Health Reports

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Research Articles

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

Childhood asthma

Wayne J. Millar and Gerry B. Hill

Abstract

Objectives

This article describes trends in the prevalence of asthma among children aged 0 to 14 from 1978/79 to 1994/95, and in hospital separations for asthma from 1974/75 to 1994/95. It also examines factors associated with childhood asthma.

Data sources

Information on asthma among children aged 0 to 11 is from the 1994/95 National Longitudinal Survey of Children and Youth (NLSCY), and among children aged 12 to 14, from the 1994/95 National Population Health Survey (NPHS). Hospital separation data are from the Hospital Morbidity File. Mortality data are from the Canadian Vital Statistics Data Base.

Analytical techniques

Prevalence estimates of asthma were calculated based on a sample of 22,831 children aged 0 to 11 from the NLSCY and 637 children aged 12 to 14 from the NPHS. Logistic regression was used to estimate the odds of asthma among children aged 0 to 11 by selected characteristics.

Main results

The prevalence of childhood asthma and hospital separations rates for asthma have increased sharply. A history of bronchitis and allergies, parental asthma, and residence in the Atlantic provinces and Quebec are associated with higher rates of asthma in children.

Key words

bronchial hyperreactivity, hospital utilization, allergy, bronchitis

Authors

Wayne J. Millar (613-951-1631; millway@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa K1A 0T6. Gerry B. Hill is with the Department of Epidemiology and Community Medicine at the University of Ottawa.

Asthma can be a debilitating and even life-threatening disease. This chronic condition causes recurrent episodes of coughing, wheezing, and breathlessness when airways become inflamed, swell up and tighten (see *What is asthma?*). Exposure to irritants such as smoke, dust, pets and molds can trigger asthma attacks. Quality of life for those who have asthma and for their families can be compromised.[1,2]

In addition to the personal toll, asthma places a burden on the health care system. The direct and indirect costs of asthma in Canada in 1990 were estimated to range between $504 and $648 million.[3]

A number of international studies have noted rising rates of asthma, particularly among children,[4-8] and have suggested that changes in the environment may be contributing to the increases. National health surveys conducted in Canada over the past two decades also reveal a sharp rise in the reported prevalence of childhood asthma. To some extent, Canadian hospital admission data for the same period mirror this increase. However, while hospital separation rates for childhood asthma rose almost every year from 1974 to 1987, they have declined slightly since then.

Methods

Data sources

Data for this article come from the 1994/95 National Longitudinal Survey of Children and Youth (NLSCY),[9] the 1994/95 National Population Health Survey (NPHS),[10] the Hospital Morbidity File, and the Canadian Vital Statistics Data Base. The NLSCY provides data for children aged 0 to 11, and the NPHS, for children aged 12 to 14. Hospital and mortality data cover the entire 0-to-14 age group. Supplemental historical information on the prevalence of childhood asthma was obtained from the 1978/79 Canada Health Survey[11] and the 1983/84 Canadian Health and Disability Survey[12] (see *Definitions*.)

The first cycle of the NLSCY was conducted in 1994/95. The target population was children from newborn to age 11. In each NLSCY household, up to four children were selected at random, and a question was asked to determine who in the household was the person most knowledgeable (PMK) about them. For 91.3% of the selected children, the PMK was the mother (89.9% biological; 1.4% step, adoptive or foster).

The 1994/95 NLSCY resulted in a responding sample of 13,439 households. In these households, 22,831 children were selected to participate in the survey. The overall response rate at the household level was 86%. Response rates for the health outcomes of children and the characteristics of the PMK were 91% or more.

The 1994/95 data on asthma among 12- to 14-year-olds are from the household component of the 1994/95 National Population Health Survey for the 10 provinces—a sample of 27,263 households, 88.7% of which agreed to participate in the survey. After the application of a screening rule (to keep the sample representative),[10] 20,725 households remained in scope. One knowledgeable person in each participating household provided general socio-demographic and health information about each household member. (The data base containing this information is called the General file.) In addition, one randomly selected person in each of the 20,725 participating households was chosen to provide in-depth information about his or her own health. In 18,342 of these households, the selected person was aged 12 or older. The response rate to these in-depth health questions was 96.1% or 17,626 respondents. (The data base pertaining to these respondents is called the Health file.) The NPHS data analysed in this article are from the Health file and refer to the 637 randomly selected children aged 12 to 14 who were in the NPHS sample. In the remaining 2,383 participating households, the randomly selected respondent was younger than age 12. In-depth health information was collected for these children as part of the NLSCY.

The sample size of the 1978/79 Canada Health Survey was 34,993 respondents, 3,704 of whom were aged 0 to 14. One person in each household responded to an interviewer-administered questionnaire on behalf of all household members. The response rate was 86%.

The 1983/84 Canadian Health and Disability Survey used a separate questionnaire for children aged 0 to 14. The sample size was 59,195 children in the 10 provinces. From proxy interviews with a parent or other responsible adult family member, the screening questionnaire identified children with long-term health conditions, which included asthma.

Data on 552,099 hospital stays of children aged 0 to 14 involving asthma were obtained from Statistics Canada's Hospital Morbidity File for fiscal years 1974/75 to 1994/95. The file contains one record for each separation from Canadian general and allied special hospitals in all provinces and territories. This analysis excludes data for the territories.

Data on asthma deaths are from the Canadian Vital Statistics Data Base. The data are adapted from information collected by the provincial and territorial registries of vital statistics.

Analytical techniques

The analysis of the prevalence of asthma focuses on children aged 0 to 11. Where feasible, data for the 12-to-14 age group from the NPHS were combined with NLSCY data to yield estimates for children aged 0 to 14.

All results in this article are based on estimates weighted up to the population level. Logistic regression was used to estimate the odds ratios for asthma among children aged 0 to 11, while controlling for selected independent variables. Sample weights were adjusted so that they average to 1, thereby reducing variance estimate bias, but not accounting for the design effect. Tests with p-values less than .01 (instead of .05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design. Nonetheless, the odds ratios reported in this article should be viewed with caution. Their standard errors, and hence, confidence intervals, may be underestimated.

The World Health Organization's Eighth and Ninth Revisions of the International Classification of Diseases were used to identify asthma in the hospital separation and mortality data.[13,14] From 1974 to 1978, the Eighth Revision was in effect; from 1979 to 1994, the Ninth Revision was used. In both revisions, the diagnostic category for asthma was 493. Similarly, for mortality, if the underlying cause of death was coded 493, it was considered an asthma death.

This article uses survey data, hospital records, and vital statistics to trace trends in the prevalence of asthma among children (see *Methods, Definitions* and *Limitations*). The health and lifestyle consequences of asthma for children and factors associated with childhood asthma are also analysed.

Prevalence rising

The prevalence of childhood asthma has risen sharply since the late 1970s. In 1978/79, an estimated 2.5% of children younger than 15 were reported to have asthma. By 1983/84, the percentage had risen only slightly, but in 1994/95, the estimate was 11.2% or 672,000 children (Table 1).

Definitions

1994/95 National Longitudinal Survey of Children and Youth

The person most knowledgeable about the child (PMK—usually the mother) answered a series of questions about the child's health and health behaviour. The analysis in this study was confined to the responses of the biological mother or father.

To determine the prevalence of asthma among children, the PMK was asked: *"Has he/she ever had asthma that was diagnosed by a health professional?"* Recent asthma attacks were determined by the question: "*Has he/she had an attack of asthma in the last 12 months?"*

The association between asthma and activity restrictions was assessed by: *"Does this condition or health problem prevent or limit his/her participation in school, at play or any other activity normal for a child his/her age?"*

Chronic conditions were assessed with the question*: "Does he/she have any of the following long-term conditions that have been diagnosed by a health professional?"* Response categories relevant for this report were: allergies, bronchitis, and emotional, psychological or nervous difficulties.

To determine the overall health of the child, the PMK was asked: *" In general, how would you describe his/her health?"* Response options were: excellent, very good, good, fair, poor.

The child's general activity level was measured with the question: "*In your opinion, how physically active is he/she compared to other children of the same age and sex?"* A list of responses was read (much more, moderately more, equally, and much less), only one of which was marked.

The child's use of hospital services was assessed by asking: "*In the past 12 months, was the child ever an overnight patient in a hospital?"*

To assess the use of health professionals, the PMK was asked: *"In the past year, how many times have you seen or talked on the telephone about the child's physical or mental health with: a general practitioner, family physician, pediatrician?"*

The health and behaviour of people in the household where the child lives could be expected to affect the child's health status. For this reason, questions were asked about the health behaviour and health status of the PMK (and the spouse or partner of that person, if applicable):

"At the present time do you smoke cigarettes daily, occasionally, or not at all?"

"Do you have any of the following long-term conditions that have been diagnosed by a health professional?" Response options relevant for this analysis were: food allergies, other allergies, asthma.

1994/95 National Population Health Survey

The 1994/95 National Population Health Survey asked a series of questions about chronic health problems. "*We are interested in 'long-term conditions' that have lasted or are expected to last 6 months or more and that have been diagnosed by a health professional. Do you have ... diagnosed by a health professional?* The response options relevant for this analysis were: food allergies, other allergies, asthma and chronic bronchitis. Respondents who reported that they had been diagnosed with asthma were asked: "*Have you had an attack of asthma in the past 12 months?"*

The prevalence of smoking was determined with the question: "*At the present time do you smoke cigarettes daily, occasionally or not at all?"*

1978/79 Canada Health Survey and 1983/84 Canadian Health and Disability Survey

The 1978/79 Canada Health Survey contained a question about the prevalence of chronic disease. The selected household respondent was asked: "*Does anyone in the family presently have: ... asthma?*" In the 1983/84 Canadian Health and Disability Survey, the children's questionnaire asked: *"Which, if any, of these long-term conditions or health problems does … have?"* Asthma was included among the options listed.

Table 1
Selected indicators of asthma among children aged 0 to 14, Canada, excluding territories, 1978/79, 1983/84 and 1994/95

	1978/79	1983/84	1994/95
Population aged 0-14	**5,531,000**	**5,326,000**	**6,000,000**
Number with asthma	141,000	167,000	672,000
% with asthma	2.5	3.1	11.2
Hospital separations for asthma	**17,223**	**27,357**	**29,073**
Per 100,000 population aged 0-14	311	514	488
Per 100,000 population aged 0-14 with asthma	12,215	16,381	4,326
Asthma deaths	**16**	**13**	**9**
Per 100,000 population aged 0-14	0.29	0.24	0.15
Per 100,000 population aged 0-14 with asthma	11.3	7.8	1.3

Data sources: *1978/79 Canada Health Survey, 1983/84 Canadian Health and Disability Survey, 1994/95 National Longitudinal Survey of Children and Youth, 1994/95 National Population Health Survey, Hospital Morbidity File, Canadian Vital Statistics Data Base*

Table 2
Prevalence of asthma among children aged 0 to 14, by selected characteristics, Canada excluding territories, 1994/95

	Number	Diagnosed with asthma	Children with asthma who had attack in past year
	'000		%
Total	**6,000**	**11**	**51**
Sex			
Male	3,096	13	50
Female	2,904	9†	51
Age			
0-4	1,960	7†	57‡
5-9	1,931	13	50
10-14	2,108	13	48
Urban/Rural			
Urban	4,894	11	45†
Rural	1,099	11	52
Not stated	7	--	--
Household income			
Lowest/Lower-middle	1,063	13	54††
Middle	1,960	10§	51
Upper-middle	1,994	11	50
Highest	911	13	46
Not stated	72	--	--

Data sources: *1994/95 National Longitudinal Survey of Children and Youth (for ages 0 to 11), 1994/95 National Population Health Survey, Health file (for ages 12 to 14)*
Note: *Because of rounding, detail may not add to total.*
† Significantly lower than other items in category ($p < 0.01$)
‡ Significantly higher than ages 10-14 ($p < 0.01$)
§ Significantly lower than lowest/lower-middle and highest income groups ($p < 0.01$)
†† Significantly higher than highest income group
-- Amount too small to be expressed

Throughout the period, asthma was more commonly reported among boys than girls. In 1978/79, 3.4% of boys and 1.6% of girls had asthma. By 1994/95, the figures were higher for both sexes, but the gap persisted: 13% versus 9% (Table 2).

In 1994/95, the percentage of children who have ever been diagnosed with asthma was almost twice as high at ages 5 to 14 (13%) as at ages 0 to 4 (7%). However, among children with asthma, the percentage who had had an attack in the past year was somewhat higher at the youngest ages.

The prevalence of asthma did not differ by urban/rural residence. On the other hand, the percentage of children with asthma who had had an attack in the previous year was significantly higher in rural than in urban areas.

Children in middle-income households had a significantly low prevalence of asthma, compared with those in both lower- and higher-income households. But among children with asthma, those in lower-income households were the most likely to have had a recent attack.

Asthma and health status

Not surprisingly, children with asthma fared less favourably on several measures of health than did other children. According to the NLSCY, 7% of children aged 0 to 11 with asthma were in fair or poor health, compared with just 1% of children who did not have the condition (Table 3).

Children with asthma were also more likely than other children to have an activity limitation: 13% versus 3%. Among those who had experienced an asthma attack in the previous year, the activity limitation rate was 22%.

The general level of physical activity among children with asthma was significantly lower than that of children who did not have asthma. Ten percent of children with asthma were described as "less active"; this applied to 6% of other children.

Children who had been diagnosed with asthma also used more health care services than those without the disease. Children with asthma averaged around six physician or pediatrician consultations in the year before the survey, about double the

number for children without asthma. As well, during that period, 11% of children with asthma had been admitted to hospital; for those who had had an asthma attack, the percentage was 19%. By contrast, just 5% of children who did not have asthma had been hospitalized.

Hospital admissions levelling off

Hospital separations for asthma among children rose from about 14,300 in 1974/75 to 34,600 in 1987/88; however, by 1994/95, they had fallen to 29,100. The trend in the age-standardized hospital separation rate for childhood asthma was similar. Between 1974/75 and 1987/88, the rate rose from 246 to 627 separations per 100,000 children aged 0 to 14. By 1994/95, it had dropped to 489 (see Appendix Tables A and B and *Regional patterns*).

