status. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(2): 25-32.

26 Gauthier P. The mother-headed single-parent family. *Revue Canadienne de Psycho-Education* 1985; 14(1): 19-30.

27 Weissman MM, Leaf PJ, Bruce ML. Single parent women: A community study. *Social Psychiatry* 1987; 22(1): 29-36.

28 Norton AJ, Glick PC. One parent families: A social and economic profile. *Family Relations: Journal of Applied Family and Child Studies* 1986; 35(1): 9-16.

29 Sanik MM, Mauldin T. Single versus two parent families: A comparison of mothers' time. *Family Relations: Journal of Applied Family and Child Studies* 1986; 35(1): 53-6.

30 Wells Gladow N, Ray MP. The impact of informal support systems on the well being of low income single parents. *Family Relations: Journal of Applied Family and Child Studies* 1986; 35(1): 113-23.

31 Pett MA, Vaughan-Cole B. The impact of income issues and social status on post-divorce adjustment of custodial parents. *Family Relations: Journal of Applied Family and Child Studies* 1986; 35(1): 103-11.

32 Statistics Canada. *Income Distributions by Size in Canada, 1996* (Statistics Canada, Catalogue 13-207-XPB) Ottawa: Minister of Industry, 1997.

33 Drolet M, Morissete R. *The Upward Mobility of Low Paid Canadians: 1993-1995*. Survey of Labour and Income Dynamics Research Paper Series (Statistics Canada, Catalogue 75F0002MPE, no. 98-07) Ottawa: Statistics Canada, 1998.

34 McLeod JD, Kessler RC. Socioeconomic status differences in vulnerability to undesirable life events. *Journal of Health and Social Behavior* 1990; 31(June): 162-72.

Appendix

Table A
Stability coefficients between cycle 1 and cycle 2 for selected health status and health care consultation indicators

		Mothers in two-parent families	Lone mothers		
	Total		Total	New	Longer-term
Self-perceived health	.56	.56	.55	.43	.58
Happiness	.44	.40	.43	.46	.52
Distress	.40	.31	.48	.06	.48
Physician consultations	.34	.39	.23	.01	.32
Consultations for mental or emotional health	.43	.51	.34	.50	.30

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Table B
Adjusted regression coefficients of selected characteristics for health status of mothers, Canada excluding territories, 1996/97

	Self-perceived health†			Happiness‡			Distress§		
	B	se	beta	B	se	beta	B	se	beta
Rating in 1994/95	0.42*	0.03	0.43	0.28*	0.04	0.34	0.34*	0.04	0.36
Personal characteristics									
Age	-0.01	0.01	-0.04	-0.01	0.01	-0.06	0.01	0.01	0.04
Socioeconomic characteristics									
Inadequate household income	-0.24	0.24	-0.04	-0.22	0.25	-0.07	0.67*	0.25	0.17
Social assistance	-0.62*	0.23	-0.09	0.03	0.19	0.01	-0.31	0.19	-0.07
Low education	-0.32*	0.12	-0.07	-0.21*	0.08	-0.08	0.25*	0.09	0.09
Full-time employed††	...	...	...	...	...	...	...	...	...
Part-time employed	-0.05	0.13	-0.01	0.08	0.09	0.03	-0.19	0.09	-0.06
Unemployed	0.32	0.36	0.02	0.07	0.15	0.01	0.12	0.23	0.02
Not in labour force	-0.03	0.17	-0.01	-0.01	0.11	-0.003	-0.11	0.11	-0.03
Family characteristics									
Mother in two-parent family††	...	...	...	...	...	...	...	...	...
New lone mother	-0.16	1.01	-0.01	0.05	0.66	0.01	0.16	0.96	0.02
Longer-term lone mother	-0.58	0.43	-0.09	-0.12	0.32	-0.03	0.28	0.28	0.07
Legally separated	-0.23	0.31	-0.02	-0.02	0.27	-0.005	-0.56*	0.27	-0.09
Number of children in household	0.07	0.09	0.02	0.03	0.05	0.02	-0.03	0.06	-0.02
Child aged 5 or younger in household	-0.12	0.16	-0.03	-0.13	0.11	-0.06	0.19	0.11	0.07
Changes									
Child loss	-0.52	0.28	-0.04	0.26	0.14	0.04	0.32	0.25	0.04
Moved	-0.11	0.14	-0.02	-0.13	0.09	-0.04	-0.04	0.10	-0.01
New employer	0.24	0.15	0.04	-0.06	0.09	-0.02	0.09	0.10	0.02
Change in emotional support	0.04	0.08	0.01	0.04	0.06	0.03	-0.03	0.08	-0.02
Health indicators									
Chronic conditions	-0.39*	0.11	-0.08	-0.13*	0.06	-0.06	0.23*	0.07	0.08
Disability days in last two weeks	-0.67*	0.19	-0.10	-0.21*	0.12	-0.06	0.42*	0.12	0.11
Activity restrictions	-1.14*	0.18	-0.17	-0.24*	0.14	-0.07	0.28*	0.13	0.07
Selected interactions									
New lone mother and number of children	-0.59	0.44	-0.10	-0.14	0.37	-0.04	-0.40	0.60	-0.11
Longer-term lone mother and number of children	0.08	0.21	0.02	-0.05	0.19	-0.03	0.02	0.18	0.01
New lone mother and child aged 5 or younger in household	1.04	0.61	0.06	0.01	0.44	0.001	-0.34	0.67	-0.03
Longer-term lone mother and child aged 5 or younger in household	-0.18	0.33	-0.02	0.30	0.33	0.05	0.16	0.39	0.02
New lone mother and inadequate household income	0.66	0.63	0.04	0.22	0.44	0.02	0.31	0.68	0.03
Longer-term lone mother and inadequate household income	0.97*	0.37	0.11	-0.43	0.31	-0.09	0.22	0.34	0.04
New lone mother and change in emotional support	-0.06	0.67	-0.003	0.09	0.50	0.01	0.33	0.46	0.03
Longer-term lone mother and change in emotional support	0.33	0.20	0.05	0.004	0.17	0.001	0.15	0.19	0.04
New lone mother and legally separated	0.92	0.66	0.06	-0.03	0.47	-0.003	1.67*	0.66	0.18
Intercept	5.39			7.55			-0.01		

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Notes:** Standard errors were estimated using the bootstrap technique, which fully accounts for the design effect. Respondents with a missing value for one or more variables were excluded from the analysis (listwise deletion). Variables for missing labour force status, income, and social assistance were included in the model to maximize the sample size, but their contribution is not shown. When not noted, reference category is absence of characteristic; for example, reference category for inadequate income is adequate income.*
†R^2 = .43; Adj. R^2= .42; F = 39.7 df = 32, 1702; p = .0001
‡R^2 = .22; Adj. R^2= .21; F = 15.0 df = 32, 1702; p = .0001
§R^2 = .30; Adj. R^2= .29; F = 22.6 df = 32, 1695; p = .0001
†† Reference category
** $p \leq 0.05$*
··· Not applicable

Table C
Adjusted regression coefficients of selected characteristics for number of health care consultations of mothers, Canada excluding territories, 1996/97

	Doctor consultations†			Consultations for mental or emotional health‡		
	B	se	beta	B	se	beta
Consultations in 1994/95	0.25*	0.09	0.27	0.36*	0.13	0.42
Personal characteristics						
Age	-0.002	0.04	-0.002	0.03	0.02	0.05
Socioeconomic characteristics						
Inadequate household income	1.10	1.13	0.05	0.41	0.58	0.03
Social assistance	0.21	1.06	0.01	-0.55	0.51	-0.04
Low education	0.43	0.48	0.03	0.24	0.25	0.02
Full-time employed§	...	...	...	...	...	...
Part-time employed	-0.42	0.44	-0.02	-0.25	0.25	-0.02
Unemployed	-0.75	1.36	-0.02	-1.36	0.97	-0.05
Not in labour force	0.46	0.92	0.02	-0.04	0.39	-0.004
Family characteristics						
Mother in two-parent family§	...	...	...	...	...	...
New lone mother	-0.68	3.66	-0.02	5.20	3.50	0.23
Longer-term lone mother	0.11	1.34	0.005	1.77	1.37	0.14
Legally separated	-0.09	1.08	-0.003	0.65	0.82	0.03
Number of children in household	-0.27	0.41	-0.03	-0.09	1.58	-0.01
Child aged 5 or younger in household	1.24	0.71	0.08	0.46	0.36	0.05
Changes						
Child loss	0.38	0.75	0.01	0.65	0.66	0.03
Moved	0.75	0.60	0.04	0.30	0.33	0.03
New employer	0.28	0.51	0.01	-0.04	0.30	-0.004
Change in emotional support	-0.56	0.43	-0.05	0.04	0.16	0.01
Health indicators						
Chronic conditions	1.09*	0.35	0.07	0.14	0.20	0.02
Disability days in last two weeks	1.64*	0.77	0.08	0.08	0.35	0.01
Activity restriction	3.24*	0.88	0.15	1.26*	0.48	0.10
Selected interactions						
New lone mother and number of children	0.35	1.88	0.02	-2.97	1.76	-0.25
Longer-term lone mother and number of children	-0.28	0.73	-0.02	-1.36	0.82	-0.20
New lone mother and child aged 5 or younger in household	1.83	3.57	0.03	-1.05	2.29	-0.03
Longer-term lone mother and child aged 5 or younger in household	1.45	1.49	0.04	-0.43	1.00	-0.02
New lone mother and inadequate household income	-2.35	3.65	-0.04	1.73	2.16	0.05
Longer-term lone mother and inadequate household income	-2.81	1.71	-0.09	1.42	1.13	0.08
New lone mother and change in emotional support	0.55	2.72	0.01	0.38	2.77	0.01
Longer-term lone mother and change in emotional support	-0.19	0.68	-0.01	0.37	1.12	0.03
New lone mother and legally separated	1.70	3.25	0.03	1.39	2.42	0.05
Intercept	1.61			-1.17		

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

***Notes:** Standard errors were estimated using the bootstrap technique, which fully accounts for the design effect. Respondents with a missing value for one or more variables were excluded from the analysis (listwise deletion). Variable for missing labour force status, income, and social assistance were included in the model to maximize the sample size, but their contribution is not shown. When not noted, reference category is absence of characteristic; for example, reference category for inadequate income is adequate income.*

† R^2 = .21; Adj. R^2= .19; F = 14.0 df = 32, 1697; p = .0001

‡ R^2 = .23; Adj. R^2= .22; F = 15.9 df = 32, 1700; p = .0001

§ Reference category

** $p \leq 0.05$*

··· Not applicable

Long working hours and health

Margot Shields

Abstract

Objectives

This article examines associations between long working hours, depression and changes in selected health behaviours. Based on an analysis of people followed over a two-year period, the relationship between changes in work hours and changes in health behaviours is explored.

Data source

The data are from the household longitudinal component of the 1994/95 and 1996/97 cycles of the National Population Health Survey, conducted by Statistics Canada. Results are based on 3,830 adult workers aged 25 to 54 (2,181 men and 1,649 women) who worked 35 hours or more per week throughout the year before their 1994/95 interview.

Analytical techniques

Multivariate analyses were used to estimate associations between working hours and depression, and changes in weight, smoking, drinking and exercise, while controlling for potential socioeconomic and work-related confounders such as education, income, occupation, shift work and self-employment.

Main results

Women who worked long hours had increased odds of subsequently experiencing depression. Moving from standard to long hours was associated with unhealthy weight gain for men, with an increase in smoking for both men and women, and with an increase in drinking for women. No associations were detected for physical activity.

Key words

weight gain, smoking, alcohol consumption, exercise, depression, work schedule tolerance

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In Canada, a growing share of the workforce is putting in long hours on the job (see *Working hours*).[1-3] Whether long hours adversely affect health has been debated for decades. However, policy-makers considering the regulation of working hours have had difficulty making decisions based on scientific research.[4]

In Japan, where long hours are common, a growing number of workers have been dying from cardiovascular causes (for instance, stroke, acute cardiac failure, myocardial infarction and aortic rupture) in their most productive years. Studies based on workers' compensation claims have found that many of the victims had been putting in long hours before they died.[5,6] The Japanese have named such deaths *Karoshi*, meaning "death from overwork."

Japanese researchers have proposed a *Karoshi* model to examine the relationship between long hours and cardiovascular disease.[5] It is hypothesized that long hours bring about unhealthy lifestyle changes such as smoking, alcohol abuse, lack of physical activity, sleeplessness, poor eating habits, and fewer chances for medical examinations. Prolonged periods of long hours may also increase anxiety, strain and irritability. Over time, individuals can become fatigued and develop a propensity toward obesity. The cumulative result can be cardiovascular disease.[5]

Methods

Data source

This article is based on data from the National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Force bases, and in some remote areas. The NPHS has both a longitudinal and cross-sectional component. Respondents who are part of the longitudinal component will be followed for up to 20 years.

Individual data are organized into two files: General and Health. Socio-demographic and some health information is collected for each member of participating households. These data are found in the General file. Additional in-depth health information is collected for one randomly selected household member. This additional information, as well as the information on the General file pertaining to that individual, is found in the Health file.

The 1994/95 NPHS provincial, non-institutional sample consisted of 27, 263 households, of which 88.7% agreed to participate in the survey. After application of a screening rule (to improve the representativeness of the sample) 20,725 households remained in scope. In 18,342 of these households, the randomly selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1% or 17,626 respondents. Of these 17,626 randomly selected respondents, 14,786 were eligible members of the longitudinal panel. In addition, 468 selected respondents for whom only general information was collected in 1994/95 and 2,022 randomly selected respondents younger than 12 were also eligible. Thus, a total of 17,276 longitudinal respondents were eligible for re-interview in 1996/97. The remaining respondents to the 1994/95 survey were sponsored by provincial governments that elected to enlarge the sample size in their province for cycle 1 only. These respondents were not followed up.

A response rate of 93.6% was achieved for the longitudinal panel in 1996/97. Of these 16,168 respondents, full information was available for 15,670; that is, general and in-depth health information for both cycles of the survey.

A more detailed description of the NPHS design, sample and interview procedures can be found in published reports.[7-9]

The sample analyzed in this article consists of 3,830 respondents aged 25 to 54 (2,181 men and 1,649 women) who worked 35 hours per week or more throughout the entire year before their 1994/95 interview, and from whom information was collected in 1996/97 (Appendix Table A). A small percentage (0.9%) of respondents, for whom working hours in the year before the 1994/95 survey were not stated, was excluded. The profile of workers putting in long hours in 1994/95 is based on the longitudinal file. Estimates based on the 1994/95 cross-sectional file are very similar (data not shown).

Every effort is made to collect the in-depth health information directly from the randomly selected individuals. However, in a small number of cases, proxy responses were accepted in both 1994/95 and 1996/97. Because the primary focus of this analysis is measurement of the change between the two NPHS cycles, the records for which a proxy response was accepted for the in-depth health interview in either cycle (4.4% of respondents) were not included: 8 respondents for whom only proxy information was available for both years; 151 with proxy information for 1994/95; and 18 with proxy information for 1996/97. These respondents were excluded to reduce potential bias that may have resulted from response errors due to proxy reporting.

Analytical techniques

All analyses are based on weighted data. The group examined consists of longitudinal respondents for whom non-proxy information was available for both 1994/95 and 1996/97. Descriptive statistics for 25- to 54-year-olds who worked 35 hours per week or more throughout 1994/95 are presented. Those who worked long hours (an average of 41 or more hours per week) are compared with those who worked standard hours (an average of 35 to 40 hours).

Multiple logistic regression was used to model the relationship between long hours in 1994/95 and a subsequent depressive episode in 1996/97. Multiple logistic regression was also used to model the effects of changing or maintaining working hours between the two surveys (for example, moving from standard to long hours or working long hours in both survey periods) in relation to changes in health behaviours; namely, unhealthy weight gain, increased smoking, increased drinking, and reduced physical activity.

Based on face validity, a review of the literature on occupational stress,[10,11] and availability in the NPHS, selected work-related and socio-demographic factors were included in the regression models as control variables. Work-related variables were: occupation, self-employment, shift work, multiple jobs, high job strain, high job insecurity, and low supervisor support. Socio-demographic characteristics included age, marital status, educational attainment, household income and the presence of children younger than 12 in the household. Unless otherwise stated, the control variables in the regression models are based on data collected in the 1994/95 survey.

In all cases, separate regression models were fitted for men and women. Coefficients of variation and standard errors were estimated using a weighted bootstrap procedure[12,13] that fully accounts for the design effect of the survey.

Using longitudinal data from the first two cycles of the National Population Health Survey (1994/95 and 1996/97), this article examines Canadian workers aged 25 to 54 who worked at least 35 hours a week in 1994/95). People in this age range are the most likely to feel stress from the "time-crunch," as they juggle work, family and personal responsibilities.[14]

The data are analyzed in the context of the early phases of the *Karoshi* model to determine if long hours (41 or more a week) are associated with depression and with changes in health behaviours. Four indicators—weight, smoking, drinking, and physical activity—are used to investigate if moving from standard to long hours is related to unhealthy lifestyle changes (see *Methods* and *Limitations*).

Working hours and health

Surprisingly few studies have examined associations between working hours and health status and behaviours. Although the effects of shift work have been studied extensively, it is rare for research to focus on the quantity of hours.[15] Nonetheless, there is currently sufficient evidence to raise concerns about the health and safety risks of working long hours.[4,15,17]

In North America and Europe, research has focused on the association between high job strain (high psychological demands coupled with low decision-making latitude[11]) and health outcomes such as depression, anxiety, migraine, high blood pressure and coronary heart disease,[18-28] and health behaviours such as smoking and excess body weight.[29-31] However, most research based on the job strain model has not explicitly examined the impact of the number of working hours.

While researchers in Japan have investigated the *Karoshi* phenomenon,[5,6] the data are, for the most part, presented as a series of cases studies; there are no epidemiologically sound estimates of the prevalence of *Karoshi*.[6] Other Japanese studies showing associations between long hours and weight gain, increased perceived stress, and an unhealthy lifestyle were based only on men in a small number of occupational groups.[32,33]

Among the few studies of the number of hours worked, a recent report by the Economic and Social Research Council in Great Britain concluded that

Working hours

At the turn of the century, a typical worker in Canada put in a 60-hour week. In the following decades, largely as a result of union activity, efforts were made to reduce the length of the workweek in the interests of health and safety. It was widely argued that more opportunity for rest and time to participate more fully in family life would have a positive effect on workers' physical and mental health.[16] As a result, there was a general downturn in working hours, and the average workweek stabilized in the 35- to 40-hour range in the mid-1960s.

However, average weekly hours provide an incomplete picture. Although average hours worked per week have changed very little since the mid-1960s, a new trend has developed since the economic downturn of the early 1980s: "hours polarization."[1-3] The proportions of male workers putting in both longer (41 or more) and shorter weekly hours (less than 35) have risen. Among female workers, a growing percentage work long hours. The proportion of the population working long hours is highest at ages 25 to 54, and the shift out of standard to long hours has been the most skewed for women aged 35 to 54.[3]

Percentage distribution of usual weekly hours, employees† aged 25 or older, by sex, Canada excluding territories, selected years 1980 to 1995

	Usual weekly hours	1980	1985	1989	1995
			%		
Men	1-34	4.4	5.2	5.2	7.1
	35-40	77.5	75.0	73.4	68.6
	41+	18.0	19.7	21.4	24.3
Women	1-34	29.9	30.9	29.3	30.1
	35-40	64.5	62.6	63.4	61.3
	41+	5.6	6.5	7.3	8.6

Data source: *Reference 3*
† Excludes self-employed

long hours have negative health consequences.[34] Using data from the British Household Panel Study, the researchers found that working long hours a week increased feelings of stress and was associated with a decline in physical exercise. For women, several associations were found between long hours and health, including problems with arms, legs, hands, and blood pressure.

Limitations

To estimate working hours, respondents were asked about jobs they had over the previous year. They were asked their usual weekly working hours and the start and end dates for each job. It may have been difficult for some respondents to recall this information. Working hours may be underestimated for those who had a complex work history over the year, particularly if it involved multiple jobs.

Professionals and managers often work unpaid overtime to deal with excessive workloads. These workers may not report those additional hours, which would result in an underestimate of working hours for this group.

The calculation to derive average working hours was based on a maximum of three jobs. Consequently, working hours for individuals who had more than three jobs during the year would be underestimated. It is expected that this constraint had only a minimal impact on the analysis. Using 1994/95 NPHS cross-sectional data, it is estimated that less than 1% of workers had more than three jobs over the year. In 1996/97, details were only asked for a maximum of three jobs. The longitudinal file has details about a maximum of three jobs for both reference years.

It is not possible to have a complete picture of an individual's work situation because the NPHS is conducted every two years, and the questions about work pertain to the year before the date of the respondent's interview. For example, respondents classified as working standard hours both reference years may not have done so in the intervening year. This may have had an effect on the associations of changes observed between reference years.

The calculation of body mass index was based on self-reported data, and some respondents may have under-reported their weight and/or over-reported their height.

Respondents were classified as having experienced a "new" major depressive episode if they experienced depression in the year before the 1996/97 survey but not in the year before the 1994/95 survey. It is possible that these respondents may have had a history of depression; that is, they experienced depression before the NPHS began, or had an episode in the non-survey year.

The final stage of the *Karoshi* model–cardiovascular disease–has not been investigated extensively. Japanese research, based on case studies of small samples of male subjects, suggests an association between long working hours, high blood pressure and heart disease.[35-37] As well, one of these studies[35] detected a "U"-shaped relationship between long working hours and the risk of a heart attack: while men working more than 55 hours per week had increased odds of experiencing an attack, so did those working 35 hours per week or less,

Measures of socio-demographic characteristics

All measures of socio-demographic characteristics were derived using data collected in the 1994/95 survey.

To establish *marital status*, respondents were asked for their current marital status. Those who chose the "now married," "common-law" or "living with a partner" options were grouped together as "married." Individuals who answered "single" were classified as "never married," and "widowed," "separated" and "divorced" were categorized as "previously married."

Respondents were grouped into three *education* categories based on the highest level of education attained: high school graduation or less; some postsecondary; and postsecondary (college, trade or university) graduation.

Household income was defined based on the number of people in the household and total household income from all sources in the 12-month period before the survey.

Household income group	People in household	Total household income
Lowest	1 to 4	Less than $10,000
	5 or more	Less than $15,000
Lower-middle	1 or 2	$10,000 to $14,999
	3 or 4	$10,000 to $19,999
	5 or more	$15,000 to $29,999
Middle	1 or 2	$15,000 to $29,999
	3 or 4	$20,000 to $39,999
	5 or more	$30,000 to $59,999
Upper-middle	1 or 2	$30,000 to $59,999
	3 or 4	$40,000 to $79,999
	5 or more	$60,000 to $79,999
Highest	1 or 2	$60,000 or more
	3 or more	$80,000 or more

compared with men who worked 40 to 45 hours per week. It may be that the men working shorter hours were doing so because of ill health.

Currently, small sample sizes preclude an examination of the relationship between long working hours and heart disease based on NPHS data. In the two years between the first and second NPHS cycles, for the population under study, the sample counts for the incidence of heart disease were 21 men and 13 women; for high blood pressure, the counts were 57 and 33, respectively.

Workers putting in long hours

In 1994/95, among the population aged 25 to 54 working 35 hours or more per week, a higher percentage of men than women put in long hours (Table 1) (see *Measures of socio-demographic characteristics*). Half of these men reported 41 or more hours of work per week, compared with about one-quarter (28%) of their female counterparts. Men working long hours averaged 55 per week; women, 51 (data not shown). Among those working long hours, 32% of the men and 19% of the women put in at least 60 hours per week.

For men, long hours were more common at ages 25 to 34 and 35 to 44 than at age 45 or older. By contrast, for women, working long hours was not significantly related to age. Marital status was not associated with long hours for either male or female workers. However, men in households with young children were significantly more likely than other men to work long hours. For women, the proportion working long hours differed little by the presence of young children at home.

Postsecondary graduates were significantly more likely to work long hours, compared with workers whose formal education had not extended beyond high school. As well, men and women in high-income households were more likely than those in middle-income households to put in long hours. For men, long hours were also common among those in households with incomes in the low-to-middle range.

Table 1
Percentage working long hours† among men and women aged 25 to 54 who worked 35 hours or more per week throughout 1994/95, by selected socio-demographic characteristics, Canada excluding territories

	Men		Women	
	Total number	Long hours†	Total number	Long hours†
	'000	%	'000	%
Total	**4,414**	**50‡**	**2,789**	**28**
Age				
25-34	1,489	52§	1,058	26
35-44	1,681	53§	1,093	28
45-54	1,244	43	638	30
Marital status				
Married	3,477	50	2,016	27
Never married	659	49	410	28
Previously married	278	47	360	32
Missing	--	--	--	--
Child(ren) under age 12 in household				
Yes	1,841	54††	1,043	25
No	2,573	47	1,746	29
Education				
Secondary graduation or less	1,439	45	778	23
Some postsecondary	1,086	50	734	26
Postsecondary graduation	1,880	53‡‡	1,272	32‡‡
Missing	--	--	--	--
Household income				
Lowest/Lower-middle/Middle	1,143	53§§	756	25
Upper-middle	1,978	44	1,255	25
Highest	1,064	58§§	691	35§§
Missing	229	49	87†††	26‡‡‡

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
Notes: *Based on 2,181 male and 1,649 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97. A critical value of 2.40 instead of 1.96 was used when significance testing involved comparison of three groups within a variable. Because of rounding, detail may not add to totals.*
† 41 or more hours per week
‡ Significantly higher than women
§ Significantly higher than ages 45-54
†† Significantly higher than no children in household
‡‡ Significantly higher than secondary graduation or less
§§ Significantly higher than upper-middle income group
††† Coefficient of variation between 16.6% and 25.0%
‡‡‡ Coefficient of variation between 25.1% and 33.3%
-- Amount too small to provide reliable estimate

Measures of work characteristics

The data in this article dealing with occupation, self-employment, shift work and multiple job-holding were derived from the first, or 1994/95, cycle of the National Population Health Survey (NPHS).

Occupation was categorized as white-collar (administrative and professional); clerical, sales or service; and blue-collar, based on the 1980 Standard Occupational Classification (SOC) system.

Respondents were asked if they "worked mainly for others for wages, salary, or commission, or in their own business, farm or professional practice." The latter were classified as *self-employed*. Unpaid family workers were excluded from the analysis (5 respondents).

Respondents who reported working anything but a regular daytime shift were coded as *shift workers* (including evening shift, night shift, rotating shift, split shift, irregular/on call schedule or other).

Some individuals had more than one job at the same time during the reference year. Those who held two or more jobs concurrently throughout 1994/95 were classified as *multiple job holders*.

When a respondent had more than one job during the reference year, the questions on occupation, self-employment, and shift work were asked about the job the respondent considered to be his or her main job.

For each job, respondents were asked how many hours per week they usually worked at that job. In addition, dates were collected for each job so that it was possible to calculate the number of weeks the respondent worked at the job during the year. With this information, the average number of hours worked per week during the reference year was calculated across all jobs. This was done for both reference years on the longitudinal file. Reference year 1994/95 is the year before the interview date of the 1994/95 survey, and reference year 1996/97 is the year before the interview date of the 1996/97 survey.

Individuals were classified as working standard hours if, on average, they worked 35 to 40 hours per week, and as working long hours if, on average, they worked 41 or more hours. The analysis in this article is based only on individuals who worked 35 or more hours per week throughout reference year 1994/95.

The pattern of *working hours* was examined across reference years by identifying the following categories:

- standard-standard: individuals who, on average, worked standard hours the entire year both reference years
- standard-long: individuals who worked the entire year both reference years, and who, on average, worked standard hours in reference year 1994/95 and long hours in reference year 1996/97
- standard-reduced: individuals who, on average, worked standard hours for the entire 1994/95 reference year, and who reduced their hours to less than 35 per week or did not work all 52 weeks of reference year 1996/97
- long-long: individuals who, on average, worked long hours the entire year both reference years
- long-reduced: individuals who, on average, worked long hours for the entire 1994/95 reference year, and who reduced their hours to less than 41 per week or did not work all 52 weeks of reference year 1996/97

The questions on job strain, job insecurity, and supervisor support were asked in the 1994/95 survey about the job the respondent had at the time of the interview. To measure *job strain*, respondents were asked to rank their responses to the following seven statements using a 5-point scale ranging from "strongly agree" (a score of 1) to "strongly disagree" (a score of 5).

1. Your job requires that you learn new things (reverse score).
2. Your job requires a high level of skill (reverse score).
3. Your job allows you freedom to decide how you do your job (reverse score).
4. Your job requires that you do things over and over.
5. Your job is very hectic (reverse score).
6. You are free from conflicting demands that others make.
7. You have a lot to say about what happens in your job (reverse score).

Job strain was measured as the ratio of psychological demands (items 5 and 6) to decision latitude. Items pertaining to decision latitude include skill discretion (1, 2, and 4) and decision authority (3 and 7). So that the potential contribution of each item to the scores for decision latitude and psychological demands would be equal, the summed scores of responses to the items pertaining to each were divided by 5 and 2, respectively. The ratio for job strain was then calculated by dividing the new score for psychological demands by that for decision latitude. For values of the ratio that fell in the upper quartile of the distribution for the total working population (scores equal to or greater than 1.18), the respondent was categorized in a high-strain job. Cronbach's alpha was used to assess the internal consistency of the job strain scale. The internal consistency estimate was 0.61 for decision latitude and 0.34 for psychological demands of work.

Job insecurity was measured by the statement, "Your job security is good." Respondents who replied "neither agree nor disagree," "disagree," or "strongly disagree" were categorized as experiencing job insecurity.

Supervisor support was measured by the statement, "Your supervisor is helpful in getting the job done." Respondents who said they disagreed or strongly disagreed were categorized as receiving low support from their supervisor.

Job characteristics

The propensity to work long hours was associated with several aspects of employment (see *Measures of work characteristics*). Men and women in white-collar occupations were more likely to report long hours than were those in clerical, sales and service occupations or in blue-collar occupations (Table 2). High proportions of shift workers and individuals who were self-employed worked long hours. And not surprisingly, long hours were very common among individuals who worked at more than one job or business (94% for men and 82% for women).

However, high job strain, high job insecurity and low supervisor support were not related to working hours. Among individuals who reported these situations, there were no significant differences in the proportions working long versus standard hours.

Table 2
Percentage working long hours† among men and women aged 25 to 54 who worked 35 hours or more per week throughout 1994/95, by selected employment characteristics, Canada excluding territories

	Men		Women	
	Total number	Long hours†	Total number	Long hours†
	'000	%	'000	%
Total	**4,414**	**50‡**	**2,789**	**28**
Occupation				
White-collar	1,487	56§	1,193	35§
Clerical/Sales/Service	875	46	1,192	22
Blue collar	1,843	45	275	17††
Missing	209	59	130	35††
Self-employed				
Yes	795	80§	271	67§
No	3,619	43	2,518	23
Shift worker				
Yes	976	57§	380	36§
No	3,438	48	2,409	26
Multiple job holder				
Yes	247	94§	163	82§
No	4,167	47	2,626	24
High job strain				
Yes	728	48	816	24
No	3,347	51	1,778	29
Missing	339	42	195	29††
High job insecurity				
Yes	1,189	49	778	27
No	2,886	51	1,817	28
Missing	339	42	195	29††
Low supervisor support				
Yes	724	52	444	27
No	3,351	50	2,151	28
Missing	339	42	195	29††

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
Notes: *Based on 2,181 male and 1,649 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97. A critical value of 2.40 instead of 1.96 was used when significance testing involved comparisons of three groups within a variable. Because of rounding, detail may not add to totals.*
† 41 or more hours per week
‡ Significantly higher than women
§ Significantly higher than other item(s) in category
†† Coefficient of variation between 16.6% and 25.0%
- - Amount too small to provide reliable estimate

Changing hours

Most people who worked standard hours in 1994/95 continued to do so throughout 1996/97: 64% of men and 69% of women (Table 3). Men who worked long hours in 1994/95 were likely to continue in 1996/97 (66%). However, this was not the case for women; those who worked long hours in 1994/95 were about as likely to reduce their hours as they were to continue with long hours. And the percentage of men moving from standard to long hours was close to triple the corresponding percentage for women (21% versus 8%).

Table 3
Pattern of working hours between 1994/95 and 1996/97 among men and women aged 25 to 54 who worked 35 hours or more per week throughout 1994/95, Canada excluding territories

	Men	Women
	%	
Standard hours† in 1994/95		
Continued standard hours in 1996/97	64‡	69‡
Moved to long hours in 1996/97	21§	8
Reduced hours in 1996/97	15	23††
Long hours‡‡ in 1994/95		
Continued long hours in 1996/97	66‡	48
Reduced hours in 1996/97	34	52

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
Notes: *Based on 2,164 male and 1,643 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97; 17 men and 6 women were excluded because of missing values for hours of work in 1996/97.*
† 35 to 40 hours per week
‡ Significantly higher than other item(s) in category
§ Significantly higher than reduced hours
†† Significantly higher than moved to long hours
‡‡ 41 or more hours per week

Depression

Previous studies have shown a number of mental health problems to be related to the work environment.[18-24] However, most of the emphasis has been on job strain, with little attention paid to working hours.

Of the population aged 25 to 54 who worked 35 or more hours per week throughout 1994/95, 5% of women and 3% of men were classified as having experienced "a new" major depressive episode at some time in the 12 months before their 1996/97 interview (Table 4) (see *Measures of health*). Women who worked long hours in 1994/95 had 2.2 times the odds of reporting having experienced a major depressive episode, compared with those who worked standard hours (Appendix Table B). For men, no relationship was found between depression and long working hours. However, consistent with numerous other studies, high job strain was related to depression for both sexes.[18-24]

Measures of health

Using the methodology of Kessler et al.,[38] the National Population Health Survey defines a major depressive episode (MDE) with a subset of questions from the Composite International Diagnostic Interview. These questions cover a cluster of symptoms for depressive disorder, which are listed in the *Diagnostic and Statistical Manual of Mental Disorders*.[39] Responses to these questions were scored and transformed into a probability estimate of a diagnosis of MDE. If the estimate was 0.9 or more (that is, 90% certainty of a positive diagnosis), then the respondent was considered to have experienced an MDE in the previous 12 months. Respondents were classified as having experienced a new MDE if they experienced an MDE in the year before their 1996/97 interview, but not in the year before they were interviewed in 1994/95.

The Canadian Guidelines for Healthy Weights use body mass index (BMI) to determine an acceptable range of healthy weights and to identify conditions of excess weight and underweight.[40] BMI is calculated by dividing weight in kilograms by height in metres squared. Four weight categories are identified based on BMI:

- Underweight (BMI less than 20)
- Acceptable weight (BMI 20 to 24.9)
- Some excess weight (BMI 25 to 27)
- Overweight (BMI greater than 27).

These guidelines are recommended for everyone aged 20 to 64, excluding pregnant women. In accordance with these guidelines, for this analysis, individuals whose BMI was 25 or higher in 1994/95 were classified as having *excess body weight*.

The BMI scale is intended to be used as a "continuum" where the risk of developing health problems increases with shifts away from the "generally acceptable range." Rapid changes within and between BMI categories should be considered as important indicators of potential problems.[40] To classify individuals as having an *unhealthy weight gain,* the average percentage gain was calculated separately for men and women between the two reference years for individuals whose BMI was 20 or more in 1994/95. For men, the average gain was 0.7%, with a standard deviation of 5.7%. For women, the average gain was 1.2%, with a standard deviation of 7.6%. Individuals were then classified as having an unhealthy weight *gain* if their percentage weight gain between reference years was more than one standard deviation above the mean: more than 6.4% for men and more than 8.8% for women. People who were underweight in 1994/95 were not classified as having an unhealthy weight gain, regardless of how many pounds they had gained by 1996/97.

To classify smokers, the NPHS asked respondents if they currently smoked cigarettes daily, occasionally or not at all. Daily smokers were asked how many cigarettes they smoked each day. Respondents were identified as having *increased daily smoking* if they had been occasional or non-smokers in 1994/95 and had become daily smokers by 1996/97, or if they were daily smokers in both surveys and the number of cigarettes smoked per day increased by three or more (a pack a week) between the two surveys.

To measure *alcohol consumption*, respondents were asked the number of drinks they had on each day in the week before the survey. A drink was defined as one bottle of beer or a glass of draft, one glass of wine or a wine cooler, or one drink or cocktail with one and a half ounces of liquor. Respondents were classified as having increased their alcohol consumption if the number of drinks consumed in the week before the 1996/97 interview exceeded the number consumed before the 1994/95 interview.

The *frequency of physical activity* was based on the number of times in the previous three months that respondents had participated in a leisure-time physical activity that lasted more than 15 minutes. Monthly frequency was derived as the number of times in the past three months divided by 3. Respondents were considered to have decreased their physical activity if they reported fewer periods of exercise in 1996/97 than they had in 1994/95.

Weight

Body mass index (BMI) is a measure of weight in relation to height. A BMI greater than 27 is associated with increased occurrence of hypertension, coronary heart disease and diabetes.[40-42] The 25-to-27 range is suggested as a caution zone that may lead to health problems in some people.

Among the group of workers examined in this analysis, a much higher proportion of men than women were overweight in 1994/95 (BMI greater than 27): 36% versus 23% (Table 4). Similarly, the proportion of men having some excess weight (BMI 25 to 27) was close to double that for women: 25% compared with 13%. The men with excess weight (BMI 25 or higher) weighed, on average, 196 pounds (89 kilograms); the women averaged 168 pounds (76 kilograms).

When factors such as age, education, smoking status, occupation, shift work and work stress were taken into account, men who worked long hours in 1994/95 had increased odds (1.4) of having excess body weight (data not shown). Among women, this association was not found.

Between 1994/95 and 1996/97, the average weight gain for the group of workers analyzed in this article was minimal: about 1 pound (0.45 kilograms) for men and 2 pounds (0.91 kilograms) for women. Nevertheless, approximately 10% of both men and women had an unhealthy weight gain. The men gained an average of 19 pounds (8.6 kilograms); the women, 21 pounds (9.7 kilograms).

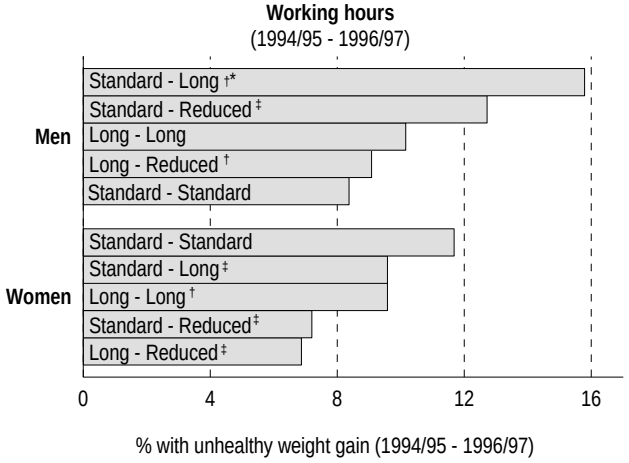
For men, moving from standard to long hours was associated with unhealthy weight gain (Chart 1).