Hospital separation rates based on the number of children with asthma are, of course, much higher. In 1978/79, the rate was 12,215 hospitalizations per 100,000 children who had ever been diagnosed with the disease (Table 1). By 1983/84, the rate had risen to 16,381. Thereafter, the number of children with asthma increased much faster than the number of asthma hospitalizations. Consequently, the hospital separation rate per 100,000 children with asthma fell to 4,326 in 1994/95.

Since 1974/75, the average time children spend in hospital for asthma has been almost halved. That

Table 3
Health status and health care utilization of children aged 0 to 11, by asthma status, Canada excluding territories, 1994/95

	Not diagnosed with asthma	Diagnosed with asthma	Asthma attack in past year
		%	
Health status			
General health			
Excellent/Very good	91	66	55
Good	8	27	33
Fair/Poor	1†	7	12
Activity limitation	3	13	22
Activity level			
More active	37	37	35
Equally active	57	53	54
Less active	6†	10	12
Health care utilization			
Overnight hospital stay in past year	5†	11	19
Mean number of consultations in past year			
Family physician	2.50†	4.60	5.88
Pediatrician	0.63†	1.44	2.06

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *Because of rounding, percentages may not add to 100%.*
† Significantly lower than children diagnosed with asthma

What is asthma?

Asthma is a chronic inflammatory disorder of the airways.[15,16] In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness and cough, particularly at night and/or in the early morning. Normally, air flows easily through the bronchial tubes, which naturally tighten to keep out very cold air or other harmful substances. But for people with asthma, the lungs also react to even minor irritants.

Asthma attacks vary in frequency and severity. Some people with asthma are generally symptom-free, with occasional mild episodes of shortness of breath. Others cough and wheeze most of the time and have severe attacks after viral infections, exercise or exposure to irritants.

An asthma attack may begin suddenly, or it may come on slowly with gradually worsening symptoms. While many attacks last for only a few minutes, in severe cases, an attack can go on for hours. During an asthma attack, the muscles that control the bronchial tubes tighten and go into a spasm. The airways swell and become inflamed, and the mucus-producing cells that line the bronchial tubes secrete more mucus, which interferes with breathing.

Drug treatments allow most people with asthma to lead relatively normal lives. Such treatments may be immediate to get an attack under control, or continuous, designed to prevent attacks.

Some children with asthma may not suffer from it when they reach late adolescence or adulthood. However, there is evidence that children with moderate to severe asthma are at higher risk for asthma and other respiratory problems in adulthood.[17] Even when the disease has clinically disappeared, the lung function of the patient frequently remains altered, or airway hyper-responsiveness and cough persist. Children with moderate to severe asthma will probably be at risk for its longer-term effects throughout their lives.[15,18,19]

Although asthma can be life-threatening, mortality from asthma among children declined from 16 deaths in 1978/79 to 9 in 1994/95 (Table 1). Rates fell from 0.29 to 0.15 deaths per 100,000 children aged 0 to 14. Expressed per 100,000 asthmatic children, the rate dropped from 11.3 to 1.3 deaths.

year, the average length of stay was 5.55 days; by 1994/95, it was 2.64 days. The decline in the number of hospital separations, as well as in length of stay, could be attributable to a combination of improved treatment of childhood asthma with medications, greater use of ambulatory care services, and the general reduction in hospital admissions for many conditions.[20]

High separation rates for youngest children and boys

Young children are more likely than older children to be hospitalized for asthma (Chart 1). This may reflect the higher rate of recent attacks reported for children younger than age 5. In 1994/95, asthma was the leading cause of hospitalization of children aged 1 to 4; for older children, it ranked second or third, depending on their sex.

Regional patterns

In 1994/95, the prevalence of childhood asthma was highest in Atlantic Canada and lowest in the Prairies. The percentage of children with asthma who had a recent attack ranged from 43% in Quebec to 59% in British Columbia.

Trends in children's hospital separation rates for asthma have been similar in all regions, with rates rising until the late 1980s or early 1990s and then declining (Appendix Table B). In 1994/95, regional variations in hospital separation rates paralleled the reported prevalence of asthma, with the highest rates in the Atlantic Region and Quebec, and the lowest in British Columbia. This marked a change from the 1970s, when the Prairie Region had the highest hospital separation rates, while Quebec had the lowest.

Several factors should be considered when interpreting regional trends in hospital separation rates for childhood asthma. Differences in rates may reflect differences in the organization of outpatient services, in the availability of hospital beds or in access to primary health care. As well, the severity of asthma within each region's child population may vary.

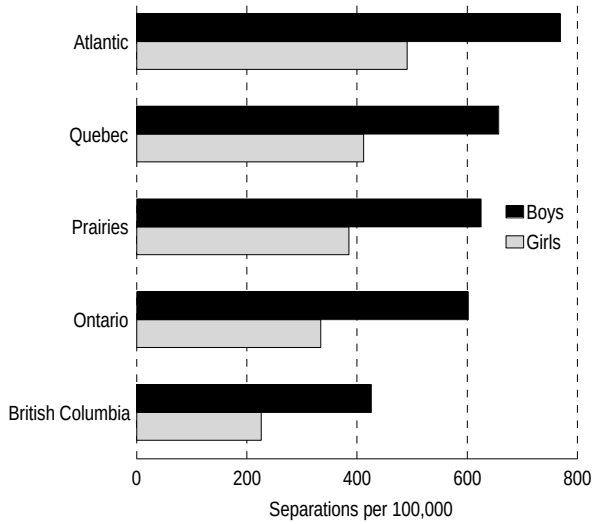
The tendency toward a higher prevalence of asthma in Atlantic Canada has been noted in a previous study.[21] The authors speculated that some of the regional differences in asthma rates may be due to variations in exposure to environmental pollution. They also suggested that early migration and settlement patterns may have contributed to a genetic predisposition to asthma in the Atlantic provinces.

Prevalence of asthma among children aged 0 to 14, by region, Canada excluding territories, 1994/95

	Number	Diagnosed with asthma	Children with asthma who had attack in past year
	'000		%
Total	**6,000**	**11**	**51**
Atlantic	498	14†	52
Quebec	1,429	12	43‡
Ontario	2,245	11	53
Prairies	1,086	10	51
British Columbia	741	11	59

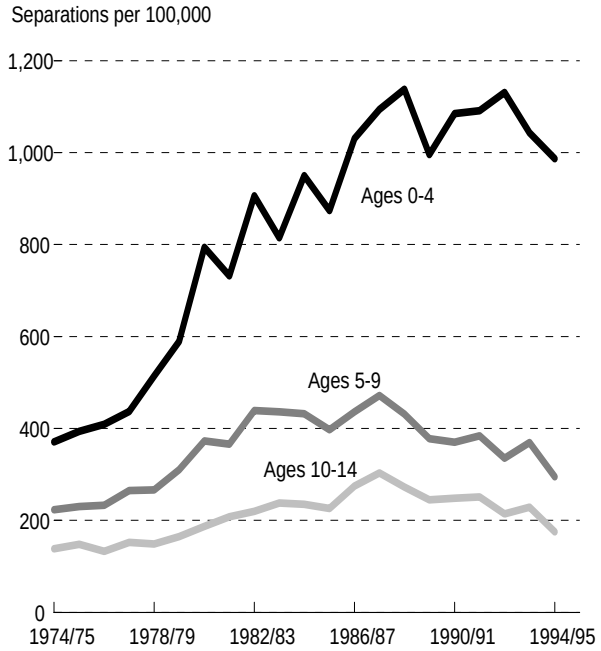
Data sources: *1994/95 National Longitudinal Survey of Children and Youth (for ages 0 to 11), 1994/95 National Population Health Survey, Health file (for ages 12 to 14)*
† Significantly higher than other regions
‡ Significantly lower than other regions
Note: *Because of rounding, number does not sum to 6,000,000.*

Hospital separation rates for asthma, by sex and region, children aged 0 to 14, Canada excluding territories, 1994/95



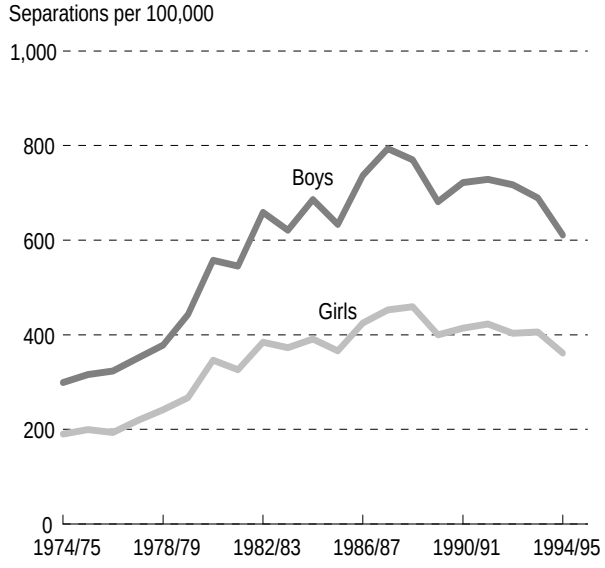
Data source: *Hospital Morbidity File*

Chart 1
Hospital separation rates for asthma, by age group, children aged 0 to 14, Canada excluding territories, 1974/75 to 1994/95



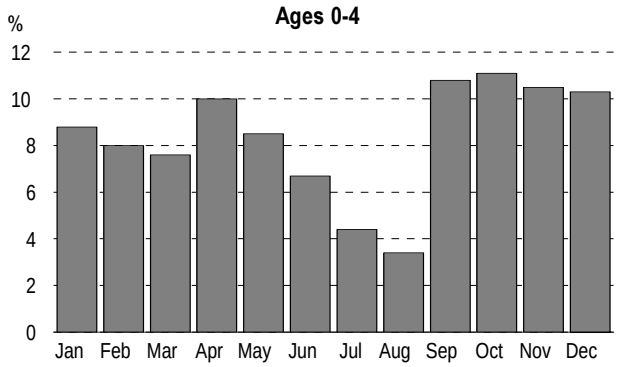
Data source: *Hospital Morbidity File*

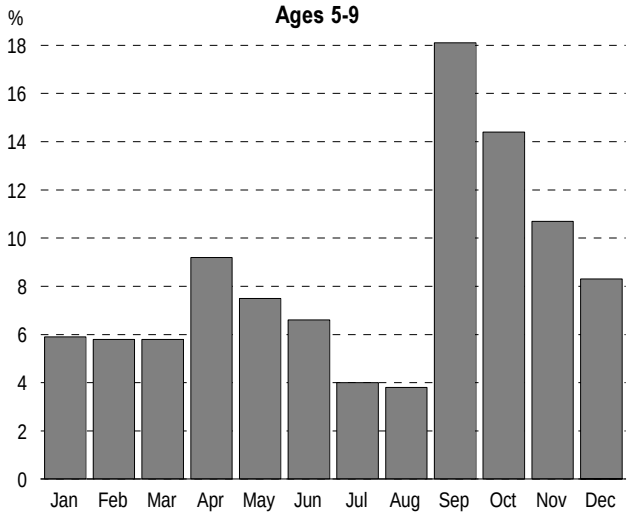
Chart 2
Hospital separation rates for asthma,† by sex, children aged 0 to 14, Canada excluding territories, 1974/75 to 1994/95

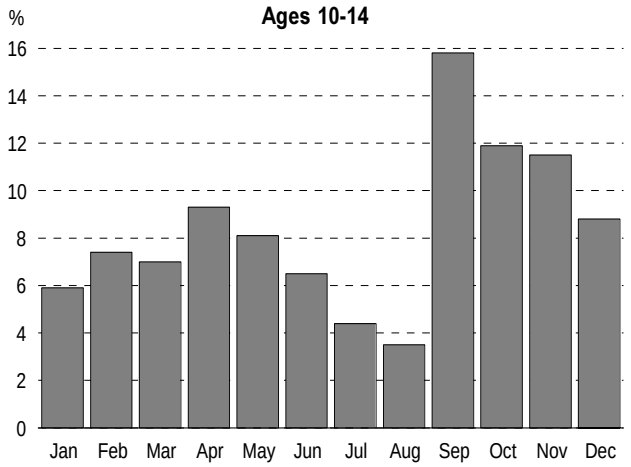


Data source: *Hospital Morbidity File*
† Age-adjusted

Chart 3
Percentage distribution of hospital separations for asthma, by month of hospitalization, children aged 0 to 14, Canada excluding territories, 1994/95







Data source: *Hospital Morbidity File*

At all ages, boys were more likely than girls to be hospitalized for asthma (Appendix Table A and Chart 2), a trend that has been noted in previous research.[21-23] The higher hospital separation rate for boys may be attributable to anatomical differences. Boys tend to have narrower airways and increased airway tone, which makes them more susceptible to airflow limitation.[15] These differences typically disappear around age 10, when the airway diameter/length ratio is the same in both sexes. In fact, in recent years, hospital separation rates for asthma among boys and girls aged 10 to14 were almost the same.

Autumn upturn

The number of hospital separations for asthma rises sharply in September, then declines each month until April when there is another smaller upturn (Chart 3). The percentage of hospital separations that occur in September is much higher for school-age children (ages 5 to 14) than for preschool children. The return to school increases the amount of time children spend indoors and the possibility of exposure to mold and dust mites, both of which have been implicated in childhood asthma.[24,25] The incidence of viral infections also rises when children go back to school, and there is some indication that respiratory viruses may exacerbate asthma attacks in susceptible children.[15] The elevated hospital separation rates in the spring could reflect exposure to pollen and molds.[26]

Factors associated with childhood asthma

According to the NLSCY, children aged 0 to 11 with a history of bronchitis or allergies were much more likely to be diagnosed with asthma and to have had a recent attack than were children without these conditions (Table 4). For instance, 49% of children with a history of bronchitis also had asthma, compared with 10% of children who did not have bronchitis.

Children aged 6 to 11 with emotional problems were also more likely to have been diagnosed with asthma and more likely to have experienced an asthma attack in the past year. The direction of this association, however, is unclear; emotional problems may have stemmed from having asthma rather than being a precursor of it.