Table 4
Selected health indicators, men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95, Canada excluding territories

	Men	Women
New major depressive episode, 1996/97 (%)	3‡	5†
Body mass index, 1994/95		
Some excess weight (BMI 25 to 27) (%)	25§	13
Overweight (BMI greater than 27) (%)	36§	23
Average weight in pounds/kilograms 1994/95	180.7/82.0§	141.7/64.3
Average weight in pounds/kilograms 1994/95 for individuals with excess weight (BMI 25 or higher)	195.7/88.8§	167.6/76.0
Weight gain, 1994/95 to 1996/97		
Average % weight gain	0.9‡	1.6†
Average gain in pounds/kilograms	1.2/0.5††	2.0/0.9‡
Unhealthy weight gain		
% with unhealthy weight gain	10	10
Average gain in pounds/kilograms	19.1/8.6	21.4/9.7
Daily smoker, 1994/95 (%)	28	25
Increase in daily smoking, 1994/95 to 1996/97 (%)	9	7
Average increase (cigarettes per day)	10	8
Increase in weekly alcohol consumption, 1994/95 to 1996/97 (%)	34§	25
Average increase (drinks per week)	6	3
Decrease in periods of leisure-time physical activity, 1994/95 to 1996/97 (%)	43	41
Average decrease (periods per month)	16§	14

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
Note: *Based on male and female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97. Excludes "missing."*
† Significantly higher than men (p = 0.05)
‡ Coefficient of variation between 16.6% and 25.0%
§ Significantly higher than women (p = 0.05)
†† Coefficient of variation between 25.1% and 33.3%

Chart 1
Percentage of men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95 and had unhealthy weight gain, by pattern of working hours between 1994/95 and 1996/97, Canada excluding territories



Data source*: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
Notes: *For both men and women, a one-tailed test was carried out to determine if the outcome measure was higher for individuals who were standard - long, compared with those who were standard - standard. Significance testing was not done for other patterns of working hours.*
† Coefficient of variation between 16.6% and 25.0%
‡ Coefficient of variation between 25.1% and 33.3%
** Significantly higher than standard - standard; one-tailed test, p = 0.05*

And even when factors such as age, education, smoking status, occupation, shift work and work stress were taken into account, men whose hours changed from standard to long had more than twice the odds (2.2) of experiencing an unhealthy weight gain, compared with men who continued to work standard hours (Appendix Table C). Among women, no significant associations were found between unhealthy weight gain and changes in working hours, although there was a significant relationship with job strain. Women classified as having high job strain in 1994/95 had increased odds (1.8) of experiencing an unhealthy weight gain by 1996/97.

Smoking

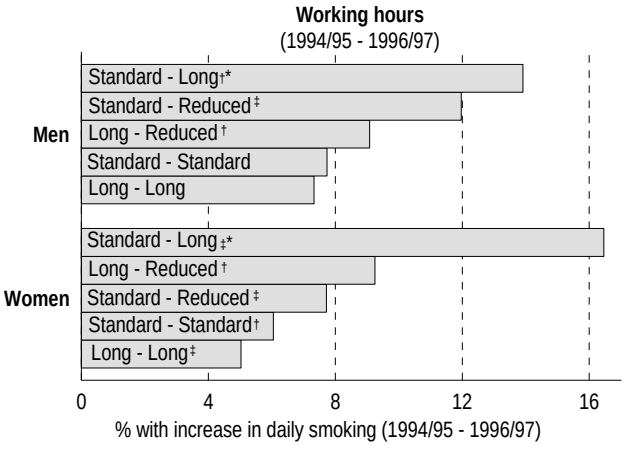
In 1994/95, 28% of the male and 25% of the female workers in this analysis were daily smokers (Table 4). There was, however, no relationship between working hours and the propensity to be a daily smoker in 1994/95 (data not shown). As well, unlike other studies that have found an association between job strain and smoking,[29,30] this analysis found no significant relationship for either sex.

Between 1994/95 and 1996/97, 9% of the male and 7% of the female workers increased their daily smoking; that is, they either became daily smokers (after being non-smokers or occasional smokers) or increased the number of cigarettes they smoked per day by at least three (Table 4). Men who increased their smoking, smoked, on average, an additional 10 cigarettes per day; for women, the average daily increase was 8.

For both sexes, changing from standard to long hours was associated with increased smoking (Chart 2). But as is true for weight gain, factors such as age and education can affect smoking behaviour. Therefore, to understand the relationship between smoking and a change in working hours, this analysis takes these factors into consideration, along with other employment characteristics such as occupation, shift work and work stress. Men who changed from standard to long hours had more than twice the odds of an increase in daily smoking, compared with men who continued to work standard hours; the corresponding odds for women were more than four times higher (Appendix Table D).

Chart 2

Percentage of men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95 and had increase in daily smoking, by pattern of working hours between 1994/95 and 1996/97, Canada excluding territories



***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

***Notes:** For both men and women, a one-tailed test was carried out to determine if the outcome measure was higher for individuals who were standard - long, compared with those who were standard - standard. Significance testing was not done for other patterns of working hours.*

† Coefficient of variation between 16.6% and 25.0%

‡ Coefficient of variation between 25.1% and 33.3%

** Significantly higher than standard - standard; one-tailed test, p = 0.05*

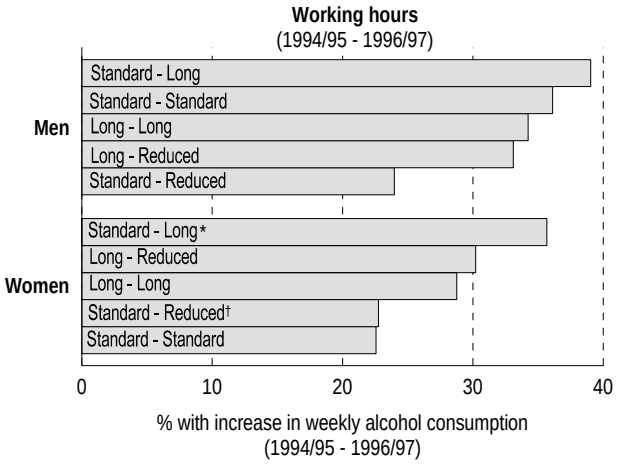
Alcohol consumption

Between 1994/95 and 1996/97, 34% of the male workers and 25% of the female workers in this analysis increased their weekly alcohol consumption (Table 4). Men who increased their consumption had, on average, an additional six drinks per week, while women had, on average, three more drinks.

Among women, higher alcohol consumption was associated with changes in working hours (Chart 3). Those who moved from standard to long hours had higher odds of increased consumption, compared with those who continued to work standard hours (Appendix Table E). Women who had worked long hours in 1994/95 and subsequently reduced their hours also had high odds of increased drinking.

For men, an increase in weekly hours was not associated with consuming more alcohol. However, those who had worked standard hours in 1994/95 and reduced their hours by 1996/97 had significantly lower odds of increasing their alcohol consumption.

Chart 3
Percentage of men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95 and had increase in weekly alcohol consumption, by pattern of working hours between 1994/95 and 1996/97, Canada excluding territories



***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Notes:** For both men and women, a one-tailed test was carried out to determine if the outcome measure was higher for individuals who were standard - long, compared with those who were standard - standard. Significance testing was not done for other patterns of working hours.*
† Coefficient of variation between 16.6% and 25.0%
** Significantly higher than standard - standard; one-tailed test, p = 0.05*

This might reflect health problems that could have prompted the reduction in hours of work. Male shift workers, too, had significantly low odds of reporting increased drinking.

Physical activity

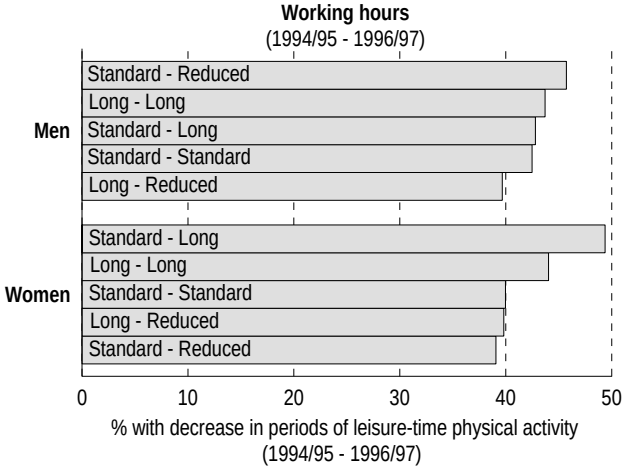
In 1994/95, the male workers included in this analysis exercised, on average, 19 times per month, while the female workers exercised 17 times per month. For both sexes, there were no significant differences in the average number of times exercising between those who worked standard and those who worked long hours (data not shown).

Between 1994/95 and 1996/97, 43% of men and 41% of women reduced the number of times they exercised. However, those who decreased their exercise tended to have had significantly higher levels to begin with: the men had exercised an average of 29 times per month in 1994/95, and the women, 27 times (data not shown). By 1996/97, these men and women had reduced their exercise level to an average of 13 times per month.

However, changes in working hours were not related to a decrease in physical activity (Chart 4). The odds that workers who moved from standard to long hours would report fewer periods of exercise were not significantly different from the odds for workers who continued with standard hours (Appendix Table F). Thus, among the four lifestyle consequences of long hours that are hypothesized by the *Karoshi* model and that are examined in this analysis, a reduction in physical activity is the only one not supported by NPHS data.

These findings are somewhat unexpected, as an increase in time on the job is likely to reduce the time available for exercise. As well, the lack of an association between hours of work and physical activity in the NPHS runs counter to the previously mentioned British study.[34] However, those researchers used a more detailed breakdown of hours of work, and detected an association between "excessively long hours" (60 or more a week) and lower levels of physical activity. Moreover, the British study did not report the relationship between changes in working hours and time devoted to physical activity.

Chart 4
Percentage of men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95 and experienced decrease in periods of leisure-time physical activity, by pattern of working hours between 1994/95 and 1996/97, Canada excluding territories



***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Notes:** For both men and women, a one-tailed test was carried out to determine if the outcome measure was higher for individuals who were standard - long, compared with those who were standard - standard. Significance testing was not done for other patterns of working hours.*

To further investigate the issue, a finer breakdown of working hours in the NPHS data was considered: standard (35 to 40 hours per week), somewhat long (41 to 59 hours), and excessively long (60 or more hours). Modest decreases in exercise levels were observed among women who moved from standard to somewhat long hours and among men who moved from somewhat long to excessively long hours. In all other cases, there were modest increases in exercise levels (data not shown). When the analysis was repeated eliminating those who did not exercise at all in 1994/95, the patterns were similar.

The inability to detect a significant association between an increase in working hours and a decrease in exercise levels may indicate that some respondents use exercise to cope with potential stressors associated with long working hours. However, a possible confounding factor may be seasonality. The time devoted to exercise varies throughout the year and tends to peak in the summer. NPHS respondents' activity levels were measured only once in each survey cycle, and individuals who increased their working hours from standard to long or somewhat long to 60 or more hours per week were more likely to have been interviewed in the summer.

Concluding remarks

From the turn of the century to the 1960s, Canada experienced a decline in working hours, which led some economists to predict a 32-hour workweek.[43] This has not happened. In fact, the proportions of men and women putting in long hours have been rising since the early 1980s.[3]

In 1994/95, half of male and over a quarter of female full-time year-round workers spent at least 41 hours a week on the job. For both sexes, long hours were associated with high educational attainment, white-collar occupations, and predictably, self-employment, shift work, and multiple job holding. For men, long hours were also associated with being aged 25 to 44, having young children at home.

Relatively little research has been devoted to the health implications of working long hours. It is not yet known whether the Japanese *Karoshi* model can be applied to Canada. However, data from the National Population Health Survey indicate that switching from standard to long hours between 1994/95 and 1996/97 increased the risk of certain negative health behaviours. Both men and women whose work schedules changed in this way had high odds of increased cigarette consumption, compared with workers who worked standard hours in both periods. Men who reported such a change in working hours had high odds of an unhealthy weight gain, compared with those who maintained standard hours. Women whose hours lengthened from standard to long had high odds of increased alcohol consumption, compared with women who continued with standard hours. In addition, women who worked long hours in 1994/95 had increased odds of subsequently experiencing depression, compared with those who worked standard hours.

In the future, as successive cycles of NPHS data become available, it will be possible to trace links between working hours and changes in lifestyle over a longer period. Associations with health outcomes in the final stages of the *Karoshi* model, such as high blood pressure and cardiovascular disease, can also be examined. ●

References

1 Morissette R, Sunter D. *What is happening to weekly hours worked in Canada?* (Statistics Canada, Catalogue 11F0019MPE) 1994; 65.

2 Sunter D, Morissette R. The hours people work. *Perspectives on Labour and Income* (Statistics Canada, Catalogue 75-001) 1994; 6(3): 8-13.

3 Sheridan M, Sunter D, Diverty B. The changing workweek: Trends in weekly hours of work. *Canadian Economic Observer* (Statistics Canada, Catalogue 11-010-XPB) September 1996: 3.1-3.21.

4 Harrington JM. *Working long hours and health.* (British Medical Journal Supplement) Birmingham, England: Institute of Occupational Health, 1994: 1581-2.

5 Uehata T. Long working hours and occupational stress-related cardiovascular attacks among middle-aged workers in Japan. *Journal of Human Ergology* 1991; 20: 147-153.

6 Nishiyama K, Johnson JV. Karoshi–Death from overwork: Occupational health consequences of Japanese production management. *International Journal of Health Services* 1997 27(4): 625-41.

7 Tambay J-L, Catlin G. Sample design of the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 29-38.

8 Swain L, Catlin G, Beaudet MP. The National Population Health Survey - its longitudinal nature. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 69-80.

9 National Population Health Survey, 1996/97. *Household Component, User's Guide for the Public Use Microdata Files* (Statistics Canada, Catalogue 82-M0009GPE) Ottawa: Statistics Canada, 1998.

10 Davidson MJ, Cooper CL. A model of occupational stress. *Journal of Occupational Medicine* 1981; 23(8): 564-74.

11 Karasek RA, Theorell T. *Healthy work: Stress, productivity and the reconstruction of working life*. New York: Basic Books, 1990.

12 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18(2): 209-17.

13 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 283-310.

14 Frederick JA. *As time goes by ... Time use of Canadians* (Statistics Canada, Catalogue 89-544) Ottawa: Statistics Canada, 1995.

15 Spurgeon A, Harrington JM, Cooper CL. Health and safety problems associated with long working hours: a review of the current position. *Occupational and Environmental Medicine* 1997; 54: 367-375.

16 Benimadhu P. *Hours of work: Trends and attitudes in Canada*. A Conference Board of Canada report from the Compensation Research Centre, Report 18-87. Ottawa, 1987.

17 World Health Organization Expert Committee. *Identification and control of work-related disease*. (WHO Technical Report No. 714), Geneva: World Health Organization, 1985.

18 Bourbonnais R, Brisson C, Moisan J, et al. Job strain and psychological distress in white-collar workers. *Scandinavian Journal of Work, Environment and Health* 1996; 22(2): 139-45.

19 Braun S, Hollander, RB. Work and depression among women in the Federal Republic of Germany. *Women and Health* 1988; 14(2): 3-26.

20 Karasek RA. Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative Science Quarterly* 1979; 24: 285-308.

21 Landsbergis PA. Occupational stress among health care workers: A test of the job demands-control model. *Journal of Organizational Behaviour* 1988; 9: 217-39.

22 Lerner DJ, Levine S, Malspeis S, et al. Job strain and health-related quality of life in a national sample. *American Journal of Public Health* 1994; 84(10): 1580-5.

23 Williams RB, Barefoot JC, Blumenthal JA, et al. Psychosocial correlates of job strain in a sample of working women. *Archives of General Psychiatry* 1997; 54: 543-8.

24 Stansfeld SA, Fuhrer R, Head J, et. al. Work and psychiatric disorder in the Whitehall II study. *Journal of Psychosomatic Research* 1997; 43(1): 73-81.

25 Light KC, Turner JR, Hinderliter AL. Job strain and ambulatory work blood pressure in healthy young men and women. *Hypertension* 1992; 20(2): 214-8.

26 Bosma H, Marmot MG, Hemingway H, et al. Low job control and risk of coronary heart disease in Whitehall II (prospective cohort) study. *British Medical Journal* 1997; 314: 558-65.

27 Karasek R, Baker D, Marxer F, et. al. Job decision latitude, job demands, and cardiovascular disease: a prospective study of Swedish men. *American Journal of Public Health* 1981; 71(7) 694-705.

28 Wilkins K, Beaudet MP. Work stress and health. *Health Reports* (Statistics Canada, Catalogue 82-003) 1998; 10(3): 47-62.

29 Hellerstedt WL, Jeffery RW. The association of job strain and health behaviours in men and women. *International Journal of Epidemiology* 1997; 26(3) 575-583.

30 Green KL, Johnson JV. The effects of psychosocial work organization on patterns of cigarette smoking among male chemical plant employees. *American Journal of Public Health* 1990; 80(11) 1368-71.

31 Karasek R, Gardell B, Lindell J. Work and non-work correlates of illness and behaviour in male and female Swedish white collar workers. *Journal of Occupational Behaviour* 1987; 8: 187-207.

32 Nakamura K, Shimai S, Kikuchi S, et. al. Increases in body mass index and waist circumference as outcomes of working overtime. *Occupational Medicine* 1998; 48(3): 169-173.

33 Maruyama S, Morimoto K. Effects of long workhours on life-style, stress and quality of life among intermediate Japanese managers. *Scandinavian Journal of Work, Environment and Health* 1996; 22(5): 353-59.

34 Sease R, Scales J. *Work now - pay later? The impact of long work hours on health and family life*. (Technical Paper No. 17) Colchester, England: Institute for Social and Economic Research, 1998.

35 Sokejima S, Kagamimori S. Working hours as a risk factor for acute myocardial infaction in Japan: case control study. *British Medical Journa*l 1998; 317: 775-80.

36 Hayashi T, Kobayashi Y, Yamaoka K, et al. Effect of overtime work on 24-hour ambulatory blood pressure. *Journal of Occupational and Environmental Medicine* 1996; 38(10): 1007-11.

37 Iwasaki K, Sasaki T, Oka T, et al. Effect of working hours on biological functions related to cardiovascular system among salesmen in a machinery manufacturing company. *Industrial Health* 1998; 36: 361-7.

38 Kessler RC, McGonagle KA, Zhao S, et al. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: Results from the national comorbidity survey. *Archives of General Psychiatry* 1994; 51(1): 8-19.

39 American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 3rd rev. ed. Washington, D.C.: American Psychiatric Association, 1987.

40 National Health and Welfare. *Canadian Guidelines for Healthy Weights*. Report of an Expert Group convened by Health Promotion Directorate, Health Services and Promotion Branch. Ottawa: Minister of National Health and Welfare, 1988.

41 Reeder BA, Angel A, Ledoux M, et. al. Obesity and its relation to cardiovascular disease risk factors in Canadian adults. *Canadian Medical Association Journal* 1992; 146(11): 2009-19.

42 Gilmore J. Body mass index and health. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(1): 31-43.

43 Hameed SMA. Four day, 32 hour work week: Analysis and prospects. In: *Three or Four Work Day Work Week*, edited by SMA Hameed and GS Paul, 5-30. Edmonton: Faculty of Business Administration, The University of Alberta, 1974.

Appendix

Table A

Longitudinal sample aged 25 to 54 working 35 or more hours per week throughout 1994/95, by sex, Canada excluding territories

	Men	Women
Total	2,181	1,649
Occupation		
White-collar	728	723
Clerical/Sales/Service	412	714
Blue collar	954	133
Missing	87	79
Self-employed		
Yes	392	147
No	1,789	1,502
Shift worker		
Yes	508	248
No	1,673	1,401
Multiple job holder		
Yes	139	98
No	2,042	1,551
High job strain		
Yes	365	485
No	1,696	1,070
Missing	120	94
High job insecurity		
Yes	594	466
No	1,467	1,089
Missing	120	94
Low supervisor support		
Yes	357	258
No	1,704	1,297
Missing	120	94
Age		
25-34	754	622
35-44	799	619
45-54	628	408
Education		
Secondary graduation or less	735	426
Some postsecondary	521	446
Postsecondary graduation	921	775
Missing	4	2
Marital status		
Married	1,574	1,056
Never married	391	302
Previously married	216	290
Missing	--	1
Child(ren) under age 12 in household		
Yes	775	557
No	1,406	1,092
Household income		
Lowest/Lower-middle/Middle	590	487
Upper-middle	1,039	794
Highest	458	324
Missing	94	44

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Note: *Includes only longitudinal respondents for whom non-proxy 1994/95 and 1996/97 information was available.*

-- Nil

Table B

Adjusted odds ratios relating selected characteristics to probability of major depressive episode in 1996/97 among men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95, Canada excluding territories

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Long working hours†	0.6	0.3, 1.3	2.2*	1.1, 4.4
White-collar†	0.5	0.2, 1.4	1.6	0.8, 3.1
Self-employed†	- -	...	0.2	0.0, 3.2
Shift worker†	0.7	0.3, 1.6	2.3	0.9, 6.0
Multiple job holder†	- -	...	- -	...
Work stress				
High job strain†	3.3*	1.3, 8.5	2.1*	1.1, 4.0
High job insecurity†	1.6	0.7, 4.1	1.0	0.5, 1.9
Low supervisor support†	0.6	0.0, 26.5	1.4	0.7, 2.9
Age				
25-34‡	1.0	...	1.0	...
35-44	1.0	0.3, 2.7	0.8	0.4, 1.6
45-54	0.9	0.2, 3.1	0.9	0.3, 2.5
Married†	0.8	0.2, 2.6	0.9	0.4, 2.1
Child(ren) under age 12 in household†	2.6	0.8, 8.0	1.4	0.6, 3.3
Education				
Secondary graduation or less‡	1.0	...	1.0	...
Some postsecondary	0.5	0.1, 1.7	0.3*	0.1, 0.8
Postsecondary graduation	0.5	0.2, 1.2	0.5	0.3, 1.0
Household income				
Lowest/Lower-middle/Middle	0.2*	0.0, 0.7	1.8	0.6, 5.3
Upper-middle	0.3*	0.1, 0.9	1.7	0.7, 4.3
Highest‡	1.0	...	1.0	...

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Notes: *Based on 2,151 male and 1,632 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97; 46 men and 75 women were categorized as having a major depressive episode in reference year 1996/97. "Missing" categories for occupation, income and work stress variables were included in the model to maximize sample size; however, their respective odds ratios are not shown. Unless otherwise noted, all characteristics refer to 1994/95.*

† Reference category is absence of characteristic; for example, the reference category for long working hours is standard working hours.

‡ Reference category for which odds ratio is always 1.0

- - Sample counts were very low for the number of individuals experiencing a major depressive episode for certain variables in the models; namely self-employed men (4), men with multiple jobs (4) and women with multiple jobs (5). This resulted in instability in the regression models and, therefore, these variables were removed from the models. The conclusions based on the analysis were similar regardless of whether these variables were included.

** $p \leq 0.05$*

··· Not appropriate

Table C

Adjusted odds ratios relating selected characteristics to unhealthy weight gain between 1994/95 and 1996/97 among men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95, Canada excluding territories

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Working hours (1994/95 - 1996/97)				
Standard - standard†	1.0	...	1.0	...
Standard - long	2.2*	1.2, 4.0	0.8	0.3, 2.2
Standard - reduced	1.5	0.7, 3.4	0.6	0.2, 1.3
Long - long	1.3	0.8, 2.1	0.9	0.4, 1.9
Long - reduced	1.2	0.6, 2.1	0.5	0.2, 1.1
Occupation				
White-collar‡	0.7	0.4, 1.0	0.7	0.4, 1.2
Self-employed‡	1.0	0.6, 1.7	0.8	0.3, 2.1
Shift worker‡	1.3	0.8, 1.9	1.6	0.9, 3.1
Multiple job holder‡	1.0	0.5, 1.9	1.7	0.6, 4.7
Work stress				
High job strain‡	1.0	0.6, 1.7	1.8*	1.0, 3.2
High job insecurity‡	1.3	0.8, 1.9	0.9	0.5, 1.5
Low supervisor support‡	0.9	0.6, 1.5	1.1	0.6, 2.3
Age				
25-34†	1.0	...	1.0	...
35-44	1.1	0.8, 1.7	0.9	0.5, 1.6
45-54	0.8	0.5, 1.2	0.6	0.3, 1.3
Married‡	0.6	0.4, 1.0	0.9	0.5, 1.5
Child(ren) under age 12 in household‡	0.8	0.5, 1.2	0.9	0.5, 1.7
Education				
Secondary graduation or less†	1.0	...	1.0	...
Some postsecondary	0.8	0.5, 1.3	0.7	0.3, 1.3
Postsecondary graduation	1.0	0.6, 1.5	0.9	0.4, 1.8
Household income				
Lowest/Lower-middle/ Middle	0.8	0.4, 1.5	2.0	0.8, 4.6
Upper-middle	1.0	0.6, 1.6	1.2	0.6, 2.6
Highest†	1.0	...	1.0	...
Daily smoker (1996/97)‡	0.7	0.4, 1.1	0.6	0.3, 1.2

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Notes: *Based on 2,134 male and 1,512 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97; 228 men and 144 women were categorized as having an unhealthy weight gain between reference years. "Missing" categories for occupation, income and work stress were included in the model to maximize sample size; however, their respective odds ratios are not shown. Because of rounding, some confidence intervals with 1.0 as the lower limit were significant. Unless otherwise noted, all characteristics refer to 1994/95.*

† Reference category, for which odds ratio is always 1.0

‡ Reference category is absence of characteristic; for example, the reference category for self-employed is paid worker.

** $p \leq 0.05$*

··· Not appropriate

Table D

Adjusted odds ratios relating selected characteristics to increased daily smoking between 1994/95 and 1996/97 among men and women aged 25 to 54 who worked 35 more hours per week throughout 1994/95, Canada excluding territories

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Working hours (1994/95 - 1996/97)				
Long - long	1.1	0.6, 2.0	1.0	0.3, 2.9
Standard - long	2.2*	1.1, 4.5	4.1*	1.4, 11.6
Long - reduced	1.2	0.6, 2.3	1.7	0.8, 4.0
Standard - reduced	1.7	0.7, 4.2	1.3	0.6, 2.8
Standard - standard†	1.0	...	1.0	...
Occupation				
White-collar‡	0.6	0.3, 1.0	0.4*	0.2, 0.8
Self-employed‡	0.5*	0.3, 0.9	0.9	0.3, 2.4
Shift worker‡	1.0	0.6, 1.9	1.3	0.5, 3.1
Multiple job holder‡	1.5	0.6, 3.9	1.2	0.4, 3.8
Work stress				
High job strain‡	1.0	0.6, 1.7	0.9	0.5, 1.6
High job insecurity‡	0.7	0.4, 1.1	1.4	0.8, 2.3
Low supervisor support‡	0.9	0.5, 1.6	1.3	0.7, 2.7
Age				
25-34†	1.0	...	1.0	...
35-44	0.7	0.4, 1.2	0.9	0.5, 1.8
45-54	0.6	0.3, 1.1	0.9	0.4, 2.1
Married‡	0.9	0.5, 1.6	0.5*	0.3, 0.9
Child(ren) under age 12 in household‡	1.0	0.6, 1.7	1.2	0.6, 2.3
Education				
Secondary graduation or less†	1.0	...	1.0	...
Some postsecondary	1.0	0.6, 1.7	0.5	0.3, 1.1
Postsecondary graduation	0.5*	0.3, 0.9	0.4*	0.2, 0.7
Household income				
Lowest/Lower-middle/ Middle	0.9	0.5, 1.7	0.6	0.2, 1.4
Upper-middle	0.9	0.5, 1.6	0.7	0.3, 1.6
Highest†	1.0	...	1.0	...

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Notes: *Based on 2,156 male and 1,637 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97; 189 men and 118 women had increased their smoking between reference years. "Missing" categories for occupation, income and work stress variables were included in the model to maximize sample size; however, their respective odds ratios are not shown. Unless otherwise noted, all characteristics refer to 1994/95.*

† Reference category for which odds ratio is always 1.0

‡ Reference category is the absence of characteristic; for example, the reference category for self-employed is paid worker.

** $p \leq 0.05$*

··· Not appropriate

Table E

Adjusted odds ratios relating selected characteristics to increased weekly alcohol consumption between 1994/95 and 1996/97 among men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95, Canada excluding territories

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Working hours (1994/95 - 1996/97)				
Long - long	0.9	0.6, 1.3	1.5	0.9, 2.5
Standard - long	1.1	0.7, 1.7	2.0*	1.1, 3.4
Long - reduced	0.8	0.6, 1.3	1.6*	1.0, 2.6
Standard - reduced	0.5*	0.3, 0.9	1.0	0.6, 1.5
Standard - standard†	1.0	···	1.0	···
Occupation				
White-collar‡	0.9	0.7, 1.2	1.0	0.7, 1.4
Self-employed‡	1.1	0.8, 1.5	0.9	0.5, 1.7
Shift worker‡	0.7*	0.5, 1.0	0.9	0.6, 1.5
Multiple job holder‡	1.0	0.6, 1.9	0.6	0.3, 1.3
Work stress				
High job strain‡	1.1	0.8, 1.6	1.0	0.7, 1.4
High job insecurity‡	0.9	0.7, 1.2	1.1	0.7, 1.5
Low supervisor support‡	1.1	0.8, 1.6	1.1	0.7, 1.7
Age				
25-34†	1.0	···	1.0	···
35-44	1.0	0.7, 1.3	0.7	0.5, 1.0
45-54	0.7	0.5, 1.0	0.9	0.6, 1.4
Married‡	0.9	0.7, 1.3	1.1	0.8, 1.5
Child(ren) under age 12 in household‡	1.1	0.8, 1.5	0.8	0.5, 1.1
Education				
Secondary graduation or less†	1.0	···	1.0	···
Some postsecondary	0.8	0.6, 1.1	1.0	0.7, 1.6
Postsecondary graduation	0.8	0.6, 1.0	1.2	0.7, 1.9
Household income				
Lowest/Lower-middle/ Middle	0.8	0.5, 1.2	1.2	0.7, 2.1
Upper-middle	0.9	0.7, 1.3	1.2	0.8, 1.9
Highest†	1.0	···	1.0	···

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Notes: *Based on 2,120 male and 1,626 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97; 696 men and 408 women increased their weekly alcohol consumption between reference years. "Missing" categories for occupation, income and work stress variables were included in the model to maximize sample size; however, their respective odds ratios are not shown. Because of rounding, some confidence intervals with 1.0 as the lower/upper limit were significant. Unless otherwise noted, all characteristics refer to 1994/95.*

† Reference category for which odds ratio is always 1.0

‡ Reference category is the absence of characteristic; for example, the reference category for self-employed is paid worker.

** $p \leq 0.05$*

··· Not appropriate

Table F

Adjusted odds ratios relating selected characteristics to decreased physical activity between 1994/95 and 1996/97 among men and women aged 25 to 54 who worked 35 or more hours per week throughout 1994/95, Canada excluding territories

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Working hours (1994/95 - 1996/97)				
Long - long	1.1	0.8, 1.4	1.1	0.7, 1.7
Standard - long	1.0	0.7, 1.6	1.4	0.8, 2.3
Long - reduced	0.9	0.7, 1.3	0.9	0.6, 1.4
Standard - reduced	1.2	0.7, 1.9	1.0	0.6, 1.5
Standard - standard†	1.0	···	1.0	···
Occupation				
White-collar‡	0.9	0.7, 1.2	1.0	0.7, 1.4
Self-employed‡	1.1	0.8, 1.5	1.1	0.7, 1.9
Shift worker‡	1.0	0.7, 1.2	0.9	0.6, 1.4
Multiple job holder‡	0.9	0.6, 1.5	1.0	0.5, 1.8
Work stress				
High job strain‡	1.0	0.7, 1.4	0.8	0.6, 1.2
High job insecurity‡	1.1	0.8, 1.4	0.9	0.7, 1.2
Low supervisor support‡	0.9	0.7, 1.3	1.0	0.7, 1.5
Age				
25-34†	1.0	···	1.0	···
35-44	0.9	0.7, 1.2	0.9	0.7, 1.3
45-54	1.1	0.8, 1.4	0.8	0.6, 1.2
Married‡	1.0	0.7, 1.3	0.9	0.6, 1.2
Child(ren) under age 12 in household‡	1.1	0.8, 1.4	1.0	0.7, 1.3
Education				
Secondary graduation or less†	1.0	···	1.0	···
Some postsecondary	1.0	0.7, 1.3	1.1	0.8, 1.7
Postsecondary graduation	1.0	0.8, 1.4	1.1	0.8, 1.6
Household income				
Lowest/Lower-middle/ Middle	0.8	0.6, 1.2	1.0	0.6, 1.5
Upper-middle	1.2	0.9, 1.6	0.7	0.5, 1.0
Highest†	1.0	···	1.0	···

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

Notes: *Based on 2,153 male and 1,635 female longitudinal respondents for whom non-proxy information was available for 1994/95 and 1996/97; 952 men and 655 women decreased their physical activity between reference years. "Missing" categories for occupation, income and work stress variables were included in the model to maximize sample size; however, their respective odds ratios are not shown. Unless otherwise noted, all characteristics refer to 1994/95.*

† Reference category for which odds ratio is always 1.0

‡ Reference category is the absence of characteristic; for example, the reference category for self-employed is paid worker.

··· Not appropriate

Hormone replacement therapy and incident arthritis

Kathryn Wilkins

Abstract

Objectives

This article provides estimates of the incidence of arthritis between 1994/95 and 1996/97 among women aged 38 or older. It also examines the association between hormone replacement therapy (HRT) and a new diagnosis of arthritis by 1996/97.

Data source

The data are from the household component of the National Population Health Survey, conducted by Statistics Canada. Results are based on a sample of 2,673 female respondents who reported that they did not have arthritis in 1994/95. This sample, when weighted, represents 4.3 million women.

Analytical techniques

Two-year incidence of arthritis was estimated using weighted bivariate frequencies. Associations of arthritis with HRT use and numerous covariates were examined using multivariate logistic regression.

Main results

In the two years between 1994/95 and 1996/97, about 8% of women (338,600) aged 38 or older were newly diagnosed with arthritis. The odds of incident arthritis for current HRT users who had used hormones for five years or longer were twice as high as for non-users. These results persisted even after controlling for potential confounders including age, number of medical visits, and body mass index.

Key words

estrogen replacement therapy, incidence, longitudinal studies, health surveys

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Arthritis is a major cause of pain, long-term disability, activity restriction and medication use.[1-3] Its etiology is not fully understood. However, it is known that osteoarthritis—the most common form of the disease—develops more frequently in women than men beginning at midlife,[4] and the risk is higher among women who have undergone surgical removal of their ovaries.[5]

Although numerous studies have addressed possible hormonal influences on the development of osteoarthritis, the results of these studies are contradictory.[5-14] In recent years, reports on the possible role of hormone replacement therapy (HRT) in preventing osteoarthritis have appeared. Curiously, in some studies that hypothesized and reported a "protective" effect of HRT, the associations observed were not statistically significant.[5,7,8,14] Other studies did find significantly lower prevalence of osteoarthritis among HRT users than among non-users, but the cross-sectional design of the research limits the interpretation of the findings.[9,10] Yet another study reported no association between HRT and osteoarthritis, once the confounding effects of obesity and health care utilization were controlled.[11]

Methods

Data source

This article is based on Statistics Canada's National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years.[15,16] It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both a longitudinal and a cross-sectional component. Respondents who are part of the longitudinal component will be followed for up to 20 years.

Individual data are organized into two files: General and Health. Socio-demographic and some health information was obtained for each member of participating households. These data are found in the General file. Additional, in-depth health information was collected for one randomly selected household member. The in-depth health information, as well as the information in the General file pertaining to that individual, is found in the Health file.

Among households in the longitudinal component, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for the household in cycle 1 and was usually the person who provided information on all household members for the General file in cycle 2.

The 1994/95 provincial, non-institutional 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, 20,725 households remained in scope.[17] In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents. Of these 17,626 randomly selected respondents, 14,786 were eligible members of the NPHS longitudinal panel, along with 468 persons for whom only general information was collected. And 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible. Thus, 17,276 respondents were eligible for re-interview in 1996/97. Interviews of the remaining respondents were sponsored by provincial governments that elected to enlarge the sample size in their province for cycle 1 only. These respondents were not followed up.

A response rate of 93.6% was achieved for the longitudinal panel in 1996/97. Of these 16,168 respondents, 15,670 provided full information; that is, general and in-depth health information for both cycles of the survey.

This analysis of hormone replacement therapy (HRT) and subsequent diagnosis of arthritis is based on longitudinal data from the household component of the first (1994/95) and second (1996/97) cycles of the NPHS for the 10 provinces. The data were weighted to reflect the sample design, adjustments for non-response, and post-stratification. The findings are based on female respondents who did not have arthritis/rheumatism and were aged 38 or older in 1994/95, and for whom complete data were provided in both interviews. The resulting sample was 2,673, weighted to represent 4.3 million women (see Appendix Table A).

Analytical techniques

With data from the longitudinal file, cross-tabulations were used to estimate disease incidence. Multiple logistic regression was used to model the relationships between HRT and self-report of physician-diagnosed incident arthritis/rheumatism in women who were aged 38 or older in 1994/95. The lower age limit for this article was specified as 38 because by 1996/97 women this age would have entered the perimenopausal period, generally defined as beginning at age 40.[18] To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.[19,20]

HRT was considered according to duration of use before the cycle 2 interview. (Because duration of HRT use was collected in 1996/97, but not in 1994/95, only data from the cycle 2 interview were used for information on HRT.) A variable for HRT use of five years or longer was included in the regression model. The reference category for this variable was not using HRT.

The analysis incorporated factors observed in previous research to be associated with the development or diagnosis of arthritis, as well as others noted to arise as a consequence of this disease. Most variables in multiple logistic regression modelling of incident arthritis were based on data collected in 1994/95. They included age, smoking history, level of physical activity, self-reported health, and body mass index. A variable for the frequency of contacts with a physician was based on data collected in 1996/97. Frequency of contacts was measured as the reported number of visits to a family doctor or general practitioner in the 12 months before the cycle 2 interview. The variable was categorized as 0 to 2 visits or 3 or more visits.

A household member other than the selected longitudinal respondent could provide information about chronic conditions, including arthritis/rheumatism. To account for possible effects of the information source on the report of incident arthritis, a variable for proxy reporting (whether the data in either cycle were reported by the respondent to whom they pertain, or by another household member) was included in the multiple regression model, but the results are not shown.

An opposing viewpoint posits that because HRT prevents bone loss, and higher bone mass is associated with an increased risk of osteoarthritis in older women, HRT may actually *increase* the risk. In the United States, a case-control study indicated that women with osteoarthritis were significantly more likely to be taking HRT than those without the disease,[21] and a cross-sectional study showed that women with osteoarthritis who were using HRT had significantly worse joint deterioration than did women who were not using HRT.[12] As well, a population-based, longitudinal study in the United States recently reported a positive association between HRT and incident arthritis.[6] This investigation's prospective design, together with the observation of a positive gradient in risk of incident arthritis with length of HRT use, enhances the plausibility of its findings. Nonetheless, evidence of a positive association between HRT and osteoarthritis is still limited.