A history of asthma in the parents was associated with asthma in children. Fully 28% of children whose biological mother had asthma had also been diagnosed with the disease; the figure was just 10% for children of mothers who did not have the condition. Among children with asthma, 59% of those whose mother was asthmatic had had an attack in the past year, compared with 49% of children

Table 4
Prevalence of asthma among children aged 0 to 11, by health characteristics of children and parents, Canada excluding territories, 1994/95

	Number	Diagnosed with asthma	Children with asthma who had attack in past year
	'000	%	
Child			
Allergies			
Yes	657	31†	55†
No	3,946	8	48
Bronchitis			
Yes	134	49†	66†
No	4,468	10	49
Emotional problems‡			
Yes	38	23†	61
No	2,259	14	47
Parents§			
Mother smokes			
Yes	1,374	13	50
No	3,042	10	51
Father smokes			
Yes	1,165	12†	51
No	2,472	9	50
Mother has asthma			
Yes	265	28†	59
No	4,171	10	49
Father has asthma			
Yes	141	19†	64†
No	3,512	10	49
Mother has allergies			
Yes	941	15†	53
No	3,496	10	50
Father has allergies			
Yes	552	12	52
No	3,101	10	50

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *Total numbers for each category will not sum to 4,673,000 because of missing data.*
† Significantly higher than other item in category
‡The question on emotional health was asked only for children older than 5.
§ Biological parents

with asthma whose mother did not have asthma. The pattern was similar if the biological father had asthma.

Table 5
Adjusted odds ratios for asthma among children aged 0 to 11, Canada excluding territories, 1994/95

	Adjusted odds ratio	99% confidence interval
Age		
0-4†	1.00	...
5-9	1.70**	1.48, 1.94
10-11	1.69**	1.43, 2.00
Sex		
Male	1.58**	1.41, 1.79
Female†	1.00	...
Allergies		
Yes	4.64**	4.09, 5.27
No†	1.00	...
Bronchitis		
Yes	6.88**	5.48, 8.65
No†	1.00	...
Parental asthma		
Neither parent asthmatic†	1.00	...
Mother asthmatic	2.78**	2.21, 3.50
Father asthmatic	1.99**	1.48, 2.67
Both parents asthmatic	3.26**	1.03,10.33
Parental smoking		
Neither parent smokes†	1.00	...
Mother smokes	1.11	0.88, 1.41
Father smokes	1.23*	1.02, 1.48
Both parents smoke	1.01	0.85, 1.20
Region		
Atlantic	1.53**	1.21, 1.94
Quebec	1.26**	1.05, 1.52
Ontario	1.10	0.92, 1.31
Prairies†	1.00	...
British Columbia	0.97	0.77, 1.23
Household income		
Lowest†	1.00	...
Lower-middle	1.29	0.84, 1.99
Middle	1.07	0.70, 1.63
Upper-middle	1.06	0.69, 1.61
Highest	1.09	0.71, 1.69

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *The multivariate analysis was based on 22,433 children for whom information was reported on all variables in the model. The multivariate logistic regression was weighted to represent 4,673,000 children aged 0 to 11 in the 10 provinces. Tests with p-values less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design.*
† Reference category for which odds ratio is 1.00
** $p < 0.05$*
*** $p < 0.01$*
... Not applicable

Exposure to cigarette smoke has frequently been associated with the development of asthma in children and with the severity of asthma attacks.[27-29] Yet the NLSCY indicates only a small increase in the prevalence of asthma among children whose parents smoked. The prevalence of asthma among children whose biological mother smoked was 13%, compared with 10% among children of non-smoking mothers. The corresponding percentages for children whose father smoked were 12% and 9%. As well, the smoking status of the parents was not associated with children having had an attack in the past year.

This does not entirely rule out a link between parental smoking and asthma. Parents of a child with asthma may be less likely to smoke, or they may not be willing to admit that they smoke. As well, the NLSCY does not provide a precise measure of the overall level of exposure to smoke. Factors such as the number of cigarettes smoked, the number of smokers in the household, whether they smoke indoors, and the ventilation of the house, all of which could influence levels of exposure, were not measured.

Significant risk factors

After the effects of other potentially confounding variables are taken into account, having bronchitis and allergies was strongly associated with asthma among children aged 0 to 11 (Table 5). Children with bronchitis had almost seven times the odds, and those with allergies nearly five times the odds, of having been diagnosed with asthma as did children without these conditions. If both biological parents had asthma, the child had about three times the odds of having asthma as did children of parents who did not have asthma. The odds of asthma were slightly elevated among children whose fathers smoked, but this was not the case if the mother or both parents smoked.

Implications

Both survey and hospital statistics show an increase in the prevalence of childhood asthma over the last two decades.[30,31] Other countries, too, have experienced similar increases.[4-6,32] It is not clear

whether the changing rates reflect a real increase in the incidence or severity of the disease, or changing perceptions. To some degree, the increase may be influenced by a greater awareness of the illness because of coverage in the mass media.[33]

Limitations

The data analyzed in this article are cross-sectional. Consequently, causality cannot be inferred from the relationships observed between the variables.

A major limitation of this analysis is the lack of information on disease severity. Having had an asthma attack in the past year indicates relatively recent problems with the condition, but no data were collected on the severity of the attack(s).

Another limitation is that parents provided information about the health of their children and about their own behaviour. Some parents may have been unwilling to acknowledge harmful behaviour, notably smoking. This may explain the weaker-than-expected association between smoking and asthma among children.

Differences in the prevalence of childhood asthma as measured by various health surveys may be partially attributable to nuances in the wording of questions. Unlike the 1978/79 Canada Health Survey and the 1983/84 Canadian Health and Disability Survey, the definition of asthma used in the 1994/95 NLSCY and NPHS specifies diagnosis by a health professional. Yet despite the more stringent definition, the prevalence of asthma in 1994/95 was much higher than that reported in the earlier surveys.

The figures on hospital separations refer to the number of hospital stays, not the number of patients. A child may be hospitalized more than once during a year because of asthma. When the number of hospital separations in 1994/95 for asthma among children aged 0 to 11 is divided by the NLSCY estimate of the number of asthmatic children, the hospital separation rate is 4%. But according to the NLSCY, 11% of children aged 0 to 11 who had asthma had been admitted to hospital in the previous year. However, the 11% estimate refers to hospitalizations for any reason, whereas the hospital separation data were calculated only for asthma. Since children with asthma tend to have other health problems, it is reasonable to assume that they might be admitted to hospital for a diagnosis other than asthma.

During the 1974/75 to 1994/95 period, the International Classification of Diseases was revised. The classification of asthmatic bronchitis changed from 490 to 493. Assessments of the impact of the revision on Canadian statistics concluded that diagnostic shifts in the classification of asthma accounted for only a small proportion of the increase in rates.[34]

Part of the increase may be attributable to a change in physicians' diagnosis and management practices since the mid-1970s. They may now be more likely to classify wheezing in a young child as asthma rather than bronchitis, and may be more likely to hospitalize children with asthma-like symptoms. A greater tendency to hospitalize young children may also be associated with research suggesting that treatment can be effective in children younger than age 2.[7]

The high prevalence of asthma among children of parents with asthma shown in the NLSCY supports the argument that heredity is important.[31] However, it is unlikely that hereditary factors in the general population could account for the sharp upturn in the reported prevalence of asthma or in hospitalization rates since the mid-1970s.

There was little evidence from the NLSCY of higher asthma rates among low-income households. Previous research on the relationship between socioeconomic status and asthma is inconsistent. Some studies have reported higher rates of childhood asthma among higher socioeconomic groups.[35,36] Others have observed a higher prevalence in lower socioeconomic groups[37] or have found no association at all.[28,38,39]

The results of this analysis show, as have other studies, that asthma is a complex and multifaceted disease. Future cycles of the NLSCY and the NPHS may provide new insights into both the natural history and consequences of the disease. ●

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Appendix

Table A

Number of hospital separations and hospital separation rates for asthma, by sex and age group, children aged 0 to 14, Canada excluding territories, 1974/75 to 1994/95

	Number of hospital separations for asthma				Hospital separation rates for asthma (per 100,000 population)			
		Age group				Age group		
	Total	0-4	5-9	10-14	Total	0-4	5-9	10-14
Boys								
1974/75	8,903	4,240	2,764	1,899	299.3	464.6	270.5	156.3
1975/76	9,272	4,560	2,758	1,954	316.0	501.3	277.8	162.2
1976/77	9,335	4,799	2,793	1,743	323.5	530.4	284.7	148.5
1977/78	10,064	5,022	3,078	1,964	351.0	555.0	318.4	172.2
1978/79	10,688	5,877	3,002	1,809	378.3	647.3	314.0	165.5
1979/80	12,407	6,992	3,517	1,898	443.0	764.3	373.7	181.5
1980/81	15,527	9,285	4,206	2,036	557.4	1,008.1	451.0	201.2
1981/82	15,181	8,807	4,149	2,225	545.1	950.4	449.2	224.0
1982/83	18,410	11,112	4,998	2,300	659.3	1,187.6	542.3	234.0
1983/84	17,419	9,935	5,012	2,472	620.8	1,050.9	544.0	254.2
1984/85	19,324	11,812	5,048	2,464	686.3	1,243.0	543.9	257.5
1985/86	17,809	10,881	4,543	2,385	632.7	1,145.5	486.4	252.7
1986/87	20,680	12,769	5,149	2,762	736.7	1,350.5	546.8	297.3
1987/88	22,456	13,823	5,586	3,047	793.8	1,451.3	585.9	327.3
1988/89	21,975	14,190	5,119	2,666	770.0	1,481.1	528.9	283.8
1989/90	19,731	12,695	4,641	2,395	681.1	1,306.1	472.2	250.6
1990/91	21,244	14,173	4,612	2,459	721.9	1,432.0	464.5	253.8
1991/92	21,647	14,338	4,777	2,532	728.6	1,433.4	478.6	258.2
1992/93	21,578	15,200	4,248	2,130	716.8	1,497.1	423.6	214.6
1993/94	21,030	14,154	4,574	2,302	689.4	1,371.0	454.0	228.6
1994/95	18,458	13,184	3,486	1,788	606.0	1,283.7	345.4	176.0
Girls								
1974/75	5,440	2,367	1,692	1,381	189.9	273.2	173.5	118.9
1975/76	5,667	2,427	1,712	1,528	199.7	281.2	180.8	132.7
1976/77	5,378	2,420	1,662	1,296	193.2	281.6	178.1	115.6
1977/78	6,031	2,697	1,912	1,422	219.1	313.5	208.5	130.6
1978/79	6,535	3,221	1,952	1,362	241.7	373.4	215.7	130.8
1979/80	7,163	3,517	2,170	1,476	267.5	405.2	243.3	148.3
1980/81	9,189	4,964	2,574	1,651	346.1	567.9	291.3	171.6
1981/82	8,670	4,429	2,432	1,809	326.5	502.9	278.1	191.6
1982/83	10,218	5,419	2,897	1,902	384.4	609.8	330.9	204.2
1983/84	9,938	5,072	2,828	2,038	372.6	566.0	322.5	221.3
1984/85	10,445	5,766	2,764	1,915	390.8	640.3	313.3	210.5
1985/86	9,767	5,293	2,685	1,789	365.8	588.0	302.9	198.7
1986/87	11,334	6,244	2,856	2,234	424.9	694.4	320.1	251.3
1987/88	12,192	6,542	3,167	2,483	452.8	719.4	350.8	278.5
1988/89	12,484	7,140	3,005	2,339	459.1	779.2	327.6	260.6
1989/90	11,033	6,238	2,610	2,185	399.8	671.4	279.6	240.0
1990/91	11,607	6,817	2,571	2,219	414.3	721.4	271.7	241.0
1991/92	11,963	6,963	2,726	2,274	423.0	730.7	285.5	243.9
1992/93	11,542	7,202	2,327	2,013	403.3	745.6	242.6	213.3
1993/94	11,755	6,855	2,707	2,193	405.6	698.4	281.0	228.8
1994/95	10,347	6,429	2,264	1,654	357.1	659.1	234.1	170.5

Data source: *Hospital Morbidity File*

Table B
Age-standardized hospital separation rates for asthma, children aged 0 to 14, by region, Canada excluding territories, 1974/75 to 1994/95

	Canada	Atlantic	Quebec	Ontario	Prairies	British Columbia
			(per 100,000 population aged 0-14)			
1974/75	245.9	238.1	176.6	252.9	329.6	241.7
1975/76	259.3	250.8	182.6	268.0	364.5	234.1
1976/77	260.0	277.9	184.6	270.4	340.6	238.1
1977/78	286.7	298.3	209.1	317.7	350.3	232.3
1978/79	311.7	332.3	232.6	331.6	392.4	266.9
1979/80	357.5	458.2	194.2	423.1	426.7	308.4
1980/81	454.5	541.3	343.4	498.5	505.6	396.6
1981/82	438.6	535.4	344.9	511.0	435.4	340.9
1982/83	525.4	651.8	462.3	573.3	532.3	382.8
1983/84	499.9	665.0	455.2	510.8	526.2	369.1
1984/85	542.5	724.0	474.4	581.6	552.2	398.9
1985/86	502.8	643.9	482.1	545.2	509.3	291.8
1986/87	584.8	712.4	551.5	648.1	588.7	361.1
1987/88	627.4	768.7	613.0	670.9	608.7	461.6
1988/89	618.2	824.9	585.4	655.9	591.2	468.5
1989/90	543.8	819.9	497.3	564.1	542.0	388.9
1990/91	571.7	876.1	453.1	621.3	581.0	432.5
1991/92	579.4	835.8	493.1	560.5	680.4	480.3
1992/93	563.9	859.1	506.0	555.8	624.9	416.8
1993/94	550.9	768.5	559.3	518.0	595.5	434.5
1994/95	492.4	618.3	536.4	463.5	430.6	334.4

Data source: *Hospital Morbidity File*

Attitudes toward smoking

Nancy Ross and Claudio Pérez

Abstract

Objectives

This article examines socio-demographic variations in attitudes about the health effects of smoking, second-hand smoke, and the importance of smoke-free environments.

Data source

The data are from the Health file of the 1996/97 cross-sectional provincial household component of the National Population Health Survey, conducted by Statistics Canada. The sample consists of 60,260 respondents aged 12 or older.

Analytical techniques

Three smoking attitude scores were derived. Multivariate analyses were used to study how age, sex, educational attainment, province and smoking status were associated with attitude scores.