Altogether, there is no consistency in findings on the association of HRT with arthritis, and certainly no consensus on whether HRT is beneficial, harmful or immaterial in the development of this chronic and potentially debilitating disease. The availability of longitudinal data from the first two cycles (1994/95 and 1996/97) of the National Population Health Survey (NPHS) provides the relatively rare opportunity to study hormone replacement therapy in relation to incident arthritis (see *Methods*, *Limitations* and *Definitions*). The NPHS collects information on a variety of health-related, behavioural and socio-demographic characteristics, so the analysis can control for the effects of factors known to be confounders of the HRT–arthritis relationship.

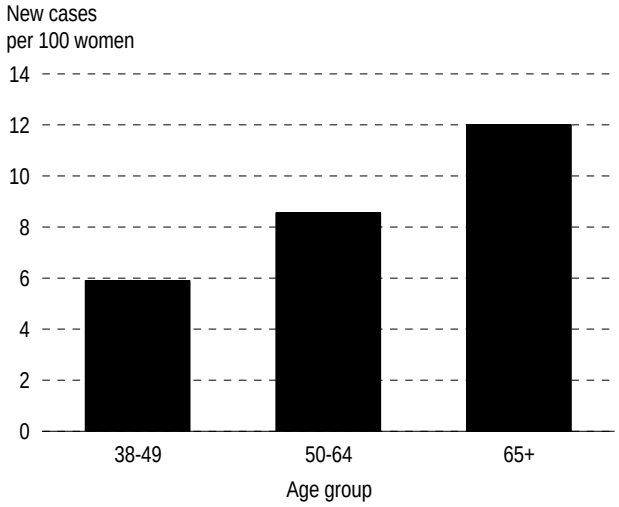
The purpose of this article is to improve understanding of the association between HRT and the subsequent development of arthritis, using population-based data that represent women aged 38 or older residing in Canadian households. This issue is especially important given the substantial number of Canadian women using hormones. Cross-sectional data from the NPHS show that nearly 1 million women aged 40 or older (15%) were using HRT in 1996/97, up from close to 800,000 (13%) in 1994/95. And among those aged 50 to 64, more than one-quarter (28%) reported HRT use in 1996/97 (data not shown).

One in twelve developed arthritis

Among women aged 38 or older who did not have arthritis/rheumatism at the time of the NPHS cycle 1 interview in 1994/95, an estimated 8% (338,600) had been diagnosed with the disease by the time of their cycle 2 interview in 1996/97. Two-year incidence rates rose sharply with age; for wormen aged 65 or older, the rate was twice that for women aged 38 to 49 (Chart 1). Because the NPHS questionnaire asks simply if a respondent has "arthritis or rheumatism," it is not possible to differentiate between specific disorders such as rheumatoid arthritis and osteoarthritis. However, prevalence studies show that osteoarthritis is by far the most common form of the disease[4] (see also *Arthritis and rheumatism*).

The rate of incident arthritis differed significantly with three characteristics studied: age, number of physician visits and years of HRT use (Table 1). As expected, the two-year incidence rate was significantly higher among women aged 65 or older than among 38- to 49-year- olds. Not surprisingly,

Chart 1
Two-year incidence rate of arthritis/rheumatism, women aged 38 or older in 1994/95, by age group, household population, Canada excluding territories



***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*

a new diagnosis of arthritis was more frequent among those who consulted physicians more often. Among women who had visited a general practitioner or their family doctor three or more times during the 12 months before the cycle 2 interview, 13 per 100 received a new diagnosis of arthritis sometime in the two-year interval. In contrast, the rate was 5 per 100 women who reported none or fewer than three doctor visits.

The two-year incidence rate of arthritis was also significantly high for long-term HRT users (five years or more), but only in comparison with women who reported less than five years of use. Among long-term users, 13 per 100 had been newly diagnosed by 1996/97, compared with 8 per 100 who were not HRT users. But because of the small sample size for long-term HRT use, the difference in these two rates is not statistically significant.

Long-term HRT linked to arthritis

Age, doctor visits and long-term HRT use tend to be related. Yet even after controlling for age and other potential confounders, the odds of incident arthritis among long-term HRT users were twice as high as for non-users (Table 2).

This analysis focussed on women who reported in 1994/95 that they did not have arthritis. Of these, women who reported HRT use of five years or more

Table 1
Two-year incidence rate of arthritis/rheumatism, women aged 38 or older in 1994/95, by selected characteristics, household population, Canada excluding territories

Characteristics	New cases per 100 women
Age group in 1994/95†	
38-49	5.9
50-64	8.6
65+	12.0‡
Self-reported health in 1994/95	
Good/Very good/Excellent	7.7
Fair/Poor	10.9§
Physician visits in past 12 months, 1996/97	
0-2	4.8
3+	12.7††
Smoking status in 1994/95	
Occasionally/ None	8.1
Daily	7.5§
Physical activity level in 1994/95	
Moderate/Active	7.9
Inactive	7.8
Body mass index in 1994/95	
Lower 2 tertiles (< 26.48)	7.1
Upper tertile (≥ 26.48)	9.8
Years of hormone replacement therapy as of 1996/97†	
None	7.8
< 5	4.9‡‡
5+	13.3§§

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
† A critical value of 2.40 instead of 1.96 was used to account for multiple comparisons.
‡ Significantly higher than the rate for 38-49 age group
§ Coefficient of variation between 16.6% and 25.0%
†† Significantly higher than the rate for 0-2 physician visits ($p \leq 0.05$)
‡‡ Coefficient of variation between 25.1% and 33.3%
§§ Significantly higher than the rate for < 5 years HRT

Table 2
Adjusted odds ratios for two-year incidence of arthritis/rheumatism, women aged 38 or older in 1994/95, by selected characteristics, household population, Canada excluding territories

Characteristics	Odds ratio	95% confidence interval
Age group in 1994/95		
38-64†	1.0	…
65+	1.6*	1.0, 2.4
Self-reported health status in 1994/95		
Good/Very good/Excellent†	1.0	…
Fair/Poor	1.0	0.5, 1.8
Physician visits in past 12 months, 1996/97		
0-2†	1.0	…
3+	2.8*	1.9, 4.1
Smoking status in 1994/95		
Occasionally/None†	1.0	…
Daily	1.0	0.6, 1.6
Physical activity level in 1994/95		
Moderate/Active†	1.0	…
Inactive	1.0	0.7, 1.4
Body mass index in 1994/95		
Lower two tertiles† (BMI < 26.48)	1.0	…
Upper tertile (BMI ≥ 26.48)	1.3	0.9, 1.9
Years of hormone replacement therapy as of 1996/97		
None†	1.0	…
< 5	0.6	0.3, 1.2
5+	2.0*	1.0, 3.8

***Data source:** 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
***Notes**: A variable for proxy-report was also entered into the model; the odds ratio is not shown. Analysis is based on a sample of 2,604; 69 were omitted from the analysis because of missing values. Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.*
**$p \leq 0.05$*
† Reference category, for which odds ratio is always 1.0
··· Not applicable

in 1996/97 would have been using HRT for at least three years when they were first interviewed in 1994/95. The association between HRT and arthritis was observed for these women, but not for women who had used HRT for shorter periods when compared with women who were not current users at the time of the 1996/97 interview.

The positive association between HRT and subsequent onset of arthritis, based on NPHS data, supports recent results from another longitudinal study conducted over a much longer time in the United States.[6] In that study, which was also based

Limitations

The National Population Health Survey (NPHS) asked simply about "arthritis or rheumatism," so it is not possible to differentiate specific types of arthritic disease. Because osteoarthritis is far more prevalent than any other arthritic condition (see *Arthritis and rheumatism*), the variables included in the analysis were selected on the basis of their reported associations with osteoarthritis.[3] However, if some covariates relate to osteoarthritis differently from the way they relate to other conditions that were reported as "arthritis or rheumatism," the observed association would be weakened. For example, if HRT were negatively associated with rheumatoid arthritis but positively associated with osteoarthritis, pooling all women with diagnoses of "arthritis/rheumatism" would dilute the positive association that existed between HRT and osteoarthritis.

For this analysis, self-reported medical diagnosis of arthritis or rheumatism in women who reported that they had not previously received such a diagnosis was defined as incident arthritis. A limitation of this definition is that self-selection may affect both the opportunity for diagnosis as well as the stage at which a disease is diagnosed. Therefore, the "incidence" of arthritis does not correspond to the actual onset of clinically detectable disease or appearance of symptoms for all women.

Since only cycle 2 data on HRT use were used for the analysis, women who had used HRT at any time and for any duration prior to the month before the cycle 2 interview and then had quit would have not been included among HRT users. This restriction likely resulted in misclassification of some women about their exposure to HRT (for example, 17% [82,655] of HRT users in cycle 1 reported not using HRT in cycle 2—data not shown), which would weaken the observed association between HRT and arthritis/rheumatism.

Because the data on use and duration of HRT, as well as incident arthritis, were collected from the same interview, there is some possibility of recall bias. That is, women who reported incident arthritis may have been more likely to report hormone use, or to report its initiation as occurring before the diagnosis of disease, compared with women who did not report arthritis. However, because the possible association between arthritis and HRT has not been widely publicized, and because the NPHS is a comprehensive survey that gathers data on a wide variety of health-related factors, the probability of such bias is likely quite small.

Because the NPHS does not collect information on menstrual status, the analysis focussed on women in the age group when the physiological changes associated with natural menopause begin.[18] However, the exclusion of younger women who had undergone surgical menopause, and the inevitable inclusion of women who had not yet completed menopause together with those who were postmenopausal somewhat impedes comparisons with other studies that dealt only with postmenopausal women.

In fact, by virtue of their age, most of the women in this analysis were perimenopausal or menopausal. However, the probable inclusion of some women who were not yet even perimenopausal, and who were therefore at lower risk of arthritis, would weaken the observed association between HRT and arthritis.

While body mass index (BMI) based on self-reports of height and weight was included as a variable in this analysis, the use of BMI for people older than 65 is not universally recommended. Because of the tendency for people to overstate their height, especially as they get older, the NPHS may underestimate the prevalence of overweight.[22] The effect would be to weaken the association between high BMI and the risk of arthritis.

The analysis was restricted to the NPHS household sample. Therefore, the results are not generalizable to the total population of women (7% of women aged 65 or older reside in long-term care facilities).[23]

Finally, the NPHS data are self- (or proxy-) reported, and the degree to which they are valid is unknown. In an effort to minimize reporting error in data related to chronic conditions (including arthritis/rheumatism), respondents were instructed to report only those conditions that had been "diagnosed by a health professional." When self-reported data on musculoskeletal symptoms from the US National Health and Nutrition Examination Survey I were compared with medical information, a high level of agreement was revealed.[24]

on self-reports of physician-diagnosed arthritis, but which focussed only on postmenopausal women, the risk of incident disease rose steadily with the duration of hormone use. A significant association with incident arthritis was observed even for one year or less of HRT use, a finding that did not emerge in analysis of the NPHS, possibly because of a lack of statistical power due to the small sample size. With 4 to 10 years of use, the relative risk rose to 1.96 in the US study, a result remarkably similar to the odds ratio of 2.0 observed in the NPHS for women who had used HRT for five years or longer.

As expected, the NPHS data indicate that older age was significantly associated with incident arthritis. The odds of disease among women aged 65 or older were 1.6 times those for women aged 38 through 64. This is consistent with the long-observed pattern of increasing risk of arthritis with advancing age.

The odds of arthritis among women who had three or more contacts with a family doctor or general practitioner in the year before the cycle 2 interview were almost three times as high as for women who had fewer physician contacts. As other

Definitions

The National Population Health Survey (NPHS) asked, "Does . . . have any of the following long-term conditions that have lasted or are expected to last six months or more and that have been diagnosed by a health professional?" *Arthritis/rheumatism* was included in this list. As a validity check, respondents who were reported not to have arthritis/rheumatism in cycle 1, but who reported in cycle 2 that they had this disease, were asked the date of diagnosis. Those reporting a date before the cycle 1 interview were probed, "So you had arthritis/rheumatism prior to our last interview in [date of cycle 1 interview]?" After eliminating the 176 cases reported to have predated the cycle 1 interview, incident arthritis/rheumatism was ascertained by tabulating the number of respondents reporting in the cycle 2 interview that they now had the condition among those who had reported two years earlier that they did not.

Three *age groups* were established: 38 to 49, 50 to 64 and 65 or older (age in 1994/95). For multiple logistic regression modelling, the age groups 38 to 64 and 65 or older were used.

Self-reported health status for cycle 1 was classified as either good/very good/excellent or fair/poor.

Physician visits in past 12 months (1996/97) were also placed in two groups: 0 to 2 and 3 or more.

Smoking status in 1994/95 was categorized as less than daily, or daily smoking.

Physical activity level was based on a derived physical activity index and was categorized as moderate/active or inactive.

Body mass index (BMI), which is calculated by dividing weight in kilograms by height in metres squared, was categorized as within the lower two tertiles (a BMI of less than 26.48) or in the upper tertile (a BMI of 26.48 or more) in cycle 1.

To determine use of *hormone replacement therapy (HRT)* in 1996/97, the NPHS asked: "In the past month, did you take hormones for menopause or aging symptoms?" Respondents who said "yes" were then asked: "What type of hormones are you taking?" (response options were estrogen only, progesterone only, both, neither) and "When did you start this hormone therapy?" Three categories were established: none, less than 5 years, and 5 or more years. Of women who reported in 1996/97 that they did take hormones, 91% specified use of estrogen, progesterone, or both (data not shown).

Arthritis and rheumatism

National Population Health Survey (NPHS) respondents were asked if they had "arthritis or rheumatism" diagnosed by a health professional. Although these terms apply to numerous clinically distinct conditions, the two most common arthritic disorders are osteoarthritis and rheumatoid arthritis. Estimates from cycle 1 of the NPHS indicate that among men and women aged 55 or older, the prevalence of arthritis or rheumatism in 1994/95 was 35%.[2] Information from survey data in the United States suggests that among people reporting physician-diagnosed arthritis or rheumatism, the ratio of rheumatoid arthritis to osteoarthritis varies from 1:23[24] to 1:15.[25]

The causes of both diseases are unclear. Osteoarthritis is a degenerative joint disease, characterized by deterioration of the joint cartilage, increases in the size of the bone at the margins, and changes in the synovial membrane. It is accompanied by pain and stiffness and occurs chiefly in older persons. Most frequently, it affects the lumbar spine, the hips, the hands and the knee.

Rheumatoid arthritis is a chronic inflammatory joint disease, usually affecting several joints. It may affect the tendons, ligaments, fascia and muscle and may also extend into the bone. Deformity develops in the late stages. Rheumatoid arthritis occurs in children as well as adults.[26]

researchers have noted, frequency of health care utilization may be related to HRT use as well as to arthritis. During their medical consultations about HRT, women taking these drugs might have a greater opportunity than non-users to receive a diagnosis of arthritis. Failure to account for this "detection bias" could confound any association between HRT and arthritis.[6,11,27] Nonetheless, the persistence of the positive association between long-term HRT use and arthritis, even after the effect of the number of physician contacts was controlled in the multiple logistic regression, strongly suggests an independent link between HRT and incident arthritis.

A positive association between high BMI and incident arthritis also emerged in unadjusted logistic regression analysis, although the designated significance level of $p < 0.05$ was not attained when the effects of other factors were considered (Table 2). The literature on the association of BMI with osteoarthritis is consistent, indicating a strong, positive link between higher levels of BMI and prevalence or incidence of disease.[7,28-37] Notably, all but one of these analyses are based on actual measures, rather than self-reports of height and weight. In the NPHS analysis, possible misclassification of respondents—specifically, categorizing people in lower BMI ranges than their actual physical measures would indicate—may have weakened the association between high BMI and arthritis.

Concluding remarks

In the current context of conflicting research results and confusion over the relationship of hormone replacement therapy with arthritis, this analysis adds to emerging evidence suggesting that long-term HRT use increases the risk of arthritis in middle-aged and older women. This association should be further examined in carefully controlled randomized clinical trials.

Because of the high prevalence and potentially disabling consequences of arthritis, identification of factors associated with its development is important. Prevention of even a small proportion of cases could have far-reaching consequences.

In recent years, numerous reports have documented the benefits of HRT, and data from the National Population Health Survey show that a substantial number of Canadian women are currently using HRT. The growing number of women who must make decisions about HRT use are entitled to the fullest information available about the risks as well as the advantages of this therapy. ●

References

1 Millar WJ. Chronic pain. *Health Reports* (Statistics Canada, Catalogue 82-003)1996; 7(4): 47-53.

2 Wilkins K, Park E. Chronic conditions, physical limitations and dependency among seniors living in the community. *Health Reports* (Statistics Canada, Catalogue 82-003-XPB) 1996; 8(3): 7-15.

3 Badley EM. The effect of osteoarthritis on disability and health care use in Canada. *Journal of Rheumatology* 1995; 22 (suppl 43): 19-22.

4 Kelsey JL, Hochberg MC. Epidemiology of chronic musculoskeletal disorders. *Annual Review of Public Health* 1988; 9: 379-401.

5 Dennison EM, Arden NK, Kellingray S, et al. Hormone replacement therapy, other reproductive variables and symptomatic hip osteoarthritis in elderly white women: A case-control study. *British Journal of Rheumatology* 1998; 37(11): 1198-1202.

6 Sahyoun NR, Brett KM, Hochberg MC, et al. Estrogen replacement therapy and incidence of self-reported physician-diagnosed arthritis. *Preventive Medicine* 1999; 28(5): 458-64.

7 Hart DJ, Doyle DV, Spector TD. Incidence and risk factors for radiographic knee osteoarthritis in middle-aged women: The Chingford Study. *Arthritis and Rheumatism* 1999; 42(1): 17-24.

8 Zhang Y, McAlindon TE, Hannan MT, et al. Estrogen replacement therapy and worsening of radiographic knee osteoarthritis: the Framingham Study. *Arthritis and Rheumatism* 1998; 41(10): 1867-73.

9 Spector TD, Nandra D, Hart DJ, et al. Is hormone replacement therapy protective for hand and knee osteoarthritis in women? The Chingford Study. *Annals of Rheumatic Disease* 1997; 56(7): 432-4.

10 Nevitt MC, Cummings SR, Lane NE, et al. Association of estrogen replacement therapy with the risk of osteoarthritis of the hip in elderly white women. Study of Osteoporotic Fractures Research Group. *Archives of Internal Medicine* 1996; 156(18): 2073-80.

11 Oliveria SA, Felson DT, Klein RA, et al. Estrogen replacement therapy and the development of osteoarthritis. *Epidemiology* 1996; 7(4): 415-9.

12 Sowers M, Hochberg M, Crabbe JP, et al. Association of bone mineral density and sex hormone levels with osteoarthritis of the hand and knee in premenopausal women. *American Journal of Epidemiology* 1996; 143(1): 38-47.

13 Samanta A, Jones A, Regan M, et al. Is osteoarthritis in women affected by hormonal changes or smoking? *British Journal of Rheumatology* 1993; 32(5): 366-70.

14 Hannan MT, Felson DT, Anderson JJ, et al. Estrogen use and radiographic osteoarthritis of the knee in women. The Framingham Osteoarthritis Study. *Arthritis and Rheumatism* 1990; 33(4): 525-32.

15 Statistics Canada. *National Population Health Survey, 1996/97. Household Component, User's Guide for the Public Use Microdata Files* (Statistics Canada, Catalogue 82-M0009GPE) Ottawa: Statistics Canada, 1998.

16 Swain L, Catlin G, Beaudet MP. The National Population Health Survey—its longitudinal nature. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 69-82.

17 Tambay J-L, Catlin G. Sample design of the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 29-38.

18 Tierney LM Jr, McPhee SJ, Papadakis MA, eds. *Current Medical Diagnosis and Treatment*, 38th edition. Stamford, Connecticut: Appleton and Lange, 1999.

19 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 283-310.

20 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18(2): 209-17.

21 Holbrook TL, Wingard DL, Barrett-Connor E. Self-reported arthritis among men and women in an adult community. *Journal of Community Health* 1990; 15(3): 195-208.

22 Health and Welfare Canada. *Canadian Guidelines for Better Weights* (Catalogue H39-134/1988E) Ottawa: Supply and Services Canada, 1988.

23 Tully P, Mohl C. Older residents of health care institutions. *Health Reports* (Statistics Canada, Catalogue 83-002) 1995; 7(3): 27-30.

24 LaPlante MP. *Data on Disability from the National Health Interview Survey 1983-1985: An InfoUse Report.* Washington, DC: US National Institute on Disability and Rehabilitation Research, 1988.

25 Cunningham LS, Kelsey JL. Epidemiology of musculoskeletal impairments and associated disability. *American Journal of Public Health* 1984; 74: 574-9.

26 Wyngaarden JB, Smith LH, Jr., eds. *Cecil Textbook of Medicine*, 17th edition. Philadelphia: W.B. Saunders Co., 1985.

27 Felson DT, Nevitt MC. Editorial. Estrogen and osteoarthritis: How do we explain conflicting study results? *Preventive Medicine* 1999; 28: 445-8.

28 Felson DT, Zhang Y, Hannan MT, et al. Risk factors for incident radiographic knee osteoarthritis in the elderly: the Framingham Study. *Arthritis and Rheumatism* 1997; 40(4): 728-33.

29 Manninen P, Riihimaki H, Heliovaara M, et al. Overweight, gender and knee osteoarthritis. *International Journal of Obesity and Related Metabolic Disorders* 1996; 20(6): 595-7.

30 Sahyoun NR, Hochberg MC, Helmick CG, et al. Body mass index, weight change, and incidence of self-reported physician-diagnosed arthritis among women. *American Journal of Public Health* 1999; 89: 391-4.

31 Oliveria SA, Felson DT, Cirilla PA, et al. Body weight, body mass index, and incident symptomatic osteoarthritis of the hand, hip, and knee. *Epidemiology* 1999; 10 (2): 161-6.

32 Slemenda C, Heilman DK, Brandt KD, et al. Reduced quadriceps strength relative to body weight: A risk factor for knee osteoarthritis in women? *Arthritis and Rheumatism* 1998; 41(11): 1951-9.

33 Vingård E, Alfredsson L, Malchau H. Lifestyle factors and hip arthrosis. A case referent study of body mass index, smoking and hormone therapy in 503 Swedish women. *Acta Orthopaedica Scandinavica* 1997; 68 (3): 216-20.

34 Hochberg MC, Lethbridge-Cejku M, Scott WW Jr, et al. The association of body weight, body fatness and body fat distribution with osteoarthritis of the knee: Data from the Baltimore Longitudinal Study of Aging. *The Journal of Rheumatology* 1995; 22(3): 488-93.

35 Felson DT, Zhang Y, Anthony JM, et al. Weight loss reduces the risk for symptomatic knee osteoarthritis in women. *Annals of Internal Medicine* 1992; 116(7): 535-9.

36 Bagge E, Bjelle A, Edén S, et al. Factors associated with radiographic osteoarthritis: Results from the population study of 70-year-old people in Göteborg. *The Journal of Rheumatology* 1991; 18(8): 1218-22.

37 Hartz AJ, Fischer ME, Bril G, et al. The association of obesity with joint pain and osteoarthritis in the HANES data. *Journal of Chronic Diseases* 1986; 39(4): 311-9.

Appendix

Table A
Distribution of selected characteristics, women aged 38 or older in 1994/95, household population, Canada excluding territories, 1994/95 to 1996/97

	Sample size	Estimated population†	
		'000	%
Total	**2,673‡**	**4,257**	**100**
Age group in 1994/95			
38-49	1,196	2,063	49
50-64	810	1,345	32
65+	667	849	20
Self-reported health status in 1994/95			
Good/ Very good/ Excellent	2,390	3,853	91
Fair/ Poor	283	404	10
Physician visits in past 12 months, 1996/97			
0-2	1,527	2,536	60
3+	1,134	1,699	40
Smoking status in 1994/95			
Occasionally/ None	2,078	3,393	80
Daily	592	853	20
Physical activity level in 1994/95			
Moderate/ Active	955	1,459	35
Inactive	1,669	2,692	65
Body mass index in 1994/95			
Lower 2 tertiles (<26.48)	1,829	2,924	69
Upper tertile (≥ 26.48)	844	1,333	31
Years of hormone replacement therapy as of 1996/97			
None	2,280	3,608	85
< 5	224	377	9
5+	163	262	6

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file*
† Percentages may not add to 100% because of rounding.
‡ Detail may not add to total as data were missing for some variables.

Older drivers—a complex public health issue

Wayne J. Millar

Abstract

Objectives

This article provides estimates of the percentage of seniors who are licensed to operate a motor vehicle. It describes the health characteristics of these license holders and reviews research relating to older drivers.

Data sources

The data are from the cross-sectional file of Statistics Canada's 1996/97 National Population Health Survey. The sample size of respondents aged 65 or older was 13,363, weighted to represent 3.4 million individuals. Supplementary data are from the 1991 Survey of Ageing and Independence, also conducted by Statistics Canada, and from Transport Canada.

Analytical techniques

The percentages of seniors with a license were calculated by age and sex. Percentages by presence of chronic conditions, disabilities and medication use were age-standardized to control for the increasing prevalence of illness at older ages.

Main results

The percentage of seniors who had a driver's license declined with advancing age. The negative association between disability and license holding was pronounced. The percentage of seniors with a driver's license was also relatively low among those with heart disease, arthritis, stroke or cataracts, and among those who reported taking selected medications in the last month.

Key words

automobile driving, traffic accidents, aging, automobile driver examination

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Driving is a complex task requiring the integration of visual, cognitive and motor skills. While old age itself is not a contraindication to driving, the increasing prevalence of chronic diseases with advancing age may make it hazardous for elderly people to get behind the wheel.[1] Previous research has indicated that when exposure is controlled, the risk of motor vehicle accidents among seniors tends to approach that for young people, who have the greatest risk.[2-8] Other studies have found that crash rates for older drivers, especially those over 75, are higher than rates for all drivers and similar to those of very young drivers (aged 16 to 19).[9,10]

The potential risk that older drivers face and impose on others is important, because the demographic profile of drivers will change dramatically over the next two decades.[11] This, in turn, could be expected to affect patterns of risk associated with driving.

In 1996/97, seniors (those aged 65 or older) numbered 3.4 million and represented 12% of the Canadian population. By 2016, this group is projected to number 5.9 million or almost 16% of Canadians. As a result, both in absolute numbers and as a proportion, the elderly will constitute a growing segment of drivers. And many of

Methods

Data source

The data on license holding and health status come from Statistics Canada's National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years.[12,13] It covers household and institutional residents in all provinces and territories, except people living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both a longitudinal and a cross-sectional component. Respondents who are part of the longitudinal component will be followed for up to 20 years.

This analysis uses cross-sectional data from cycle 2 of the NPHS, conducted in 1996/97. The data pertain to the household population in the 10 provinces.

The 1996/97 cross-sectional sample is made up of longitudinal respondents and respondents who were selected as part of supplemental samples, or buy-ins, in three provinces. The additional respondents for the buy-ins were chosen with the random digit dialing (RDD) technique and were included for cross-sectional purposes only.

Individual data are organized into two files: General and Health. Socio-demographic and some health information was obtained for each member of participating households. These data are found in the General file. Additional in-depth health information was collected for one randomly selected household member. The in-depth health information, as well as the information on the General file pertaining to that individual, is found in the Health file.

In households belonging to the cross-sectional buy-in component, one knowledgeable person provided the socio-demographic and health information about all household members for the General file. As well, one household member, not necessarily the same person, was randomly selected to provide in-depth health information about himself or herself for the Health file.

In households belonging to the longitudinal component, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for that household in cycle 1 (1994/95) and was usually the person who provided information about all household members for the General file in cycle 2.

The 1996/97 cross-sectional response rates for the Health file were 93.6% for the longitudinal component and 75.8% for the RDD component, yielding an overall response rate of 79.0%.

Data on possession of a driver's license and the health characteristics of the licensed population come from the 1996/97 cross-sectional Health file. The sample size of the population aged 12 or older was 81,804. This analysis focuses on the 13,363 respondents who were aged 65 or older, representing approximately 3.4 million individuals.

Supplementary data on the driving practices of older Canadians were obtained from Statistics Canada's 1991 Survey of Ageing and Independence. Data from Transport Canada were used to calculate motor vehicle accident mortality rates of the licensed population.

Analytical techniques

The percentages of license holders among seniors were calculated by age and sex. Percentages by presence of chronic conditions and disability and by drug use were age-standardized to control for the increasing prevalence of illness at older ages.

All estimates were weighted to represent the population at the date of the survey. The 1996/97 population (both sexes) was used as a reference population for direct age standardization of rates. Because of the complex nature of the survey design, bootstrap procedures were employed to derive the variances of the estimates, and to compare differences between percentages.[14,15] The .05 level was used to denote statistical significance.

Limitations

The major limitation of this analysis is that the NPHS asked only about possession of a driver's license, not about driving behaviour. Data from the Survey of Ageing and Independence were used to estimate the proportion of license holders who actually drive. However, it was not possible to make such estimates by chronic conditions, disabilities or medication use. Therefore, while the overall majority of elderly people who had a driver's license were drivers, the percentage could be considerably lower among those in poor health.

NPHS data on chronic conditions are subject to the problems inherent in self-reporting. Specifically, there was no independent source to verify whether people who reported having been diagnosed with a condition actually did have it. Nor was there any indication of the severity of the various conditions reported, which might affect driving ability.

Proxy respondents may have provided some of the data about chronic conditions. The degree of bias in such reporting may differ, depending on the disease. In fact, for some conditions, such as impaired cognitive function, proxy responses may yield more reliable information.

Table 1
Household population aged 65 or older with valid driver's license, by selected demographic characteristics, Canada excluding territories, 1996/97

	Population			Percentage with driver's license		
	Total	Men	Women	Total	Men	Women
		'000			%	
Total	**3,416**	**1,479**	**1,937**	**59**	**77**†	**45**
Age group‡						
65-69	1,134	508	625	71	85	59
70-74	962	422	541	63	81	49
75-79	681	283	398	54	76	39
80-84	379	166	212	41	61	25
85+	261	100	161	23	49	8
Province						
Newfoundland	57	26	31	43§	57	32
Prince Edward Island	16	7	9	67††	92	47
Nova Scotia	114	48	66	61	79	48
New Brunswick	91	39	52	68††	88	51
Québec	833	348	485	49‡‡	77	29
Ontario	1,304	566	738	61	76	51
Manitoba	145	62	83	59	79	44
Saskatchewan	137	61	76	67	89	50
Alberta	257	115	142	61	74	52
British Columbia	461	207	255	63	78	51
Household income						
Lowest	656	204	452	44§§	70	33
Lower-middle	1,190	553	637	57†††	76	41
Upper-middle	748	368	380	70	83	57
Highest	147	83	64	77	92	55
Missing	674	270	405	57	71	48
Education						
Less than high school	1,725	744	980	50§§	72	33
High school graduation	527	205	323	62‡‡‡	81	50
Some post-secondary	495	216	279	69	86	56
Postsecondary graduation	618	285	333	72	82	64
Missing	51	29	22	42	51	30

***Data source**: 1996/97 National Population Health Survey, cross-sectional sample, Health file*
***Notes:** All percentages are age-adjusted. Because of rounding, detail may not add to totals. Significant differences in percentage with driver's license are shown for total only. Where applicable, the p value was adjusted to take multiple comparisons into account.*
† Significantly higher than women
‡ All differences between age groups in percentage with driver's license are significant.
§ Significantly lower than all provinces except Nova Scotia and Québec
†† Significantly higher than Québec
‡‡ Significantly lower than all provinces except Newfoundland and Nova Scotia
§§ Significantly lower than other items in category
††† Significantly lower than highest income
‡‡‡ Significantly lower than postsecondary graduation

these drivers will continue to rely on private transportation to maintain their independence and an active lifestyle.[16]

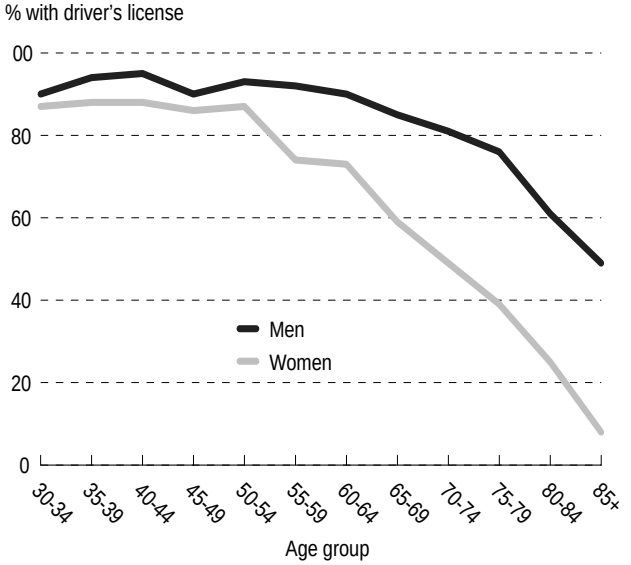
This article examines the health status of people aged 65 or older who reported having a valid driver's license. The findings are based on the 1996/97 National Population Health Survey (NPHS), supplemented by data from the 1991 Survey of Ageing and Independence and from Transport Canada (see *Methods* and *Definitions*). The results are discussed in the context of other research on older drivers.

License holding declines at older ages

In 1996/97, about 6 in 10 people aged 65 or older, just over 2 million individuals, held a valid driver's license. The rate dropped from 71% at ages 65 to 69 to 23% at age 85 or older (Table 1).

License holding was more common among senior men than women—77% versus 45%—a gap that widened at older ages. This sharp divergence reflects historical differences in the division of labour in the household and in the workforce. As successive cohorts of women move through the life cycle, the sex difference in license-holding rates among seniors will probably narrow (Chart 1).

Chart 1
Household population aged 30 or older with valid driver's license, by age group and sex, Canada excluding territories, 1996/97



***Data source:** 1996/97 National Population Health Survey, cross-sectional sample, Health file*

The lowest percentages of license holders among the elderly were in Newfoundland (43%) and Quebec (49%). Percentages in other provinces did not differ significantly. Income was also a factor: only 44% of seniors in the lowest income group had a license, compared with 77% in the highest income group. There was a similar gradient by level of education. Seniors with higher education were significantly more likely than those with relatively little education to have a driver's license.

Exposure to risk

Of course, a driver's license alone is not a good measure of exposure to risk.[4] It is necessary to know if elderly license holders actually drive, and how frequently they do so.[5] While such information was not collected by the 1996/97 NPHS, the 1991 Survey of Ageing and Independence did ask about driving behaviour. Between the two surveys, the estimate of the proportion of seniors with a driver's license rose only slightly, from 56% in 1991 to 59% in 1996/97.

The 1991 data showed that the majority of seniors who had a license—93% of men and 67% of women—were drivers (Table 2). As well, the percentage of drivers among elderly license holders did not decrease at older ages. Nonetheless, the low rates of license holding among the elderly mean that, for seniors overall, the degree of exposure to the risks associated with driving is small compared with younger age groups. In fact, just 40% of the total population aged 65 or older drove three or more times a week (data not shown).

The drop in license holding at older ages may be attributable to changing roles, such as the end of commuting to work after retirement. But the decrease may also be related to diminished ability to operate motor vehicles.

Table 2
Motor vehicle use among household population aged 65 or older, by age group and sex, Canada excluding territories, 1991

	Population	Percentage with driver's license	License holders who: used vehicle as driver	License holders who: drove 3 or more times/week
	'000	%	%	%
Total	**2,764**	**56**	**83**	**72**
65-69	1,011	66	81	75
70-74	770	61	84	71
75-79	513	50	84	71
80+	470	30	90	68
Men	**1,187**	**80**	**93**	**81**
65-69	467	86	94	86
70-74	340	84	94	79
75-79	208	79	91	77
80+	172	58	93	71
Women	**1,577**	**37**	**67**	**58**
65-69	544	49	62	58
70-74	430	43	69	57
75-79	305	31	72	60
80+	298	13	82	62

Data source: *1991 Survey of Ageing and Independence*
Note: *Because of rounding, detail may not add to totals.*

Health problems increase at older ages

With advancing age, the prevalence of various chronic conditions tends to increase (Appendix Table A). For instance, in 1996/97, just 21% of 45- to 64-year-olds reported that they had been

Physician's Guide to Driver Examination

The Canadian Medical Association's *Physician's Guide to Driver Examination*[1] (currently under revision) presents guidelines and expert opinions designed to help physicians assess their patients' medical fitness to drive. The *Guide* does not have the force of law; responsibility for issuing a driver's license rests with provincial and territorial licensing authorities. However, most jurisdictions have regulations that require physicians to report medically unfit drivers.[16] An additional consideration is the degree to which physicians may be held liable if they fail to report a patient who is subsequently involved in a motor vehicle accident.

The *Guide* emphasizes that as long as an elderly person remains free of impairing conditions, there is no reason why he or she may not drive without restriction. Nevertheless, a number of age-related conditions that may affect a driver's ability are identified: mental deterioration, visual impairment, cardiovascular disease, diabetes mellitus (which increases the risk of visual impairment and hypoglycemia), musculoskeletal conditions, multiple conditions, and the effects of drugs (such as antihypertensives, sedatives and tranquilizers).

The *Guide* recommends a medical examination to assess driving fitness every two years from ages 70 to 80, and annually thereafter. This assessment should include an evaluation of both physical and mental status.

diagnosed with arthritis/rheumatism. However, among people aged 65 to 74, 40% had arthritis, and at age 85 or older, the proportion was 53%. Similarly, the prevalence of heart disease rose steadily, from 5% at ages 45 to 64 to 22% at age 85 or older. The pattern was similar for glaucoma, cataracts, stroke and diabetes.

Not surprisingly, the percentage of people reporting disabilities also increased at older ages. An estimated 5% of seniors had an uncorrected vision problem, or a mobility problem for which they required personal aid (Appendix Table B). About 4% had an uncorrected hearing problem; 3% had a serious problem with cognition, and 2% reported a problem with manual dexterity. By age 85 or older, the prevalence of each of these disabilities was much higher. In comparison, no more than 1% or 2% of people aged 45 to 64 reported such disabilities.

Age alone is not a risk factor for involvement in motor vehicle accidents. The onset of driving difficulties occurs at different ages for different individuals.[17] As well, some chronic conditions, and even some disabilities, may not seriously affect driving ability. The degree of impairment associated with a given condition may be quite variable, as the same conditions can have markedly different functional consequences for different individuals.[18] Some conditions, however, can severely impair the ability to drive (see *Physician's Guide to Driver Examination*).

Association with chronic conditions

For several chronic conditions, license-holding rates between seniors who did and did not report having the condition differed significantly. For instance, 36% of seniors who reported having had a stroke were license holders, compared with 59% who had not had a stroke (Table 3). The percentages for heart disease, arthritis and cataracts were also significantly low.

The amount of pain caused by a chronic condition may be just as much a factor in license holding as the condition itself. Severe pain can affect concentration and limit freedom of movement to an extent that makes driving extremely dangerous.[1] In fact, only 49% of seniors who reported suffering severe chronic pain had a driver's license.