Main results

Smokers placed less emphasis than non-smokers on the health risks associated with smoking. Older Canadians, particularly smokers aged 65 and older, tended to have more lenient attitudes toward smoking, compared with younger age groups. Respondents with high school education or less held more lenient attitudes, compared with those with a university degree. Quebec residents were more tolerant of tobacco use than were residents of other provinces.

Key words

smoking cessation, smoke-free environments, passive smoking, tobacco

Authors

Nancy Ross (613-951-3725; rossnan@statcan.ca) is with the Institutions and Social Statistics Branch and Claudio Pérez (613-951-1733; perecla@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa K1A 0T6.

The social acceptability of smoking has declined in North America since the 1960s,[1] when evidence first began to mount about the relationship between smoking and lung cancer and other diseases. In 1967, nearly half of Canadians were smokers.[2] Since then, the prevalence of smoking has declined. Nonetheless, in 1996/97, about a third of Canadians aged 12 or older smoked daily or occasionally. And while fewer Canadians are now smokers, the public health and economic impacts of tobacco are still enormous.[3-8]

Canadians have been exposed to more than 30 years of public health efforts to curb smoking. This includes the passage of legislation by all levels of government restricting smoking, both in response to and to promote a shift in norms and values related to tobacco use.

While health education theory and psychosocial models suggest that attitude change is a necessary precursor to behaviour change,[9,10] it is also possible that behaviour changes like quitting or starting smoking have an influence on attitudes or that attitudes and behaviours change concurrently.[11] This article investigates socio-demographic

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 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 of attitudes toward smoking uses cross-sectional data from cycle 2 of the NPHS, which was conducted in 1996/97. The data analyzed here pertain to the household population in the provinces.

The 1996/97 cross-sectional sample is made up of longitudinal respondents and respondents who were selected as part of sample buy-ins that were carried out in three provinces. The additional sample respondents were chosen with the random digit dialing (RDD) technique and were included for cross-sectional purposes only. Most of the data for cycle 2 were collected through computer-assisted telephone interviews.

Socio-demographic and some health information was 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.

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 on all household members for the General file in cycle 2. In households belonging to the 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.

Taking into account both household and selected person responses, the 1996/97 cross-sectional response rates for the Health file were 93.1% for the continuing longitudinal component and 75.8% for the RDD component, yielding an overall rate of 79.0%. A total of 81,804 respondents completed the questions for the Health file, of whom 73,402 were aged 12 or older.

This analysis began with the 73,402 persons aged 12 or older who completed the Health file interview in 1996/97. The sample size for the questions about smoking attitudes was slightly smaller because these questions were posed only to respondents who had indicated in an earlier question whether they smoked "daily," "occasionally" or "not at all" at the time of the interview. As well, respondents selected to augment the sample size in Alberta were not asked the questions about attitudes toward smoking. The resulting sample size for this analysis was 60,260. A more detailed description of the survey design, sample, and interview procedures can be found in published reports.[12,13]

Analytical techniques

Attitudes toward smoking were analyzed as groups of related questions about smoking. Three attitude scores were derived to measure beliefs about: the *health effects of smoking;* the *health effects of second-hand smoke;* and the *importance of smoke-free environments* (see *Measuring attitudes toward smoking*).

Variations in smoking attitudes were assessed in a number of ways. Mean scores were compared by smoker type and by intention to quit. Multivariate analysis was used to estimate adjusted score means. Adjusted means were obtained by province and by the interaction of smoking status with each of age, sex and educational attainment.

The choices for explanatory variables were based on their hypothesized relationship to attitudes toward smoking. Research indicates that beliefs about the negative health effects of smoking and second-hand smoke were not as strong among older age groups, women, those with lower educational attainment and current smokers, and that attitudes toward smoking vary geographically.[14-18]

Multiple linear regression models were constructed to observe the statistical significance of the effects of each explanatory variable used to calculate adjusted means, along with selected interactions (Appendix Table A). Unadjusted means can be found in Appendix Table B.

Responses were weighted to represent the target population of the NPHS. Statistical significance was determined using a weighted boostrap resampling procedure, which fully accounts for the design effect of the survey.

differences in attitudes toward smoking under the broad assumption that attitudes are associated with behaviour. The data are from the 1996/97 National Population Health Survey (see *Methods* and *Limitations*).

Smokers scored lower

Almost 90% of Canadians agreed that smoking is harmful, and more than three-quarters agreed that second-hand smoke can cause health problems in non-smokers. As might be expected, smokers' attitude scores were generally lower (more lenient) than those of non-smokers with regard to the health effects of smoking and second-hand smoke, and they placed less importance on smoke-free environments. Furthermore, there was a gradient in scores on all three attitude measures, with daily smokers scoring lower than occasional smokers who, in turn, scored lower than non-smokers (Chart 1). The only exception was the difference in scores for the health effects of smoking between occasional and non-smokers, which was not significant.

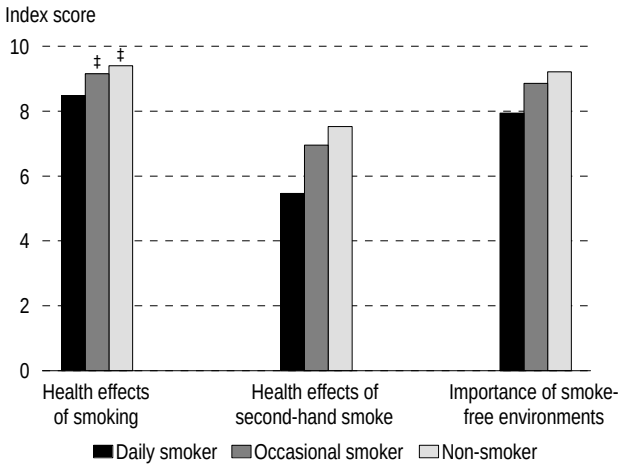
To some extent, these findings support earlier research in Ontario that showed never and former smokers to be more knowledgeable about the health effects of smoking and second-hand smoke and more supportive of smoking restrictions.[16]

The largest differences among the three smoking status groups in the NPHS were in their attitudes about the health effects of second-hand smoke. Medical research on the negative effects of second-hand smoke and use of the findings in anti-smoking campaigns is relatively recent. Therefore, it may take more time, especially for smokers, to believe these messages.

It may also be that smokers downplay the negative effects of smoking to reconcile psychological conflicts that may arise between attitude and behaviour. The same may be true of people who are continually exposed to second-hand smoke. NPHS respondents who indicated that someone in their household smoked had lower attitude scores on the health effects of second-hand smoke and placed significantly less importance on smoke-free environments than did respondents in households with no smokers (data not shown).

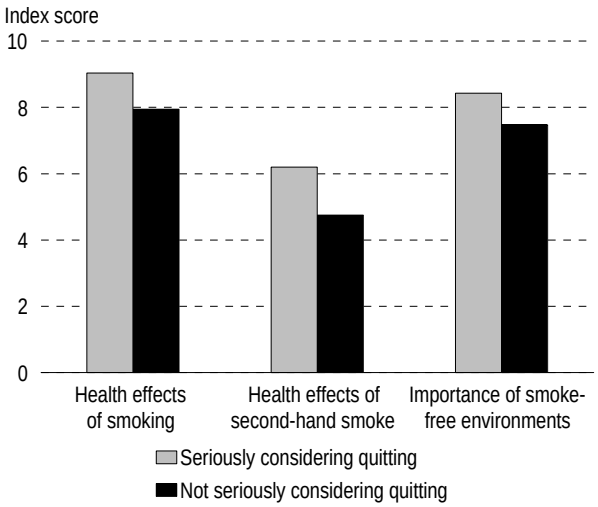
Some evidence from other research suggests that attitudes toward second-hand smoke may be changing. For example, a Toronto study found that, between 1983 and 1988, disparities in knowledge

Chart 1
Average scores for attitudes toward smoking,† by smoking status, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, Health file*
† Higher scores indicate stronger anti-smoking attitudes.
‡ The difference between these two scores is not significant at alpha = 0.05 (using the Bonferroni test for multiple comparisons).

Chart 2
Smokers' average scores for attitudes toward smoking,†‡ by quitting intentions, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, Health file*
† Higher scores indicate stronger anti-smoking attitudes.
‡ All differences between scores by quitting intention are significant at alpha = 0.05.

Measuring attitudes toward smoking

In this article, the term "attitude" refers to a summary of beliefs and opinions about smoking. The three smoking attitude scores were derived from the following NPHS items:

Health effects of smoking

- Smoking cigarettes can cause lung cancer in a smoker.
- Smoking cigarettes can cause heart disease or heart problems in a smoker.
- Smoking cigarettes can cause a stroke in a smoker.
- Smoking cigarettes can cause bronchitis, emphysema or asthma in a smoker.

Health effects of second-hand smoke

- Second-hand smoke can cause lung cancer in a non-smoker.
- Second-hand smoke can cause heart disease or heart problems in a non-smoker.
- Second-hand smoke can cause a stroke in a non-smoker.
- Second-hand smoke can cause bronchitis, emphysema or asthma in a non-smoker.

Importance of smoke-free environments

- Children who are exposed to second-hand smoke are more likely to suffer ill health and developmental problems than children who are not exposed to it.
- Pregnant women and others living with them should not smoke in the home during the pregnancy.
- Non-smokers should be provided with a smoke-free environment at work.
- Smokers should ask permission before smoking in the presence of others.

The response options for each question in the three groupings were "agree," "disagree" and "no opinion." Items were scored such that the higher the score, the more negative the attitude toward smoking. For example, respondents who agreed with "Smoking cigarettes can cause lung cancer in a smoker" scored 3, those who disagreed scored 1, and those with no opinion scored 2. Since each score was derived using four questions (where all four responses had to be valid), respondents could score between 4 and 12 on each measure. For ease of interpretation, the scores were re-scaled to be between 0 and 10.

Respondents were asked the first group of questions only if they answered "yes" to the filter question: "Do you believe that smoking cigarettes can cause health problems in a smoker?" The questions in the second group were posed only if the respondent answered "yes" to the filter question: "Do you believe that second-hand smoke can cause health problems in a non-smoker?" However, dropping respondents who answered "no" to these filter questions would bias the results. To keep those who did not recognize the dangers of smoking or of second-hand smoke in the analysis, a value of "disagree" was imputed to all four items in the corresponding group of questions. This affected 1,751 records (3%) with a valid *health effects of smoking* score and 6,674 records (14%) with a valid *health effects of second-hand smoke* score. There was no filter question for the third group of questions.

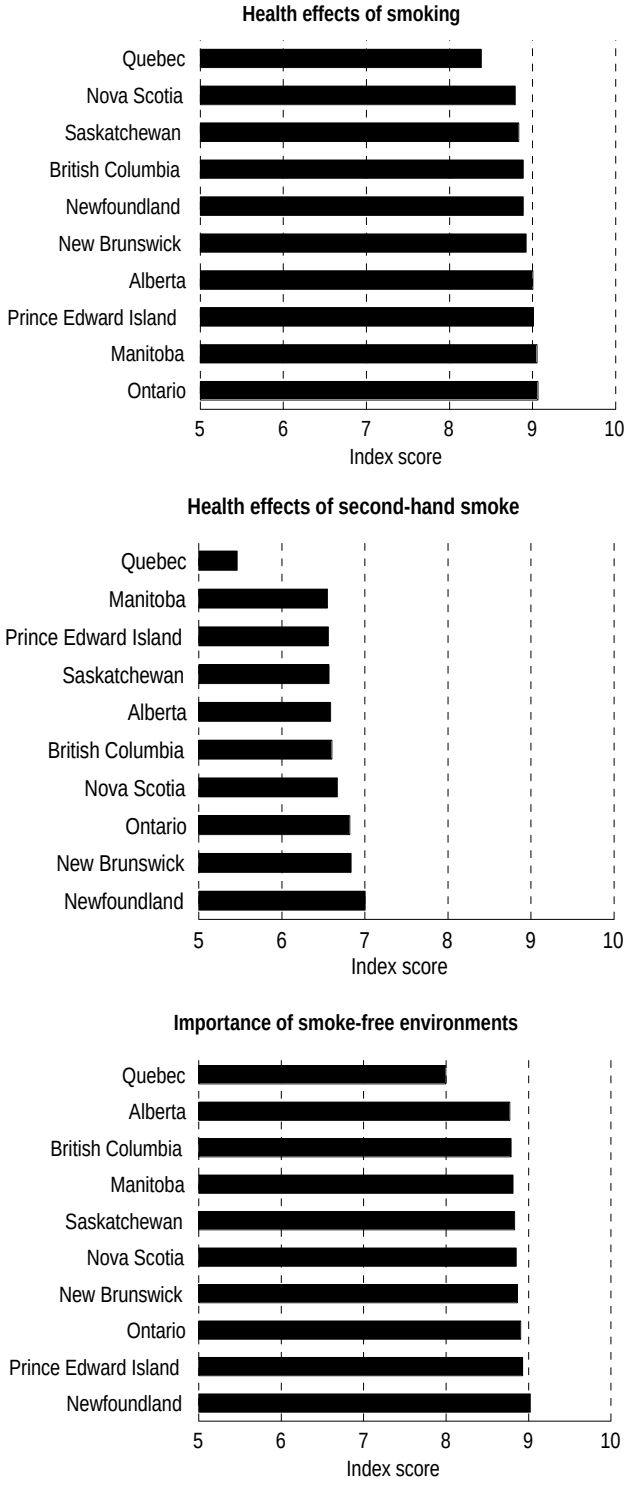
The internal consistency of the attitude questions within each grouping was tested with Cronbach's alpha.[19] Reliable health measures typically have Cronbach's alpha scores above 0.75.[20] The consistency scores for the items measuring attitudes toward the *health effects of smoking* and of *second-hand smoke* were 0.90 and 0.92, respectively, while the score for the *importance of smoke-free environments* grouping was 0.60. The internal consistency for the last grouping seems modest, but population studies with large sample sizes can withstand lower reliability measure values.[21] In all three cases, the items within each grouping were asked sequentially, and in the case of the first two, the wording of the four items is similar. This, along with the imputation mentioned above, may influence response patterns so as to inflate internal consistency.

To determine *smoking status*, respondents were asked, "At the present time, do you smoke cigarettes daily, occasionally or not at all?" In all analyses except Chart 1, daily and occasional smokers were grouped into a "smoker" category.

Intention to quit was determined with the question, "Are you seriously considering quitting within the next 6 months?"

The question "Does anyone in this household smoke regularly inside the house?" was used to determine the *presence of smokers at home*.

Chart 3
Adjusted† average scores for attitudes toward smoking,‡ by province, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, Health file*
*† Adjusted for smoking status, sex, age, educational attainment and the interactions of smoking status * sex, smoking status * age, and smoking status * educational attainment*
‡ Higher scores indicate stronger anti-smoking attitudes.

between smokers and non-smokers about the health effects of second-hand smoke actually increased.[22] However, a more recent Ontario study showed that the gap between smokers' and non-smokers' attitudes toward smoke-free homes is narrowing. Even so, most homes with children in which there are also daily smokers are not smoke-free.[23]

Attitudes about the importance of smoke-free environments may incorporate issues of politeness as well as beliefs about health effects. Thus, scores for smokers and non-smokers alike generally indicate that people agree about the need for smoke-free places more readily than they acknowledge the negative health consequences of second-hand smoke.

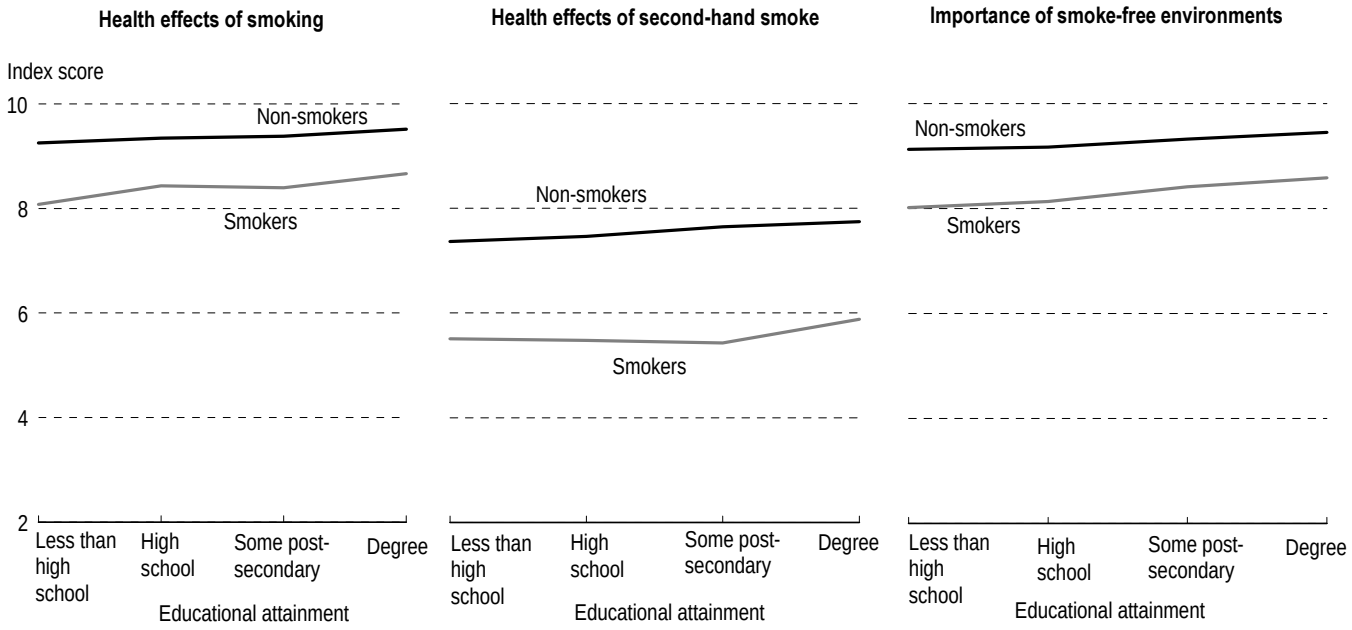
Smokers' attitudes also varied by whether they were seriously considering quitting. Those who intended to quit scored significantly higher on all three measures than smokers who did not intend to quit (Chart 2). These results suggest that awareness of the health risks may be an important catalyst in the process of quitting. It may also be that those who are ready to quit are more likely to accept and admit the health risks.[24]

When other variables were taken into account, smoking status remained a significant explanatory variable in the models of beliefs about the health effects of second-hand smoke and about the importance of smoke-free environments (Appendix Table A). It was not significant, however, in the model of beliefs about the health effects of smoking. This is likely a reflection of the grouping together of daily and occasional smokers into one category (smoker). As noted earlier, occasional and non-smokers' scores on the health effects of smoking index were not significantly different (Chart 1).

Quebeckers more tolerant

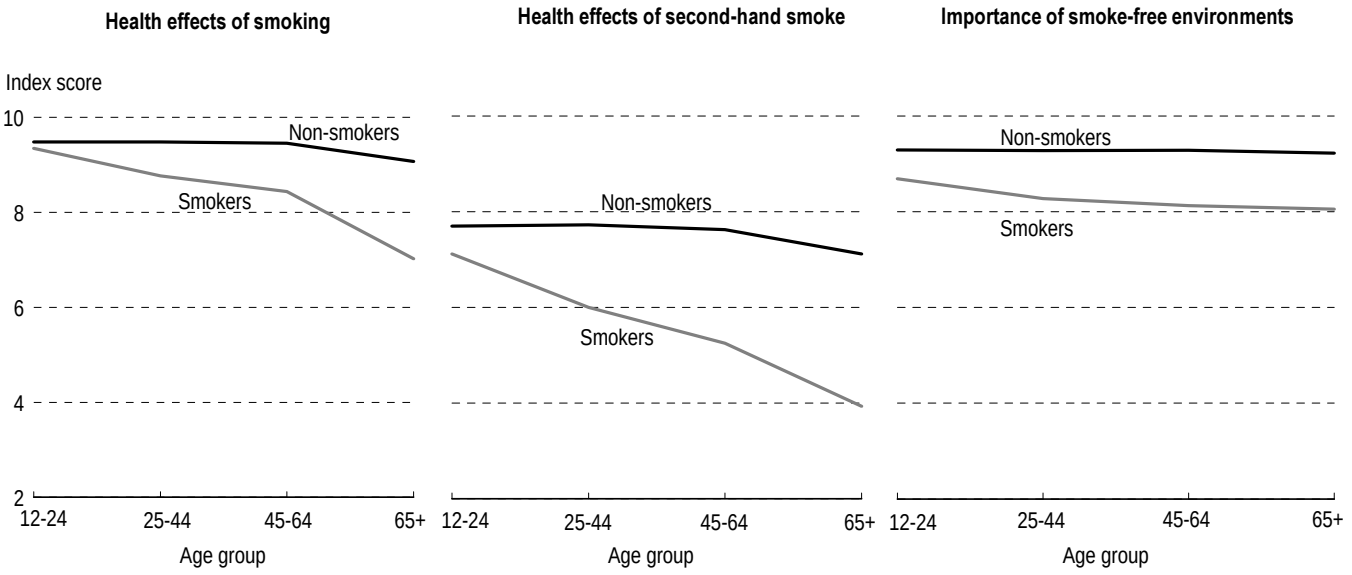
Quebec has had the highest smoking rate in Canada since the 1960s.[2] Therefore, it is not surprising that Quebeckers' attitudes toward smoking were significantly less negative than those of other Canadians, even when confounding variables like smoking status, education, age and sex were taken into account (Chart 3, Appendix Table A). These results might also reflect provincial differences in

Chart 4
Adjusted† average scores for attitudes toward smoking,‡ by educational attainment and smoking status, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, Health file*
*† Adjusted for sex, age, province, and the interactions of smoking status * sex and smoking status * age*
‡ Higher scores indicate stronger anti-smoking attitudes.

Chart 5
Adjusted† average scores for attitudes toward smoking,‡ by age groups and smoking status, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, Health file*
*† Adjusted for sex, educational attainment, province, and the interactions of smoking status * sex and smoking status * educational attainment*
‡ Higher scores indicate stronger anti-smoking attitudes.

smoking prevention programs, local and provincial legislation, and messages conveyed by the media.

Alberta was the only province showing significantly more supportive attitudes toward smoke-free environments compared with Ontario, the reference province.

Scores rise with educational attainment

Educational attainment appears to be the best single socio-demographic predictor of smoking or smoking cessation.[1] Therefore, it is hardly surprising that attitude scores are associated with level of education (Chart 4). Respondents with high school or less had significantly lower scores on all three attitude measures.

There appeared to be little interaction between smoking status and educational attainment, with the wide gap in scores between smokers and non-smokers staying fairly constant across most attainment groups. The exception was smokers with less than high school, whose attitude scores on the health effects of smoking and on the importance of smoke-free environments were significantly lower.

Limitations

The assumption of this analysis is that attitudes and behaviour are related. However, the cross-sectional nature of this study does not allow for specific testing of which one precedes the other.

All data were self-reported, and the degree of their validity is unknown. Certain smokers may have reported a non-smoking status or may have exaggerated anti-smoking attitudes because of the social desirability of these responses.

Another limitation concerns the interpretation of questions. For example, some respondents might believe that smoking causes lung cancer only among people who smoke heavily for a long period of time. Similarly, some respondents could have interpreted exposure to second-hand smoke to mean brief, casual exposure, and therefore, not considered it to have health consequences; others might have assumed the question implied daily exposure at home or at work and answered differently.

Youths smoke despite anti-smoking attitudes

An age cohort effect can be seen in beliefs about the health effects of smoking and second-hand smoke (Chart 5). People aged 65 or older had significantly lower attitude scores on the health effects of smoking and of second-hand smoke, relative to people aged 12 to 24.

Furthermore, among smokers, those in the three oldest age groups had significantly lower attitude scores for all three measures. The oldest smokers held relatively moderate beliefs about the health effects of smoking and had dramatically more lenient attitudes about the effects of second-hand smoke.

For people aged 12 to 24, attitudes and behaviour were more inconsistent. Both smoking and non-smoking youths believed strongly in the health hazards. However, this obviously did not dissuade the smokers in this age group from tobacco use. Factors such as peer pressure or home environment may have much more influence over young people than do beliefs about health risks that may affect them too far in the future to seem relevant. Indeed, analyses of Statistics Canada's 1994 Youth Smoking Survey showed that most young people held strong anti-smoking attitudes—that second-hand smoke is harmful, that tobacco is addictive, and that smokers are unable to quit anytime they want to—yet many young people with these attitudes smoked.[25] Efforts to prevent smoking initiation by youths might take this inconsistency between their attitudes and behaviour into account and emphasize other negative consequences of smoking such as unpleasant breath and reduced disposable income.

Men and women hold similar attitudes

Research suggests that women smoke for different reasons than men,[14,26] which may be expected to result in different attitudes. However, the questions used in the NPHS may not have captured such differences. For instance, although women had slightly lower attitude scores, after smoking status, age, education and province were taken into account, the difference was not statistically significant. This

is surprising, given the relatively slow decline of smoking prevalence among women, compared with men.[1,2,27,28] Women placed a higher emphasis on the importance of smoke-free environments, but this, too, was not significant.

Implications

Attitudes toward smoking vary with socio-demographic characteristics. And as might be expected, smokers are more tolerant than non-smokers. Such attitudes may reflect a lack of knowledge, or with the decline in smoking, smokers may now comprise a more homogenous and committed group, resistant to many smoking prevention efforts. For a smoker, accepting the facts about health risks would result in an uncomfortable psychological state in which attitudes and behaviour are not consistent. Out of psychological necessity, smokers may need to downplay the negative health effects.

Young people who smoke do so while acknowledging the negative consequences of smoking. Young smokers were supportive of smoke-free environments, perhaps because they have encountered public restrictions on smoking throughout their lives. The smoking rate in this age group, however, has been increasing in the 1990s. Thus, it may also be that young people express negative attitudes toward smoking simply because it is more socially desirable.

Older smokers held the most moderate beliefs about health effects, especially of second-hand smoke. This has important public health implications. If older smokers had full knowledge of and belief in the health risks of second-hand smoke, they might be less inclined to expose others.

Concluding remarks

The majority of Canadians seem to be convinced of the negative effects of smoking, perhaps in part due to anti-smoking messages. The decline in smoking over the past 30 years from more than one-half to less than one-third of the population is perhaps the best evidence of the success of public health efforts in combatting smoking-related disease and death. However, campaigns conveying the message about the effects of second-hand smoke have not resonated with as many people, especially older smokers. Furthermore, public attitudes toward smoking have remained fairly tolerant in Quebec. For youths, awareness of health risks and support for smoke-free environments do not seem to deter those who smoke. Clearly, the health risk is only one of many factors that influence an individual's smoking behaviour. ●

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Appendix

Table A
Regression results for scores on attitudes toward smoking,† Canada excluding territories, 1996/97