Table 3
Household population aged 65 or older with valid driver's license, by sex and selected chronic conditions,† Canada excluding territories, 1996/97

	Total		Men		Women	
	Total number	With driver's license	Total number	With driver's license	Total number	With driver's license
	'000	%	'000	%	'000	%
Total	**3,416**	**59**	**1,479**	**77**	**1,937**	**45**
Heart disease						
Yes	548	54‡	267	71	281	37
No	2,864	59	1,211	78	1,654	45
Missing	4	--	1	--	3	--
Arthritis						
Yes	1,448	55‡	504	77	944	43
No	1,966	61	974	77	992	46
Missing	2	--	--	--	2	--
Diabetes						
Yes	357	53	184	75	174	30
No	3,057	59	1,295	77	1,762	46
Missing	1	--	–	–	1	–
Effects of stroke						
Yes	134	36‡	73	46	61	24§
No	3,281	59	1,405	79	1,876	45
Missing	1	--	--	--	1	--
Glaucoma						
Yes	166	54	65	71	100	43
No	3,247	59	1,412	77	1,835	44
Missing	4	--	--	--	3	--
Cataracts						
Yes	513	51‡	177	70	336	41
No	2,901	60	1,301	78	1,599	45
Missing	3	--	--	--	2	--
Number of chronic conditions						
None	1,345	63	643	78	702	49
1	1,276	59	525	80	752	45
2 +	795	50‡	311	70	484	37
Chronic pain						
No pain	2,571	62††	1,141	80	1,430	47
Mild/Moderate	668	50	281	67	387	37
Severe	161	49	51	73	110	38
Missing	16	--	5	--	10	--

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Notes: *All percentages are age-adjusted. Because of rounding, detail may not add to totals. Significant differences in percentage with driver's license are shown for total only. Where applicable, the p value was adjusted to take multiple comparisons into account.*
† Diagnosed by a health professional
‡ Significantly lower than other item(s) in category
§ Coefficient of variation between 16.6% and 25.0%
†† Significantly higher than other items in category
– Nil
-- Coefficient of variation too high to provide reliable estimate

Table 4
Household population aged 65 or older with valid driver's license, by selected disabilities† and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
	Total number	With driver's license	Total number	With driver's license	Total number	With driver's license
	'000	%	'000	%	'000	%
Total	**3,416**	**59**	**1,479**	**77**	**1,937**	**45**
Cognitive						
No problem	2,391	60	1,013	79	1,378	47
Some problem	921	57	419	76	501	40
Serious problem	92	26‡	42	32	50	21
Missing	13	--	4	--	9	--
Manual dexterity						
No problem	3,333	59	1,449	78	1,884	45
Problem	81	37‡§	28	45§	53	34††
Missing	3	--	2	--	1	--
Mobility						
No problem	2,934	62	1,288	81	1,646	47
Problem, no aid needed	65	46	29	46§	36	43§
Problem, needs technical aid	258	47‡‡	114	65	144	31
Problem, needs personal aid/ cannot walk	157	16‡§	46	25††	110	11††
Missing	2	--	–	--	–	--
Vision						
No problem	578	61	284	77	294	46
Corrected problem	2,636	60	1,136	79	1,499	46
Uncorrected problem	185	34‡	52	43	133	30§
Missing	18	--	–	--	12	--
Hearing						
No problem	2,927	60	1,212	80	1,715	45
Corrected problem	334	56	184	66	150	40
Uncorrected problem	149	47‡‡	78	61	71	32§
Missing	7	--	–	--	2	--

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Notes: *All percentages are age-adjusted. Because of rounding, detail may not add to totals. Significant differences in percentage with driver's license are shown for total only. Where applicable, the p value was adjusted to take multiple comparisons into account.*
† Diagnosed by a health professional
‡ Significantly lower than other item(s) in category
§ Coefficient of variation between 16.6% and 25.0%
†† Coefficient of variation between 25.1% and 33.3%
‡‡ Significantly lower than no problem
– Nil
-- Coefficient of variation too high to provide reliable estimate

Strong link with disability

Not only were chronic conditions associated with license holding, but as might be expected, so were disabilities, which may or may not have resulted from such conditions (Table 4). About 60% of seniors who did not report a disability had a driver's license. Among those with a disability, the proportions holding a license were consistently lower, although how much lower depended on the disability.

Just 26% of elderly people with a serious cognitive problem had a driver's license. But considering the nature of the disability, this is a relatively high percentage. Cognitive function involves memory, information processing, and decision-making, all of which are essential to safe driving. A number of studies have shown an increased risk of accidents among people with cognitive impairment.[19-22] However, a study in the United Kingdom found that many patients with dementia continued to drive despite a striking deterioration in driving performance.[23] For about 18% of patients, deterioration in driving skills was one of the first signs of dementia.[23] As well, the decision to stop driving was often initiated by family members and physicians rather than by the patients with dementia themselves.[24]

About a third (34%) of seniors with an uncorrected vision problem and 37% with a manual dexterity problem were licensed to drive. For those with a serious mobility problem, the rate was much lower: 16% who needed personal aid had a license. The rate was higher for seniors who reported an uncorrected hearing problem, nearly half of whom had a driver's license.

Medication use

At older ages, as the number of chronic conditions and disabilities increases, so does the use of medications,[25] some of which may hinder driving ability. In 1996/97, 45% of seniors who reported taking tranquilizers in the month before their interview were license holders, as were 48% who had taken antidepressants, and 52% who took sleep medications (Table 5). The proportions of license holders among those who took diuretics, antihypertensives or heart medication were higher:

54% or 55%. Nonetheless, in all cases, the proportion of license holders was significantly lower among seniors taking these medications than among those who were not.

The literature on the effects of drugs on driving is inconclusive. In a retrospective cohort study of four categories of drugs—benzodiazepines, cyclic antidepressants, oral opioid analgesics and antihistamines—the relative risk of injurious crash involvement for the use of any one of these drugs was 1.5.[26] Among people taking at least two of these drugs, the relative risk increased if one of them was a benzodiazapine or a cyclic antidepressant. As well, for both drugs, the relative risk increased with dose and was substantial at high doses. Another study concluded that benzodiazepines approximately double the risk of motor vehicle accidents; the risk for older drivers was higher when they took longer-acting and large quantities of benzodiazepines.[27] By contrast, a population-based matched case-control study found no evidence of a dose-related effect among persons who used benzodiazepines.[28] And a recent Canadian study concluded that while exposure to long half-life benzodiazepines was associated with an increased risk of motor vehicle accidents, there was no elevated risk for short half-life benzodiazepines.[29]

Table 5
Household population aged 65 or older with valid driver's license, by selected medications and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
Medication use in past month	Total number	With driver's license	Total number	With driver's license	Total number	With driver's license
	'000	%	'000	%	'000	%
Total	**3,416**	**59**	**1,479**	**77**	**1,937**	**45**
Tranquilizers						
Yes	169	45†	50	61	119	39
No	3,226	60	1,419	78	1,808	45
Missing	21	--	10	--	11	--
Antidepressants						
Yes	150	48†	60	71	90	32
No	3,247	59	1,412	77	1,834	45
Missing	20	--	7	--	13	--
Sleep medications						
Yes	269	52†	101	72	168	40
No	3,131	59	1,371	78	1,759	45
Missing	17	--	6	--	11	--
Diuretics						
Yes	377	54†	128	68	249	46
No	3,020	59	1,344	78	1,677	44
Missing	19	--	7	--	11	--
Antihypertensives						
Yes	1,112	55†	423	77	690	41
No	2,285	61	1,048	78	1,236	46
Missing	19	--	8	--	11	--
Heart medications						
Yes	643	55†	311	73	332	38
No	2,756	60	1,161	79	1,594	46
Missing	18	--	7	--	11	--
Number of selected medications used in past month						
None	1,939	62‡	930	78	1,009	47
1	988	54	371	75	617	41
2 +	489	54	178	74	312	42

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Notes: *All percentages are age-adjusted. Because of rounding, detail may not add to totals. Significant differences in percentage with driver's license are shown for total only. Where applicable, the p value was adjusted to take multiple comparisons into account.*
† Significantly lower than not taking medication
‡ Significantly higher than other items in category
-- Coefficient of variation too high to provide reliable estimate

Older drivers at higher risk?

As mental and sensory abilities decline, many seniors make compensatory changes in their driving behaviour that may reduce their overall exposure to risk.[30,31] The elderly may also be more flexible in their use of time and may have more choice about when and where they drive.[32,33] They are less likely than middle-aged people to drive at night and during peak hours. Seniors tend to avoid limited access highways and to drive at lower speeds. A recent study linking police accident records to hospital discharge data found little evidence that drivers aged 65 to 74 imposed excess risk of injury or death on other drivers at both aggregate and individual levels of analysis.[34]

In addition, research on the risk of accidents among elderly drivers with specific diseases is ambiguous. A study in the province of Québec suggested that elderly people with impairments or chronic diseases were not at increased risk of road accidents.[35] Another Québec study of men aged 45 to 70 showed no increased risk of accidents for drivers suffering from cardiovascular disease.[36] And

an earlier report found no clear evidence that ocular disease, impaired vision, or diminished hearing increased the risk of motor vehicle accidents among older drivers.[37] On the other hand, a more recent study concluded that impaired visual processing and glaucoma may play a role in crashes involving older drivers.[40]

However, researchers' conclusions about the risk posed by older drivers depend largely on the statistical indicators they choose. For example, if absolute numbers are considered, younger drivers would warrant closer scrutiny than older drivers. But if collisions or injuries per kilometre driven are used, older drivers have rates similar to those of young adults (see *Motor vehicle mortality*).

Motor vehicle mortality

Research has shown that compared with younger age groups, older drivers are more likely to be seriously injured or to die in motor vehicle collisions, assuming comparable speeds and similar vehicles.[5-8]

In 1996, seniors represented 11% of licensed drivers, but accounted for 18% of people killed in motor vehicle collisions. The age-specific motor vehicle traffic accident mortality rate for all licensed drivers was 16.4 deaths per 100,000.[38] The rate peaked among 15- to 19-year-olds at 40.6 deaths per 100,000, and was also relatively high (25.1) at ages 20 to 24. Among license holders aged 25 to 64, the rate did not rise above 14.0. However, the mortality rate at age 65 or older—27.2—was higher than at ages 20 to 24.

These rates do not consider the relatively low level of exposure among older drivers. Since accident risk is proportional to the frequency of vehicle use or annual kilometres,[39] if exposure had been controlled, mortality rates for older drivers might have been higher.

Motor vehicle accident mortality, by age group, both sexes, Canada, 1996

				Deaths per 100,000:	
Age group	Population	Licensed population	Deaths	population	licensed population
	'000	'000			
Total	**28,641.5**	**18,700.0**	**3,062**	**10.6**	**16.4**
0-4	1,234.6	···	39	3.2	···
5-14	3,963.0	···	129	3.3	···
15-19	2,110.7	937.0	380	18.0	40.6
20-24	1,872.6	1,564.0	393	21.0	25.1
25-34	4,471.5	3,959.7	537	12.0	13.6
35-44	5,237.6	4,780.0	429	8.2	9.0
45-54	3,770.5	3,361.4	346	9.2	10.3
55-64	2,564.9	2,099.0	265	10.3	12.6
65+	3,416.1	1,998.9	544	15.9	27.2

Data sources: *1996/97 National Population Health Survey, cross-sectional sample, Health file for licensed population; Transport Canada for mortality (Reference 39)*

··· Not applicable

Screening high-risk older drivers

If age-related health conditions are associated with driving ability, it seems logical to suggest that licensing agencies screen older drivers. But while individuals with severe and obvious impairments are easy to identify, for the many elderly drivers without gross deficits, fitness to drive may be difficult to assess.[18,24]

A range of tests to evaluate the driving performance of elderly people has been proposed.[23,41-43] However, NPHS estimates of the number of elderly license holders with chronic conditions or disabilities suggest that identifying and testing them would be a massive and expensive undertaking (see *Health problems among older license holders*). And even if such tests were administered, correlations of test scores with crash or violation rates would be confounded by the possibility that those with better scores will have more accidents because they drive more.[44]

The question of screening older drivers places unique pressures on physicians,[9] who must consider the welfare of the community, the welfare of their patients, and the confidentiality of the doctor–patient relationship.[45] This has become even more of an issue in jurisdictions where physicians can be held liable for accidents caused by older drivers who have obvious functional impediments. A study of physicians' attitudes concluded that they generally believed that they had a legal responsibility to assess driving ability, but that they were uncertain about how to do so and about their responsibility toward their senior patients who drive.[46]

Health problems among older license holders

The prevalence of chronic conditions and disabilities that might affect driving ability was generally higher among seniors who were unlicensed than among those who were licensed. Nonetheless, substantial numbers of elderly people with a driver's license reported having such health problems. For instance, in 1996/97, an estimated 776,000 elderly license holders had arthritis, and 280,000 had been diagnosed with heart disease. While far fewer had disabilities, 101,000 elderly license holders required technical aid with mobility, and 17,000 needed personal aid. About 63,000 reported an uncorrected hearing problem. As well, substantial numbers of elderly license holders were taking medications that could affect their ability to drive.

Number of driver's license holders aged 65 or older with selected health conditions, by sex, Canada excluding territories, 1996/97

	Total	Men	Women
	'000	'000	'000
Total license holders	**1,999**	**1,139**	**860**
Chronic conditions			
Heart disease	280	185	95
Arthritis	776	383	393
Stroke	42	31†	11†
Glaucoma	84	45	39†
Cataracts	229	116	114
Diabetes	189	137	52
Severe chronic pain	73	37†	36†
Disabilities			
Serious cognitive problem	17†	12†	5††
Manual dexterity problem	28	11	16
Mobility			
Needs technical aid	101	66†	35
Needs personal aid	17	8††	--
Uncorrected vision problem	50††	20	30††
Uncorrected hearing problem	63	44	18††
Medication use in past month			
Tranquilizers	76	32†	44
Antidepressants	72†	44	28††
Sleep medications	133	71	61
Diuretics	196	86	110
Antihypertensives	602	325	277
Heart medications	334	221	114

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Note*: Because of rounding, detail may not add to totals.*
† Coefficient of variation between 16.6% and 25.0%
†† Coefficient of variation between 25.1% and 33.3%
-- Coefficient of variation too high to provide reliable estimate

The decision to quit

Despite the uncertainty individual physicians may have about their role in the licensing process, their input can be crucial. In a study of residents of a retirement community, over one-quarter of respondents (27%) who had quit driving said they had done so based on "advice from a physician." A further 20% mentioned "nervousness behind the wheel," and an almost equal number said they had trouble seeing cars or people.[47]

Other research, too, has shown that driving cessation may be influenced by health status.[48,49] A study of community-dwelling elderly people found that six conditions explained about half the decisions to stop driving: macular degeneration, retinal hemorrhage, any deficit in activities of daily living, Parkinson's Disease, effects of a stroke, and syncope (episodes of sudden unconsciousness).[50]

Because motor vehicles are such an important feature of modern life, the decision to stop driving is very difficult for many elderly people. And although the health of seniors may affect their ability to drive, the mobility afforded by driving can also affect their health and well-being.[45,51,52] Aside from convenience, driving is a symbol of autonomy and competence.[47] Driving cessation may entail the loss of self-esteem and change the overall quality of life.[53] A longitudinal analysis showed substantial increases in depressive symptoms among elderly people who stopped driving, even after accounting for demographic characteristics and health-related factors.[54]

Driving cessation also has implications for seniors' ability to function independently and their participation in the community. The decision may be influenced by the availability of alternative transportation or of other people who can take over driving responsibilities.[48,49] In fact, according to the 1991 Survey of Ageing and Independence, 30% of seniors who were drivers reported that public transportation was not available where they lived. For older people in rural areas or in areas without access to public transportation, an end to driving may necessitate moving, with the consequent disruption of the person's sense of community.[16,55]

Definitions

Information about possession of a *driver's license* was obtained by asking National Population Health Survey (NPHS) respondents, "Do you have a valid driver's license for a motor vehicle?" (include cars, vans, trucks, motorcycles).

Respondents' *education* was divided into four categories: less than high school graduation, high school graduation, some postsecondary, and postsecondary graduation.

Household income was based on a derived variable that accounted for the number of people living in the household. Income was divided into quartiles: lowest, lower-middle, upper-middle, and highest.

Respondents were asked if a health professional had diagnosed them as having selected *chronic conditions.* Based on a review of the literature, the following conditions were selected for this article: heart disease, arthritis or rheumatism, diabetes, the effects of a stroke, glaucoma, and cataracts.

In addition, respondents were asked about the presence of *disabilities* related to cognition, manual dexterity, mobility, vision, and hearing.

A variable derived from a question on thinking ability and another question on memory was created to determine *cognitive function*. The categories were: no cognitive problems, some difficulty thinking, somewhat forgetful, somewhat forgetful/difficulty thinking, very forgetful/unable to remember/to think. For this analysis, respondents were considered to have a cognitive problem if they were in either of the last two categories.

A derived variable was created to assess manual *dexterity*. Respondents were divided into those with and those without a manual dexterity problem. Respondents with a problem included those who had a problem but needed no help, along with those who had a problem and needed equipment, help with some tasks, help with most tasks, or help with all tasks.

A derived variable was created to classify *mobility* problems. Mobility status was divided into four categories: no problem; problem, no aid needed; problem, needs technical aid (mechanical support or wheelchair); and problem, needs personal aid/cannot walk.

Hearing was classified into the following six categories: no hearing problem, problem hearing group/corrected, problem hearing group and individuals/corrected, problem hearing group and individuals/individuals corrected, problem hearing group and individuals/not corrected, and cannot hear. For this article, hearing was classed as: no problem, corrected problem, and uncorrected problem.

A derived variable was created that classified *vision* according to the following categories: no problem, problem corrected by lenses, uncorrected problem seeing close, uncorrected problem seeing distance, problem seeing close and distance/no sight. In this analysis, vision was categorized as: no problem, corrected problem, and uncorrected problem.

Data on *medication use* were based on responses to the question, "In the past month, did you take any of the following medications?" The interviewer then read a list of medications and marked all that applied. Those used for this analysis were antidepressants, diuretics or water pills, medicine for blood pressure, medicine for the heart, sleeping pills, and tranquilizers such as Valium.

Estimates of the proportion of older Canadians who *drove* were obtained from the 1991 Survey of Ageing and Independence. During a telephone or a face-to-face interview, respondents were asked if they had a valid driver's license and if anyone in the household owned a vehicle. This question was followed with: "Does the respondent use this vehicle mostly as a driver or as a passenger?" To obtain an approximation of the degree of *exposure to driving*, the survey asked, "How often does the respondent drive?" Response options were: not applicable, more than 3 times per week, 1 to 3 times per week, 1 to 3 times per month, less than once a month, and never.

Concluding remarks

The consensus emerging among researchers tends to be that decisions about licensing people with age-related disorders should be based on functional measures rather than on diagnostic labels.[18,56,57] Older drivers are not a homogeneous group, and there does not appear to be a predictable pattern of risk.[30,34,58]

The public health response to the reality of an aging population and the consequent increase in the number of older drivers could involve a wide range of measures. For instance, some researchers have argued that policy and program administrators must consider providing alternate transportation to meet the needs of elderly people who can no longer drive.[51]

Training or retraining older drivers may improve their driving performance,[51] and a number of jurisdictions have introduced defensive driving courses specifically for seniors. In some areas, older

drivers who successfully complete the courses are eligible for automobile insurance discounts.[59]

It is also important to consider the technological and environmental context in which all drivers function. Improvements in highway and motor vehicle design could benefit everyone, not just elderly drivers.[9]

In the future, elderly drivers may have much different characteristics than the current cohort. And because of changes in the design of cars and highways, in enforcement practices, and in norms relating to driving, the risk patterns associated with older drivers may also change.[51] Therefore, it is difficult to assess the risk that senior drivers will impose on themselves or on others in the future. ●

References

1 Canadian Medical Association. *Physician's Guide to Driver Examination*. 5th edition. Ottawa: Canadian Medical Association, 1991.

2 US Department of Transportation. *Older population. Traffic Safety Facts 1996*. Available at: http://www.hhtsa.dot.gov/people/ncsa/FactPrev/Older96.hth. Accessed September 29, 1998.

3 Chipman ML, MacGregor CG, Smiley AM, et al. The role of exposure in comparisons of crash risk among different drivers and driving environments. *Accident Analysis and Prevention* 1993; 25(2): 207-11.

4 Hakamies-Blomqvist L, Johansson K, Lundberg C. Driver licences as a measure of older drivers' exposure: a methodological note. *Accident Analysis and Prevention* 1995; 27(6): 853-7.

5 Evans L. Risk of fatality from physical trauma versus age and sex. *Journal of Trauma* 1988; 28(3): 368-78.

6 McCoy GF, Johnston RA, Duthie RB. Injury to the elderly in road traffic accidents. *Journal of Trauma* 1989; 29(4): 494-7.

7 Peek-Asa C, Dean BB. Traffic-related injury hospitalization among California elderly, 1994. *Accident Analysis and Prevention* 1998; 30(3): 389-96.

8 Waters C, Gibbons L, Semenciw R, et al. Motor vehicle traffic accidents in Canada, 1978-87 by time of occurrence. *Canadian Journal of Public Health* 1994; 84(1): 58-9.

9 Brown BP. Medical conditions, medications and driving (editorial). *Canadian Family Physician* 1998; 44: 705-7.

10 Massie DL, Campbell KL, Williams AF. Traffic accident involvement rates by driver age and gender. *Accident Analysis and Prevention* 1995; 27(1): 73-87.

11 George MV, Norris MJ, Nault F, et al. *Population Projections for Canada, Provinces and Territories, 1993-2016* (Statistics Canada, Catalogue 91-520) Ottawa: Minister Responsible for Statistics Canada, 1994.

12 Tambay J-L, Catlin G. Sample design of the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 29-38.

13 Swain L, Catlin G, Beaudet MP. The National Population Health Survey—its longitudinal nature. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 69-82.

14 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18(2): 209-17.

15 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 283-310.

16 Bess I. Seniors behind the wheel. *Canadian Social Trends* (Statistics Canada, Catalogue 11-008) 1999; Autumn (54): 2-7.

17 Cooper PJ. Differences in accident characteristics among elderly drivers and between elderly and middle-aged drivers. *Accident Analysis and Prevention* 1990; 22(5): 499-508.

18 Waller JA. Research and other issues concerning effects of medical conditions on elderly drivers. *Human Factors* 1992; 34(1): 3-15.

19 Retchin SM, Anapolle J. An overview of the older driver. *Clinics in Geriatric Medicine* 1993; 9(2): 279-96.

20 Waller JA. Cardiovascular disease, aging and traffic accidents. *Journal of Chronic Diseases* 1967; 20: 615-20.

21 Cooper PJ, Tallman D, Tuokko H, et al. Vehicle crash involvement and cognitive risk deficit in older drivers. *Journal of Safety Research* 1993; 25: 9-17.

22 Dubinski RM, Williamson A, Gray CS, et al. Driving in Alzheimer's disease. *Journal of the American Geriatrics Society* 1992; 40: 1112-6.

23 O'Neill D, Neubauer K, Boyle M, et al. Dementia and driving. *Journal of the Royal Society of Medicine* 1992; 85(4): 199-202.

24 O'Neill D. Physicians, elderly drivers, and dementia. *Lancet* 1992; 339(8784): 41-3.

25 Millar WJ. Multiple medication use among seniors. *Health Reports* (Statistics Canada, Catalogue 82-003-XPB) 1998; 9(4): 11-7.

26 Ray WA, Fought RL, Decker MD. Psychoactive drugs and the risk of injurious motor vehicle crashes in elderly drivers. *American Journal of Epidemiology* 1992; 136(7): 873-83.

27 Thomas RE. Benzodiazapine use and motor vehicle accidents. Systematic review of reported association. *Canadian Family Physician* 1998; 44: 799-808.

28 Leveille SG, Bucher DM, Koepsell TD, et al. Psychoactive medications and injurious motor vehicle collisions involving older drivers. *Epidemiology* 1994; 5(6): 591-8.

29 Hemmelgarn B, Suissa S, Huang A, et al. Benzodiazepine use and the risk of motor vehicle crash in the elderly. *Journal of the American Medical Association* 1997; 278(1): 27-31.

30 Evans L. Older driver involvement in fatal and severe traffic crashes. *Journal of Gerontology* 1988; 43(6): S186-S193.

31 Chu X. *The effects of age on the driving habits of the elderly. Evidence from the 1990 National Personal Transportation Study* (DOT-T-95-12). Washington, DC: US Department of Transportation, 1994.

32 Ball K, Owsley C, Stalvey B, et al. Driving avoidance and functional impairment in older drivers. *Accident Analysis and Prevention* 1998; 30(3): 313-22.

33 Marottoli RA, Ostfeld AM, Merrill SS, et al. Driving cessation and changes in mileage driven among elderly individuals. *Journal of Gerontology* 1998; 48(5): S255-60.

34 Dulisse B. Older drivers and risk to other road users. *Accident Analysis and Prevention* 1998; 29(5): 573-82.

35 Gresset J, Meyer F. Risk of automobile accidents among elderly drivers with impairments or chronic diseases. *Canadian Journal of Public Health* 1994; 85(4): 282-5.

36 Guibert R, Potvin L, Clampi A, et al. Are drivers with CVD more at risk for motor vehicle crashes? Study of men aged 45 to 70. *Canadian Family Physician* 1998; 44: 770-6.

37 McCloskey LW, Koepsell TD, Wolf ME, et al. Motor vehicle collision injuries and sensory impairments of older drivers. *Age and Ageing* 1994; 23(4): 267-73.

38 Transport Canada. *1996 Canadian Motor Vehicle Traffic Collision Statistics, TP3322, October 1997*. Available at: http://www.tc.gc.ca/roadsafety/Stats/stats96/st96agee.html. Accessed July 28, 1998.

39 Lefrançois R, D'Amours M. Exposure and risk factors among elderly drivers: A case control study. *Accident Analysis and Prevention* 1997; 29(3): 267-75.

40 Owsley C, McGwin G, Ball K. Vision impairment, eye disease and injurious motor vehicle crashes in the elderly. *Ophthalmic Epidemiology* 1998; 5(2): 101-13.

41 Parasuraman R, Nestor P. Attention and driving. Assessment in elderly individuals with dementia. C*linics in Geriatric Medicine* 1998; 9(2): 377-87.

42 Odenheimer GL, Beaudet M, Jette AM, et al. Performance-based driving evaluation of the elderly driver: safety, reliability, and validity. *Journal of Gerontology* 1994; 49(4): M153-9.

43 Hunt L, Morris JC, Edwards D, et al. Driving performance in persons with mild senile dementia of the Alzheimer type. *Journal of the American Geriatrics Society* 1993; 41(7): 747-53.

44 Trobe JD, Waller PF, Cook-Flannagan CA, et al. Crashes and violations among drivers with Alzheimer disease. *Archives of Neurology* 1996; 53(5): 411-6.

45 Reuben DB, Silliman RA, Traines M. The aging driver, medicine, policy, and ethics. *Journal of the American Geriatrics Society* 1988; 36(12): 1135-42.

46 Miller DJ, Morley JE. Attitudes of physicians toward elderly drivers and driving policy. *Journal of the American Geriatrics Society* 1993; 41(7): 722-4.

47 Persson D. The elderly driver: deciding when to stop. *Gerontologist* 1993; 33(1): 88-91.

48 Chipman ML, Payne J, McDonough P. To drive or not to drive: The influence of social factors on the decisions of elderly drivers. *Accident Analysis and Prevention* 1998; 30(3): 299-304.

49 Kington R, Reuben D, Rogowski J, et al. Sociodemographic and health factors in driving patterns after 50 years of age. *American Journal of Public Health* 1994; 84(8): 1327-9.

50 Campbell MK, Bush TL, Hale WE. Medical conditions associated with driving cessation in community-dwelling, ambulatory elders. *Journal of Gerontology* 1993; 48(4): S230-4.

51 Waller PF. The older driver. *Human Factors* 1991; 33(5): 499-505.

52 Yassuda MS, Wilson JJ, von Merling O. Driving cessation: the perspective of senior drivers. *Educational Gerontology* 1997; 23(6): 525-38.

53 Stutts JC. Do older drivers with visual and cognitive impairments drive less? *Journal of the American Geriatrics Society* 1998; 46(7): 854-61.

54 Marottoli RA, Mendes de Leon CF, Glass TA, et al. Driving cessation and increased depressive symptoms: prospective evidence from the New Haven EPESE. Established Populations for Epidemiological Studies of the Elderly. *Journal of the American Geriatrics Society* 1997; 45(2): 202-6.

55 Legh-Smith J, Wade DT, Hewer RL. Driving after a stroke. *Journal of the Royal Society of Medicine* 1986; 79(4): 200-3.

56 Odenheimer GL. Dementia and the older driver. *Clinics in Geriatric Medicine* 1993; 9(2): 349-64.

57 Drachman DA, Swearer JM. Driving and Alzheimers' disease: the risk of crashes. *Neurology* 1993; 43(12): 2448-56.

58 Barr RA. Recent changes in driving among older adults. *Human Factors* 1991; 33(5): 597-600.

59 Underwood M. The older driver. Clinical assessment and injury prevention. *Archives of Internal Medicine* 1992;152(4): 735-40.

Appendix

Table A
Prevalence of chronic conditions, household population aged 45 or older, by age group and sex, Canada excluding territories, 1996/97

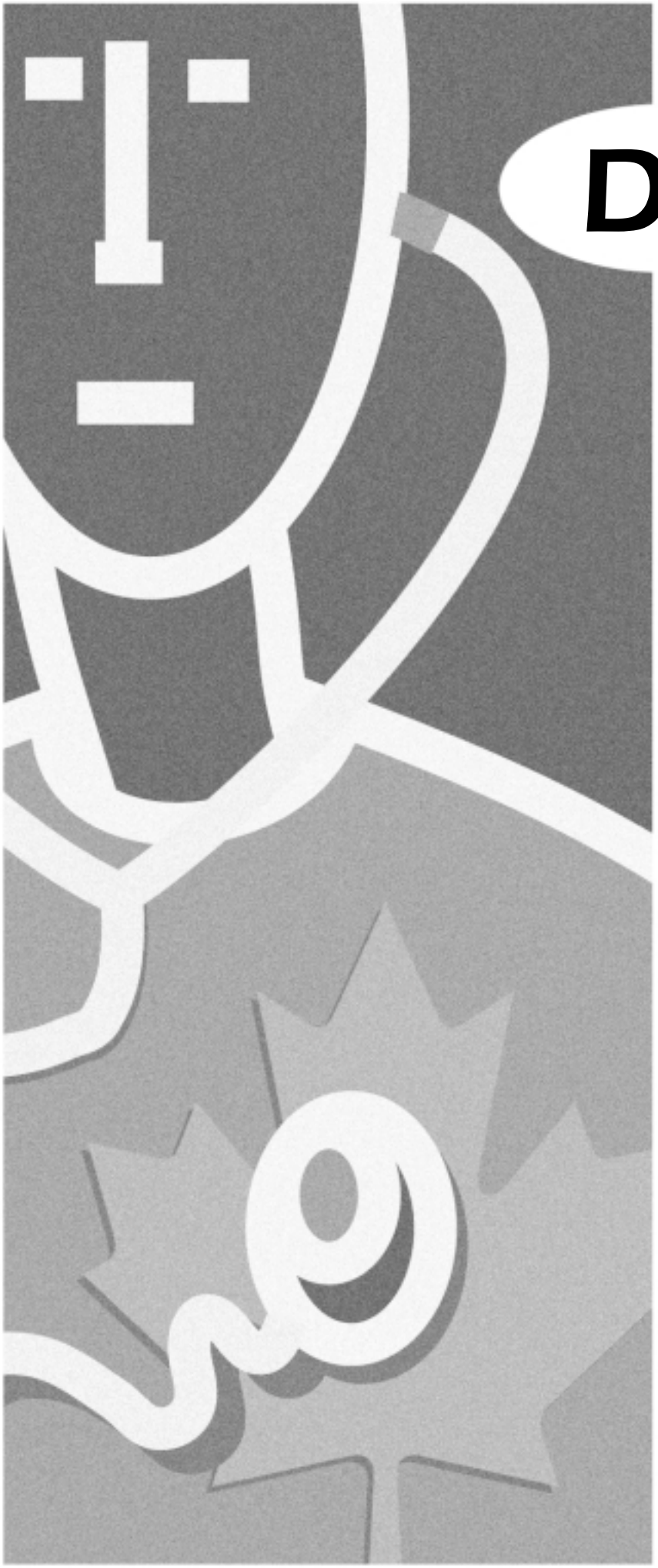
	Total	Men	Women
		%	
Heart disease			
45-64	5	6	4
65+	16	18	14
65-74	13	16	11
75-84	20	22	18
85+	22	20††	23
Arthritis			
45-64	21	14	27
65+	42	34	49
65-74	40	32	46
75-84	45	36	52
85+	53	43†	59
Diabetes			
45-64	5	6	4
65+	10	12	9
65-74	10	11	9
75-84	11	14	10
85+	--	--	--
Effects of stroke			
45-64	1	1†	1†
65+	4	5	3
65-74	3	4†	2†
75-84	5	7†	4
85+	8	8	8††
Glaucoma			
45-64	1	1†	1†
65+	5	4	5
65-74	4	4†	4
75-84	7	6†	7†
85+	7	4††	9†
Cataracts			
45-64	2	2†	2
65+	15	12	17
65-74	9	7	11
75-84	23	19	26
85+	31†	29††	33

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Coefficient of variation between 16.6% and 25.0%
†† Coefficient of variation between 25.1% and 33.3%
-- Coefficient of variation too high to provide reliable estimate

Table B
Prevalence of disabilities, household population aged 45 or older, by age group and sex, Canada excluding territories, 1996/97

	Total	Men	Women
		%	
Serious cognitive problem			
45-64	1	1†	1
65+	3	3	3
65-74	1	2†	1†
75-84	3	4†	3†
85+	9†	7†	11†
Manual dexterity problem			
45-64	1	1	1
65+	2	2	3
65-74	2†	1†	--
75-84	2	2††	2
85+	5†	--	5†
Mobility problem (needs personal aid)			
45-64	1	1†	1†
65+	5	3†	6
65-74	2	1†	2
75-84	7	5††	8
85+	19	--	23
Uncorrected vision problem			
45-64	2	2	2
65+	5	4	7
65-74	3	2	4
75-84	7	4†	9
85+	15	12	18
Uncorrected hearing problem			
45-64	1	2	1
65+	4	5	4
65-74	3	4	2
75-84	5	7	4
85+	11†	9	11†

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Coefficient of variation between 16.6% and 25.0%
†† Coefficient of variation between 25.1% and 33.3%
-- Coefficient of variation too high to provide reliable estimate



Data Releases

Synopses of recent health information produced by Statistics Canada

Statistical report on the health of Canadians, 1999

A new report containing detailed statistics on more than 80 topics related to the health status of Canadians and the major determinants of health is now available. The *Statistical report on the health of Canadians* draws primarily on results from the National Population Health Survey, as well as other sources such as the National Longitudinal Survey on Children and Youth.

A section on health determinants explores social, economic and physical environments, health services, personal resources and coping, health knowledge and lifestyle behaviours. A section on health status examines individual well-being, general health and function, injuries, conditions and diseases, and death.

Originally released on September 17, 1999, the *Statistical report on the health of Canadians, 1999* (Catalogue no. 82-570-XIE) is available free of charge on Statistics Canada's website: www.statcan.ca. Select "Products and services," then "Downloadable publications (free)," followed by "Health." For more information, or to enquire about the concepts, methods and data quality, contact Larry Swain (613-951-8569; larry.swain@statcan.ca), Health Statistics Division. To obtain a print copy of this report, telephone 613-951-5995.

Cancer incidence, 1995 (complete) and 1996, 1997 (preliminary)

Cancer incidence data for 1995 are now available at the national level. A total of 117,054 new cases of cancer were diagnosed in 1995, down 1.4% from the previous year. Women accounted for 55,992 of new cases in 1995, up 1% from a year earlier. The 61,062 cases reported for men represented a 3.6% decline over 1994. The slight downturn in cancer cases is mostly attributable to decreases in prostate cancer.

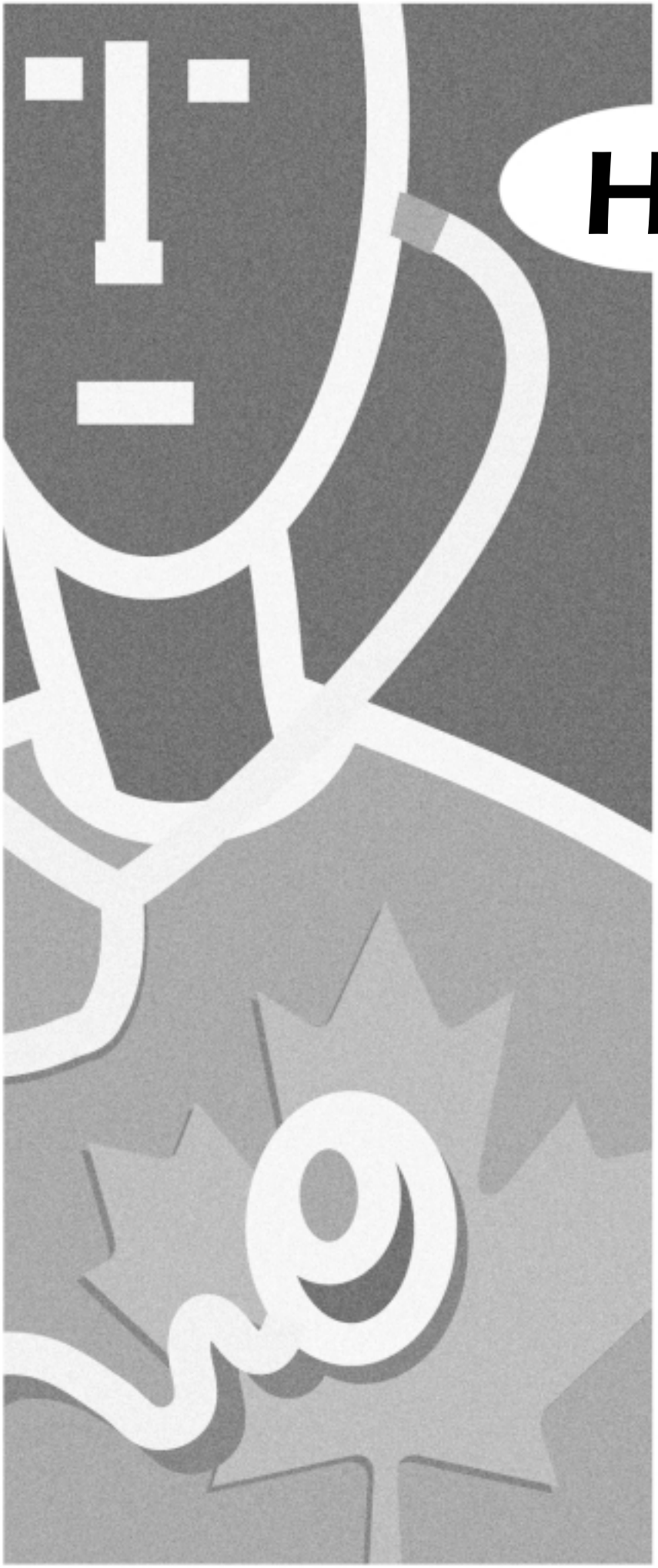
Preliminary cancer incidence data for 1996 and 1997 are also available. The 1996 data include information on new cases of cancer diagnosed in 1996 as reported by nine provincial and two territorial cancer registries. The 1997 data include information from six provincial and two territorial cancer registries.

These data were originally released in the Statistics Canada publication *The Daily* on September 2, 1999. For more information, or to enquire about the concepts, methods or data quality of this release, contact Judy Lee (613-951-1775) or the Client Custom Services Unit (613-951-1746), Health Statistics Division.

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



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