	Health effects of smoking			Health effects of second-hand smoke			Importance of smoke-free environments		
	Unstandardized coefficient (b)	95% confidence interval	Standardized coefficient (beta)	Unstandardized coefficient (b)	95% confidence interval	Standardized coefficient (beta)	Unstandardized coefficient (b)	95% confidence interval	Standardized coefficient (beta)
Smoker	0.19	-0.13, 0.51	0.04	-0.63*	-1.09, -0.17	-0.08	-0.26*	-0.51, 0.00§	-0.06
Female	-0.05	-0.13, 0.03	-0.01	-0.03	-0.17, 0.12	0.00	0.03	-0.04, 0.10	0.01
Age									
12-24‡									
25-44	0.00	-0.11, 0.11	0.00	0.02	-0.20, 0.24	0.00	-0.01	-0.12, 0.09	0.00
45-64	-0.02	-0.14, 0.09	0.00	-0.08	-0.31, 0.15	-0.01	-0.01	-0.13, 0.11	0.00
65+	-0.41*	-0.55, -0.28	-0.06	-0.52*	-0.78, -0.27	-0.05	-0.07	-0.18, 0.05	-0.01
Education									
Less than high school	-0.26*	-0.37, -0.15	-0.05	-0.38*	-0.62, -0.14	-0.05	-0.32*	-0.41, -0.22	-0.08
High school	-0.17*	-0.28, -0.05	-0.03	-0.28*	-0.50, -0.07	-0.03	-0.28*	-0.39, -0.16	-0.05
Some postsecondary	-0.13*	-0.22, -0.03	-0.02	-0.10	-0.28, 0.08	-0.01	-0.12*	-0.21, -0.03	-0.03
Degree‡									
Province									
Newfoundland	-0.02	-0.17, 0.13	0.00	0.18	-0.12, 0.48	0.01	0.02	-0.12, 0.17	0.00
Prince Edward Island	0.01	-0.10, 0.12	0.00	-0.48*	-0.80, -0.15	-0.01	-0.01	-0.18, 0.15	0.00
Nova Scotia	-0.11	-0.29, 0.06	-0.01	-0.37*	-0.70, -0.05	-0.02	0.07	-0.07, 0.20	0.01
New Brunswick	-0.13	-0.30, 0.05	-0.01	-0.15	-0.52, 0.21	-0.01	-0.03	-0.18, 0.12	0.00
Quebec	-0.47*	-0.62, -0.32	-0.09	-1.51*	-1.76, -1.27	-0.18	-0.58*	-0.70, -0.46	-0.13
Ontario‡									
Manitoba	0.03	-0.04, 0.10	0.00	-0.22*	-0.38, -0.05	-0.01	0.01	-0.06, 0.08	0.00
Saskatchewan	-0.30*	-0.47, -0.13	-0.02	-0.47*	-0.80, -0.15	-0.02	-0.11	-0.29, 0.07	-0.01
Alberta	-0.07	-0.18, 0.04	-0.01	-0.25*	-0.51, 0.00§	-0.02	0.12*	0.02, 0.22	0.02
British Columbia	-0.01	-0.10, 0.09	0.00	-0.12	-0.35, 0.12	-0.01	0.04	-0.05, 0.14	0.01
Interaction terms									
Smoker, female	-0.10	-0.33, 0.12	-0.02	-0.05	-0.38, 0.28	0.00	-0.14	-0.31, 0.04	-0.02
Smoker, aged 25-44	-0.58*	-0.86, -0.30	-0.09	-1.13*	-1.56, -0.70	-0.10	-0.40*	-0.65, -0.14	-0.07
Smoker, aged 45-64	-0.89*	-1.18, -0.61	-0.10	-1.79*	-2.24, -1.34	-0.12	-0.55*	-0.84, -0.27	-0.07
Smoker, aged 65+	-1.93*	-2.42, -1.44	-0.12	-2.66*	-3.30, -2.03	-0.10	-0.58*	-0.94, -0.23	-0.04
Smoker with less than high school	-0.32*	-0.61, -0.02	-0.04	0.01	-0.44, 0.47	0.00	-0.25*	-0.48, -0.02	-0.04
Smoker with high school	-0.05	-0.35, 0.25	-0.01	-0.11	-0.55, 0.32	-0.01	-0.17	-0.41, 0.07	-0.02
Smoker with some post-secondary	-0.13	-0.42, 0.15	-0.02	-0.35	-0.76, 0.07	-0.02	-0.05	-0.28, 0.18	-0.01
Smoker in Newfoundland	-0.30	-0.67, 0.06	-0.01	0.02	-0.67, 0.70	0.00	0.18	-0.08, 0.45	0.01
Smoker in Prince Edward Island	-0.12	-0.46, 0.22	0.00	0.44	-0.20, 1.07	0.00	0.08	-0.24, 0.41	0.00
Smoker in Nova Scotia	-0.31	-0.80, 0.18	-0.01	0.45	-0.28, 1.18	0.01	-0.24	-0.63, 0.15	-0.01
Smoker in New Brunswick	-0.02	-0.42, 0.37	0.00	0.34	-0.31, 1.00	0.01	-0.01	-0.28, 0.25	0.00
Smoker in Quebec	-0.42*	-0.72, -0.12	-0.05	0.32	-0.11, 0.74	0.02	-0.65*	-0.89, -0.41	-0.09
Smoker in Manitoba	-0.08	-0.29, 0.14	0.00	-0.11	-0.49, 0.27	0.00	-0.22*	-0.40, -0.03	-0.01
Smoker in Saskatchewan	0.16	-0.20, 0.52	0.01	0.44	-0.19, 1.08	0.01	0.08	-0.29, 0.44	0.00
Smoker in Alberta	0.03	-0.30, 0.36	0.00	0.05	-0.51, 0.60	0.00	-0.50*	-0.81, -0.18	-0.04
Smoker in British Columbia	-0.33	-0.70, 0.04	-0.03	-0.19	-0.86, 0.47	-0.01	0.31*	-0.61, -0.02	0.03
Intercept	9.75	9.63, 9.88	0.00	8.24	8.00, 8.49	0.00	9.50	9.39, 9.61	0.00

Data source: *1996/97 National Population Health Survey, Health file*
† High scores indicate stronger anti-smoking attitudes.
‡ Reference category
§ Confidence interval limits include zero because of rounding.
** Significant at alpha = 0.05*

Table B
Unadjusted average scores for attitudes toward smoking,† Canada excluding territories, 1996/97

	Health effects of smoking	Effects of second-hand smoke	Importance of smoke-free environments
Age by smoking status			
12-24, non-smoker	9.4	7.6	9.2
25-44, non-smoker	9.5	7.7	9.3
45-64, non-smoker	9.4	7.5	9.2
65+, non-smoker	9.0	7.0	9.1
12-24, smoker	9.1	6.8	8.4
25-44, smoker	8.7	5.8	8.1
45-64, smoker	8.3	5.0	7.9
65+, smoker	6.8	3.6	7.7
Education by smoking status			
Less than high school, non-smoker	9.2	7.2	9.0
High school, non-smoker	9.4	7.5	9.1
Some postsecondary, non-smoker	9.4	7.6	9.3
Degree, non-smoker	9.6	7.8	9.4
Less than high school, smoker	8.2	5.6	7.8
High school, smoker	8.7	5.6	8.0
Some postsecondary, smoker	8.7	5.6	8.2
Degree, smoker	8.8	5.9	8.3
Provinces			
Newfoundland	9.2	7.6	9.1
Prince Edward Island	9.3	7.0	9.1
Nova Scotia	9.1	7.1	9.1
New Brunswick	9.2	7.3	9.0
Quebec	8.7	5.9	8.3
Ontario	9.4	7.5	9.1
Manitoba	9.4	7.2	9.1
Saskatchewan	9.1	7.0	9.0
Alberta	9.3	7.2	9.1
British Columbia	9.3	7.3	9.1
Sex by smoking status			
Male, non-smoker	9.4	7.6	9.2
Female, non-smoker	9.4	7.5	9.2
Male, smoker	8.6	5.7	8.1
Female, smoker	8.5	5.6	8.0

Data source: *1996/97 National Population Health Survey, Health file*
† High scores indicate stronger anti-smoking attitudes. Possible range is between 0 and 10.

Which workers smoke?

Leslie A. Gaudette, Anne Richardson and Sara Huang

Abstract

Objectives

This article examines differences by occupation in daily cigarette smoking prevalence and intensity among full-time workers, and how these differences are associated with smoking restrictions at work.

Data sources

Most of the data are from a Health Canada-sponsored Supplement to the 1994/95 National Population Health Survey (NPHS). The analysis is based on 5,674 respondents aged 15 to 64 who were full-time workers at the time of their interview. Comparable information is presented from the 1978/79 Canada Health Survey and the 1986 Labour Force Survey Smoking Supplement.

Main results

In 1994/95, 28% of full-time workers were daily smokers, and about a third of them smoked 25 or more cigarettes a day. Smoking prevalence and intensity were lowest among white-collar workers and highest among blue-collar workers. Since 1978/79, there has been an overall decline in smoking prevalence, and since 1986, a decline in smoking intensity among all workers except those in outdoor blue-collar occupations. About 6 in 10 full-time workers who smoked daily encountered restrictions at work.

Key words

cigarette smoking, smoking cessation, smoking intensity, occupation, workplace health and safety

Authors

Leslie A. Gaudette (613-951-4381; lgaudet@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa K1A 0T6. Anne Richardson and Sara Huang, students from the University of Waterloo, were with the Health Statistics Division on co-operative education assignments.

White-collar, pink-collar, blue-collar—the terms evoke images of the kind of work that people do. They also connote differences in socioeconomic status and work environments. Not so obvious is that these broad occupational groups are associated with distinct patterns of cigarette smoking.

Previous studies have found that smoking behaviour differs among occupational groups. Specifically, the prevalence of smoking is higher among blue-collar workers than among professionals.[1-5] However, Canadian research on the relationship between occupation and smoking has been limited.[5]

This analysis, based on the 1994/95 National Population Health Survey (NPHS), focuses on full-time workers who smoke daily (see *Methods* and *Definitions*). Smoking prevalence, amount smoked, attempts to cut down or quit, and encountering restrictions at work are examined by occupation. Occupation, of course, is strongly related to two other measures of socioeconomic status—education and income—that are both associated with smoking.[6,7] Understanding how smoking varies by occupation is important in planning workplace health promotion programs.

Methods

Data sources

Most of the data in this article are from Statistics Canada's 1994/95 National Population Health Survey (NPHS) for the 10 provinces. This analysis excludes long-term residents of hospitals and residential care facilities and residents of the Yukon and the Northwest Territories.

The 1994/95 non-institutional sample for the provinces comprised 27,263 households, of which 88.7% agreed to participate. After application of a screening rule, 20,275 households remained in scope.[8,9] One knowledgeable person in every participating household provided general socio-demographic and health information about each household member. In total, data pertaining to 58,439 individuals were collected. The data base containing this information is called the General file.

In addition, one randomly selected person in each of the 20,275 participating households was chosen to provide in-depth information about their own health. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents. The data base containing in-depth health information, as well as data from the General file pertaining to these respondents is called the Health file.

Of the 17,626 randomly selected respondents aged 12 or older, 14,786 were eligible members of the NPHS longitudinal panel. These respondents were also eligible for a Health Canada-sponsored supplement. The response rate to these questions was 90.6%, yielding a sample size of 13,400 respondents. The data base containing information from the Health Canada supplement, as well as from the General and Health files pertaining to these respondents, is called the Supplementary file.

The analysis in this article is based on 5,674 respondents (representing an estimated 10.6 million Canadians) to the Health Canada Supplement who were aged 15 to 64 and who were full-time workers on the day of their interview; 1,640 of them reported that they smoked daily. Results may, therefore, differ somewhat from those reported for all Canadians.[10]

As well as the NPHS, data from the 1978/79 Canada Health Survey (CHS) and the 1986 Labour Force Survey (LFS) Smoking Supplement are presented to show historical trends. The total sample size of the lifestyle and health questionnaire component of the CHS was 20,726, of whom 10,584 were workers aged 15 to 64. The total response rate was 87%.[10] The sample size of the LFS Smoking Supplement was 30,799 adults aged 15 or older; 16,764 of these respondents were workers aged 15 to 64.[7] (Comparisons of 1994/95 data with earlier years pertain to both full- and part-time workers. The NPHS sample for these comparisons numbered 7,023 respondents.)

Analytical techniques

All estimates were weighted to represent the population at the date of the survey. The bootstrap procedure was used to calculate the coefficient of variation (CV) for each percentage estimate; estimates with a CV greater than 16.6% are indicated in each table or chart. The bootstrap procedure was also used to calculate standard errors for the differences between two percentages ($p = 0.05$). A Bonferroni approach was used for multiple comparisons, with the probability set at 0.05.

To analyze smoking patterns in different occupational groups, the main occupation of each respondent was coded into 1 of 22 occupational groups, based on the 1970 and 1980 Standard Occupational Classification Manuals,[9,11,12] and then reclassified into 11 groups. Further regrouping created four broad categories: white-collar, pink-collar, blue-collar outdoor, and blue-collar indoor.

Daily smoking prevalence, smoking intensity, attempts to cut down or quit, and restrictions at work were calculated by occupational group and by sex for full-time workers (see *Definitions*). To provide context, daily smoking prevalence was also calculated for part-time workers, workers with irregular schedules (as opposed to regular weekday hours), and people not currently employed for pay (caring for family, attending school, looking for work, retired, ill, or on disability).[9]

Limitations

The NPHS definitions of the working population differ somewhat from those of the LFS Smoking Supplement and the CHS. The NPHS analysis focuses on the smoking behaviour of Canadians aged 15 to 64 who were working for pay or profit on the day of their interview. For the LFS Smoking Supplement and the CHS, the employed are those who worked at any time in the previous week, or in the previous two weeks, respectively.

Historical comparisons may be limited by the different methods used to administer and obtain responses to each survey. For example, proxy reporting will affect smoking rates, depending on the proportion of responses that are proxy and the degree to which proxy responses diverge from self-reported smoking behaviour. Proxy reporting to the NPHS smoking questions represented just 4% of total responses.[9] However, for the 1986 LFS Smoking Supplement, proxy reports were close to 30%.[7] The CHS questionnaire was self-administered to minimize proxy reporting. Nonetheless, responses may have been influenced by the presence of other household members.[13]

The NPHS did not ask all respondents about the presence of workplace smoking bans. Rather, only smokers were asked if there were places where they found restrictions on their smoking. This limits the ability to associate workplace smoking bans with smoking prevalence or cessation.

Smoking and work arrangements

More than one in four (28%) of the 10.6 million Canadians aged 15 to 64 who were working full time in 1994/95 reported that they smoked daily (Table 1). Younger workers tended to have somewhat higher daily smoking rates than did those aged 45 and older (data not shown). Although 29% of full-time workers aged 15 to 44 were daily smokers, the figure was 25% among those aged 45 to 64.

The prevalence of daily smoking varied by hours of work and work schedules. It was higher among people working irregular hours or shifts involving weekends (29%) than among workers with regular weekday schedules (25%). However, the prevalence of daily smoking was comparatively low among part-time workers (24%) (Chart 1).

The highest daily smoking rates were among people who described their main activity as looking

Definitions

To classify smokers, the 1994/95 NPHS asked the following questions:

1. At the present time, do/does ... smoke cigarettes daily, occasionally or not at all?
2. Have you/he/she ever smoked cigarettes at all?

Daily smokers are respondents who answered "daily" to question 1. *Occasional smokers* are those who answered "occasionally" to question 1. *Former smokers* are those who answered "not at all" to question 1 and "yes" to question 2.

Current daily smokers were asked: "How many cigarettes do you smoke each day now?" *Smoking intensity* was measured by grouping responses to this question into two categories, with heavy smokers defined as those smoking 25 or more cigarettes per day.

The Health Canada-sponsored Supplement to the NPHS asked current smokers about their attempts to quit or cut down: "Have you tried to quit smoking in the last 12 months?" and "Are you smoking less now than you were 12 months ago?" Current smokers were also asked about encountering restrictions: "Nowadays, there are many restrictions on where people are allowed to smoke. In your day-to-day activities, where do you find you have restrictions on your smoking?" The interviewer did not read a list, but marked any of the following responses: at home; at the home of friends or relatives; in public places; at work; at school; at an entertainment or sports activity; transportation; any other places (specify); none of the above.

Respondents who had worked at any time for pay or profit in the past 12 months were asked a number of questions about their hours of work, occupation, and dates worked in the last year for each of up to six jobs. From the roster of jobs, respondents were asked: "What is your main job?" Occupation was determined by responses to two further questions: "Thinking about the main job, what kind of work was/were....doing?" and "In this line of work, what were your/his/her most important duties or activities?" For this analysis, workers were classified into white-collar, pink-collar, blue-collar-indoor, and blue-collar-outdoor occupations. Outdoor workers in fishing, forestry and farming were grouped together, as they are the least likely to be affected by smoking restrictions[5,7] (see Appendix Table A).

Working status, determined using a derived variable on the NPHS, was defined as "currently working," "not currently working, but had a job," "did not work in the last 12 months," "not applicable," or "not stated." Another derived variable, main job working hours, was used to determine whether respondents worked "full-time" (30 hours or more per week) or "part-time" (less than 30 hours per week) at their main job. The weighted number of NPHS respondents aged 15 to 64 currently working (both full and part time) agreed closely with Labour Force Survey estimates of employment for 1994: 13.3 million versus 13.1 million.

Shift work was assessed using a derived variable, type of working hours for main job. In this article, "regular weekday hours" was defined as "regular shift—no weekend." Any other response (including a regular shift with weekend, rotating shifts, irregular/on call schedule, or other) was considered "irregular hours."

Respondents were asked, "What do you consider to be your main activity?" Responses were: caring for family; working for pay or profit; work/caring for family for pay/profit; going to school; recovering from illness/on disability; looking for work; retired; other. Responses to this question were used together with those for working status to classify respondents first as currently working (as some current workers listed another activity as their main activity), and then as caring for family, going to school, recovering from illness/on disability/looking for work, retired, and other.

for work (48%) or who were ill or on disability (52%). This is consistent with previous research findings of higher smoking rates among the unemployed.[2]

High smoking rates in blue-collar occupations

In 1994/95, the prevalence of daily smoking among full-time workers was highest in male-dominated blue-collar occupations. The high smoking prevalence among workers in construction, transportation and mining (43%) approached that of people whose main activity was looking for work (48%). Daily smoking prevalence was somewhat lower in female-dominated pink-collar occupations, and lowest in the white-collar professional and managerial groups (Table 1). Previous studies, too, have shown smoking prevalence to decline with increasing occupational status.[1,2,4]

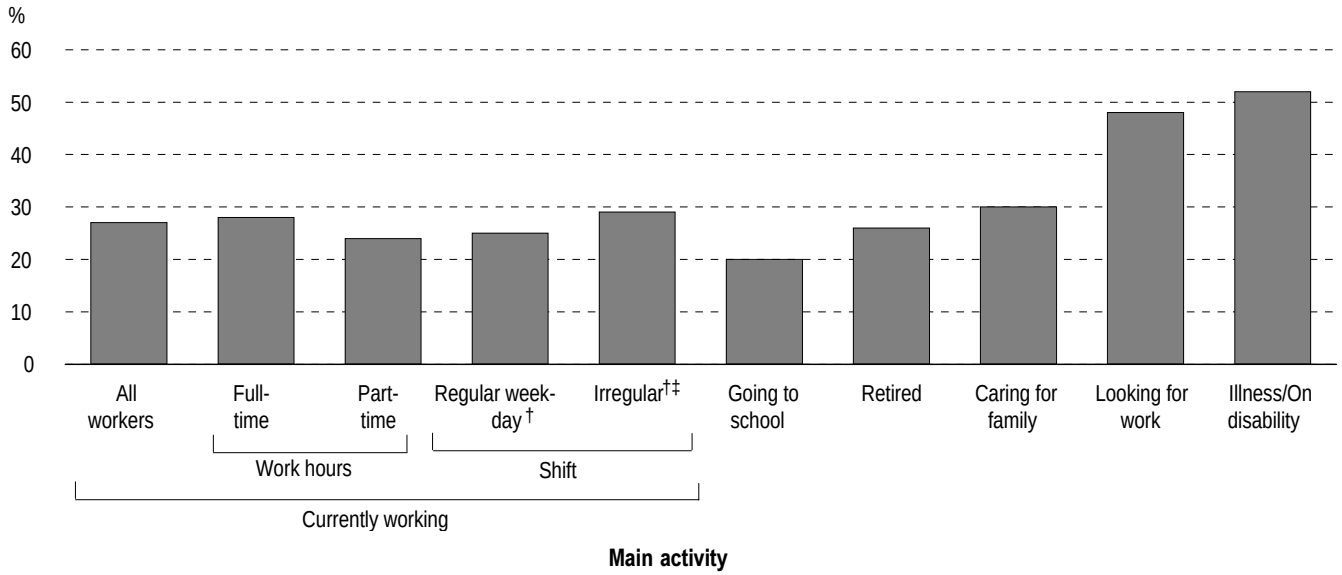
Overall, daily smoking prevalence was higher among male than female workers. In most occupations, however, smoking rates of male and female workers were similar. The exception—apparently higher rates among women in manufacturing— was not statistically significant.

The occupations in which the prevalence of smoking was high were not necessarily the ones accounting for the largest number of smokers, and therefore, having the greatest potential for reducing the overall number of workers who smoke (Chart 2). In 1994/95, 44% of male full-time workers who were daily smokers (about 850,000) were in manufacturing or in construction/transportation/mining. Clerical and service occupations together represented 49% of female workers who were daily smokers (about 500,000).

Majority felt restricted at work

About 6 in 10 (58%) full-time workers who smoked daily reported that they encountered workplace smoking restrictions, almost the same number that found restrictions in public places (60%) (Table 2). However, restrictions on smoking at work varied by occupation, whereas there was much less variation in restrictions reported for public places.

Chart 1
Prevalence of daily smoking, by main activity, population aged 15 to 64, Canada excluding territories, 1994/95

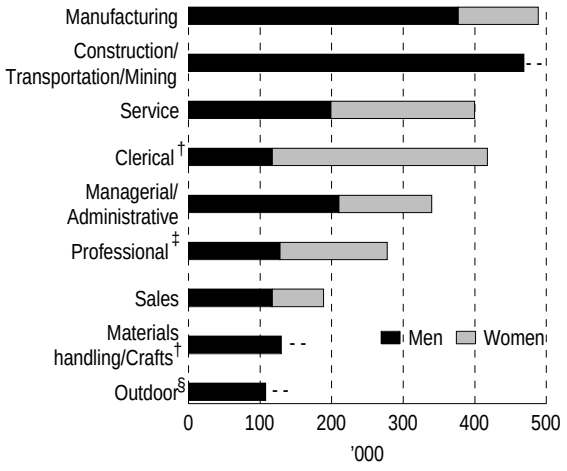


Data source: *1994/95 National Population Health Survey, Supplementary file*
† Includes both full- and part-time workers.
‡ Evenings, weekends, shifts

A higher percentage of female than male smokers (69% versus 52%) experienced restrictions at work, although similar proportions of men and women were restricted in public places (data not shown). This is not surprising, as women are more likely to be employed indoors, where smoking bans are more common (see *Workplace smoking bans*). The smokers who reported the highest rates of encountering restrictions at work were in occupations often located in office buildings: clerical (79%), sciences (74%), and other professional (73%). As well, relatively high percentages of workers in materials handling/crafts (64%) and manufacturing (59%) reported restrictions, probably an effect of indoor worksites, as well as the need to protect machinery and products and ensure safety in working with hazardous or flammable substances.

By contrast, just over half of smokers in sales (51%) and service (55%) reported restrictions at work. Their workplaces—establishments such as restaurants and retail outlets, for instance—may overlap public areas where smoking is permitted.[5] Hospitality workers, in fact, are subjected to higher levels of second-hand smoke than are workers in offices that allow smoking: exposure in restaurants is nearly two times higher, and in bars, four to six

Chart 2
Number of daily smokers, by sex and occupation, full-time workers aged 15 to 64, Canada excluding territories, 1994/95



Data source: *1994/95 National Population Health Survey, Supplementary file*
† High coefficient of variation for men (16.6% to 25.0%)
‡ Sciences, other professional
§ Forestry, farming, fishing
- - Sample too small to permit reliable estimate

Table 1
Prevalence of daily smoking, by sex and occupation, full-time workers aged 15 to 64, Canada excluding territories, 1994/95

Occupation	Number of full-time workers	Daily smokers		
		Both sexes	Men	Women
	'000		%	
All occupations†	**10,600**	**28**	**29**	**25**
White-collar	**3,524**	**18**	**17**	**18**
Managerial/Administrative	1,709	20	19	21
Sciences	646	16	15‡	- -
Other professional	1,169	15	- -	16
Pink-collar	**3,442**	**29**	**29**	**29**
Clerical	1,445	29	29‡	29
Sales	782	24	24	24
Service	1,215	33	33	32
Blue-collar indoor	**1,816**	**35**	**34**	**40**
Manufacturing	1,424	34	33	41
Materials handling/Crafts	391	39	39	- -
Blue-collar outdoor	**1,533**	**39**	**40**	- -
Outdoor§	419	28	30	- -
Construction/Transportation/ Mining	1,114	43	43	- -
Not stated	286	- -	- -	- -

Data source: *1994/95 National Population Health Survey, Supplementary file*
† Includes not stated.
‡ High cœfficient of variation (16.6% to 25.0%)
§ Forestry, farming, fishing
- - Sample too small to permit reliable estimate

Table 2
Percentage of full-time workers aged 15 to 64 who smoked daily and encountered smoking restrictions at work and in public places, by occupation, Canada excluding territories, 1994/95

Occupation	Encountered smoking restrictions:	
	at work	in public places
	%	
All occupations	**58**	**59**
Managerial/Administrative	60	60
Sciences	74	62
Other professional	73	54
Clerical	79	59
Sales	51	67
Service	55	62
Manufacturing	59	54
Materials handling/Crafts	64	60
Outdoor†	- -	65
Construction/Transportation/Mining	40	56

Data source: *1994/95 National Population Health Survey, Supplementary file*
† Forestry, farming, fishing
- - Sample too small to permit reliable estimate

times higher.[14] As well, service workers are often employed on weekends or evenings and in businesses with fewer than 20 employees, all of which are associated with higher smoking prevalence and fewer restrictions.[15]

Only 40% of daily smokers in construction/transportation/mining occupations reported encountering workplace restrictions, and there were too few workers in outdoor occupations who were restricted to be shown here.

Pace of decline varies

The prevalence of daily smoking dropped substantially among all workers (both full- and part-time) between 1978/79 and 1986, but from 1986 to 1994/95, the pace of decline slowed (Table 3). The overall downturn reflects the general decrease in smoking during the entire period, but differs from the more recent trend in the 1990s for smoking rates in the total population to level off or even rise.[16]

Workplace smoking bans

According to a recent study,[5] 80% of Canadian workers were subject to workplace smoking restrictions in 1994, double the proportion in 1986. Fewer than 10% of workers had experienced *total* smoking bans in their workplace in 1986, but by 1994, the figure had increased fourfold.[5] In the latter year, total smoking bans affected more workers than did partial bans in British Columbia, Ontario, and the Atlantic provinces. Ontario was the leader, with almost half of workers subject to total bans. By contrast, in Quebec, just one-quarter of workers reported total bans. Together with that province's high smoking rates, this may reflect a more permissive attitude toward tobacco use.[5] (See *Attitudes toward smoking* in this issue.)

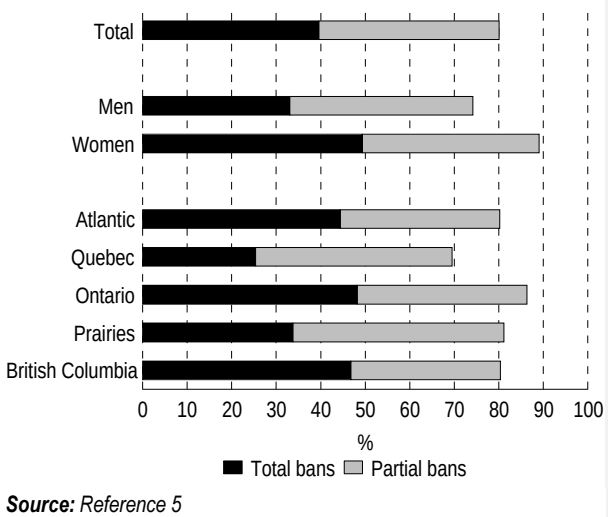
Early policies that restricted workplace smoking aimed to prevent damage to machines, guard against contamination of products, reduce fire hazards, and avoid adverse client contact.[17] But once the hazards of environmental tobacco smoke, more commonly known as second-hand smoke, were recognized, smoking bans were intended primarily to protect non-smokers[3,16] and to reduce the possibility of legal action against employers. As well, in Canada, the annual added cost of employing a smoker has recently been estimated at $2,565, based on the sum of the costs of increased absenteeism, decreased productivity, increased life insurance premiums, and the provision of smoking areas.[18]

Worksite restrictions may help smokers quit.[19-23] Most studies have shown a modest reduction in smoking prevalence after restrictions or bans have been implemented, as well as a reduction of 4 or 5 cigarettes consumed per workday by smoking workers.[19,23-29] One study calculated that this was equivalent to about 55 packs not smoked in a year.[30] Worksite restrictions have the greatest effect on those who want to quit,[22] heavy smokers,[20,23] and people who work more than 50 hours a week.[24]

Federal legislation on smoking in public places and at the workplace is governed by the Non-smokers' Health Act (1988) and Non-smokers' Health Regulations.[31] In Ontario and Newfoundland, provincial legislation controls or bans workplace smoking. As well, all provinces, except Nova Scotia and Prince Edward Island, give municipalities authority to develop smoking bylaws[31] that control smoking at work and in public places such as hospitals, restaurants, retail outlets and public transit.[32]

Provincial legislation, however, does not consistently define the term "workplace." Workplace commonly refers only to indoor space or is limited to offices, rather than applying to any place of employment. Consequently, bans do not usually cover occupations that involve outdoor work.

Percentage of workers affected by workplace smoking restrictions, by sex and region, Canada, 1994



Source: *Reference 5*

Patterns of decline in daily smoking prevalence varied by occupation. Substantial drops occurred throughout the 1978/79-to-1994/95 period among workers in white- and pink-collar occupations. Between 1978/79 and 1986, prevalence also declined among blue-collar workers. However, between 1986 and 1994/95, rates rose or remained stable among men in all blue-collar occupations except manufacturing, where the rate declined. By contrast, among women in manufacturing, daily smoking prevalence increased. This may partly reflect the high coefficient of variation for the 1994/95 estimate.

Men heavier smokers than women

Just over one-third of full-time workers who were daily smokers smoked heavily; that is, 25 or more cigarettes a day. Men were much more likely than women to be heavy smokers: 40% versus 26%. The highest proportions of heavy smokers were in male-dominated blue-collar occupations, particularly construction/transportation/mining (49%). The lowest smoking intensities were in occupations with higher female representation such as clerical (26%) and service (27%) (Table 4).

Trends in smoking intensity since 1978/79 were generally similar for both sexes (Chart 3). In all occupational groups, the proportion of heavy smokers rose between 1978/79 and 1986. By 1994/95, the proportion had fallen below the 1978/79 level for white- and pink-collar workers, but increased slightly among men in blue-collar outdoor occupations, who are the workers least likely to be affected by workplace smoking restrictions.

Table 3
Prevalence of daily smoking, by sex and occupation, full- and part-time workers aged 15 to 64, Canada excluding territories, 1978/79, 1986 and 1994/95

	Both sexes			Men			Women		
Occupation	**1978/79**	**1986**	**1994/95**	**1978/79**	**1986**	**1994/95**	**1978/79**	**1986**	**1994/95**
Total workers ('000)	**9,687**	**11,420**	**13,320**	**6,090**	**6,470**	**7,357**	**3,597**	**4,950**	**5,961**
		%			%			%	
Total	**42**	**30**	**27**	**44**	**32**	**29**	**37**	**28**	**25**
White-collar	**32**	**22**	**18**	**35**	**24**	**17**	**28**	**21**	**19**
Managerial/Administrative	36	26	21	36	25	19	34	29	23
Sciences	31	20	17	33	21	16†	24†	20†	- -
Other professional	30	19	15	35	22	14†	27	17	16
Pink-collar	**43**	**31**	**27**	**44**	**31**	**27**	**41**	**31**	**28**
Clerical	39	32	28	39	36	30†	39	31	27
Sales	44	27	23	46	26	22	40	27	23
Service	46	34	30	45	34	29	47	35	31
Blue-collar indoor	**46**	**37**	**34**	**48**	**39**	**33**	**37**	**30**	**36**
Manufacturing	47	37	34	49	39	33	38	30	38
Materials handling/Crafts	42	35	35	44	36	36	33†	30	- -
Blue-collar outdoor	**49**	**35**	**38**	**49**	**36**	**40**	**38†**	**24**	- -
Outdoor‡	38	25	28	38	27	31	- -	19	- -
Construction/Transportation/Mining	53	39	43	53	39	43	- -	- -	- -

Data sources: *1978/79 Canada Health Survey, 1986 Labour Force Survey, 1994/95 National Population Health Survey, Supplementary file*
Note: *In the Canada Health Survey, workers are those who were employed at any time in the two weeks before their interview. In the Labour Force Survey, workers are those who were employed in the week before they were interviewed. In the National Population Health Survey, workers are those who were employed for pay or profit on the day of the interview.*
† High coefficient of variation (16.6% to 25.0%)
‡ Forestry, farming, fishing
- - Sample too small to permit reliable estimate

The decline of smoking prevalence and increase in intensity between 1978/79 and 1986 occurred because prevalence fell disproportionately among workers who smoked less heavily.[7] The result was a larger percentage of heavy smokers among those who continued to smoke. Since 1986, both prevalence and intensity declined in most occupational groups.

Encountering restrictions at work was associated with lower smoking intensity: 31% of workers who reported such restrictions smoked 25 or more cigarettes a day, compared with 40% of those who were not restricted (data not shown).

Trying to quit, cutting down

Almost 4 in 10 full-time workers who were daily smokers reported having tried to quit in the past year (Table 4). Daily smokers in service occupations were the most likely to have made the attempt (44%); those in construction/transportation/mining occupations, the least likely (31%).

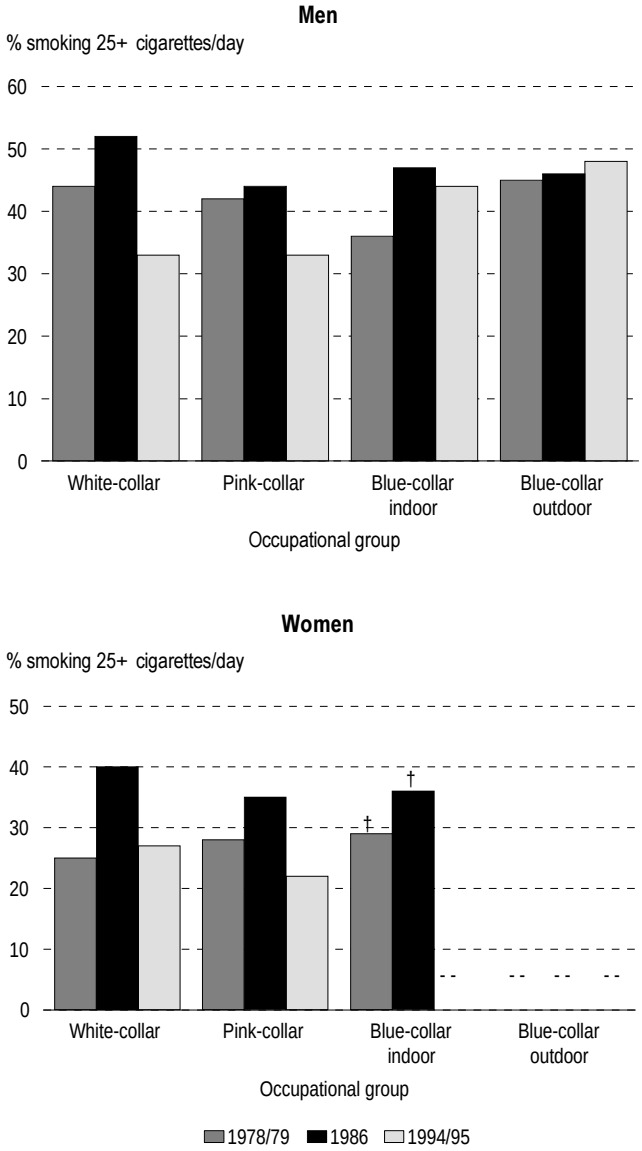
Encountering workplace smoking restrictions was associated with attempts to cut down (data not shown). In 1994/95, 36% of daily smokers who

Table 4
Smoking intensity and cessation attempts, by occupation, full-time workers aged 15 to 64 who smoked daily, Canada excluding territories, 1994/95

Occupation	Daily smokers	Smoke 25+ cigarettes per day	In last 12 months: Smoking less	In last 12 months: Tried to quit
	'000	%	%	%
All occupations†	**2,933**	**35**	**33**	**39**
White-collar	**618**	**33**	**32**	**39**
Managerial/Administrative	340	35	34	40
Professional‡	278	29§	30	38
Pink-collar	**1,007**	**28**	**34**	**42**
Clerical	418	26§	35	41
Sales	189	36	36	38
Service	400	27	33	44
Blue-collar indoor	**640**	**40**	**30**	**39**
Manufacturing	489	40	33	41
Materials handling/Crafts	151	40§	--	--
Blue-collar outdoor	**592**	**45**	**34**	**34**
Outdoor††	117	34§	--	45§
Construction/Transportation/ Mining	475	49	35	31
Not stated	75	--	--	--

Data source: *1994/95 National Population Health Survey, Supplementary file*
Note: *Because of rounding, number of daily smokers may not match numbers calculated from figures in Table 1.*
† Includes not stated.
‡ Sciences, other professional
§ High cœfficient of variation (16.6% to 25.0%)
†† Forestry, farming, fishing
-- Sample too small to permit reliable estimate

Chart 3
Daily smokers who smoked 25 or more cigarettes per day, by sex and occupational group, workers aged 15 to 64, Canada excluding territories, 1978/79, 1986 and 1994/95



Data source: *1978/79 Canada Health Survey, 1986 Labour Force Survey, 1994/95 National Population Health Survey, Supplementary file*
† High cœfficient of variation (16.6% to 25.0%)
-- Sample too small to permit reliable estimate

found restrictions at work reported trying to smoke less, compared with 29% of workers who did not find restrictions. There was, however, no relationship between encountering restrictions and trying to quit.

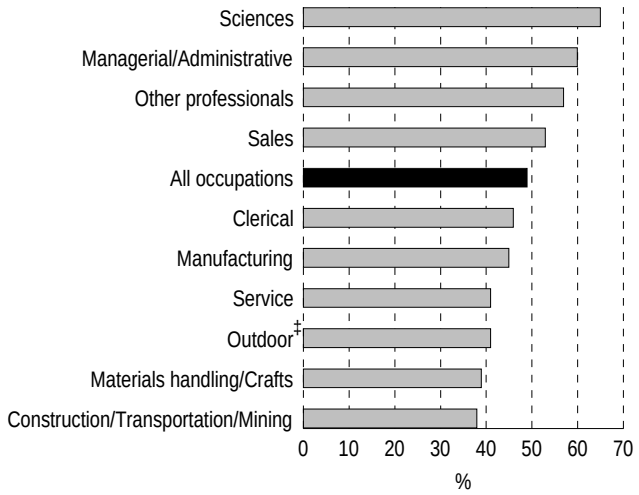
Professionals most likely to quit

About half of full-time workers, both men and women, who had ever smoked (daily or occasionally) reported having quit. The figure was around 6 out of 10 for workers in scientific, managerial or professional occupations, but just 4 out of 10 in construction/transportation/mining, materials handling/crafts, and outdoor occupations (Chart 4).

Earlier studies, too, have found smokers in professional occupations to be the most likely, and those in non-managerial and construction occupations the least likely, to quit.[2,4,7,21] NPHS data show that substantial percentages of those in professional occupations also reported workplace smoking restrictions.

But encountering restrictions was not always linked to quit rates. Comparatively large percentages of daily smokers in clerical, manufacturing, and materials handling/crafts occupations reported workplace smoking restrictions, yet quit rates in these occupations were below average.

Chart 4
Quit rate† of full-time workers aged 15 to 64 who ever smoked, by occupation, Canada excluding territories, 1994/95



Data source: *1994/95 National Population Health Survey, Supplementary file*
† Former smokers as a percentage of current smokers plus former smokers
‡ Forestry, farming, fishing

Three patterns

Distinct patterns of smoking prevalence and intensity by occupation emerge from the NPHS data. White-collar workers had the lowest smoking prevalence, the highest cessation rates, and average smoking intensity. In addition, their smoking prevalence and intensity declined between 1986 and 1994/95. High percentages of white-collar workers who were daily smokers found restrictions at work, consistent with their easily regulated indoor office workplaces.

The daily smoking prevalence of pink-collar workers was close to that for all workers in 1994/95 and had declined steadily since 1978/79. As well, the proportion of heavy smokers fell substantially after 1986. By 1994/95, the smoking intensity of pink-collar workers was the lowest of all workers, while their cessation rate matched that for workers overall. A relatively high percentage of clerical workers reported smoking restrictions at work. The percentages of sales and service workers reporting restrictions were much lower. This has been attributed to an overlap between their worksites and less regulated public places.[5]

Workers in blue-collar occupations reported the highest smoking prevalence and intensity. Although some had attempted to quit, their success rate was low. The relative lack of restrictions in construction/transportation/mining and outdoor occupations was accompanied by stable daily smoking prevalence and slightly increasing intensity among male workers.

Implications

The 1994/95 National Population Health Survey shows that smokers who reported workplace restrictions were less likely to smoke heavily and more likely to have tried to cut down. However, these results cannot be used to conclude that the presence of bans caused reductions in smoking. In fact, workers reporting restrictions were no more likely to have tried to quit than workers who reported no restrictions.

Smoking restrictions are only one factor that may influence workers who smoke. Smoking has been associated with stress caused by high job strain.[33,34] It may be a coping strategy to deal with work involving high demands and low levels of autonomy.[33] (See *Work stress and health* in this issue.) Women in clerical occupations, who have a below-average quit rate, fit these stress patterns.[35] High job strain can also be expected from the assembly-line nature, tight supervision and boredom associated with many indoor blue-collar occupations.[34] As well, some blue-collar occupations entail a degree of danger. Workers in such jobs may perceive smoking to be a relatively innocuous risk compared with other serious hazards that they confront.

Social factors are also important. Many blue-collar workers seem to be committed smokers who may be receiving support from peer groups to continue smoking,[5] and may be more likely to socialize in places with less stringent smoking restrictions. ●

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Appendix

Table A
Equivalent occupational groups, 1994/95 National Population Health Survey and 1971 and 1980 Standard Occupational Classification (SOC)

Occupational group	Analysis group	1994/95 NPHS occupational group	SOC major group, 1971 and 1980
White-collar	Managerial/ Administrative	Managerial/ Administrative	11
	Sciences	Natural science	21
		Social science	23
	Other professional	Religion	25
		Teaching	27
		Medicine	31
		Artistic	33
Pink-collar	Clerical	Clerical	41
	Sales	Sales	51
	Services	Services	61
Blue-collar indoor	Manufacturing	Processing	81,82
		Machining	83
		Fabricating	85
	Materials handling/ Crafts	Materials handliing	93
		Other crafts	95
Blue-collar outdoor	Outdoor	Farming	71
		Fishing	73
		Forestry	75
	Construction/ Transportation/ Mining	Construction	87
		Transportation	91
		Mining	77
Not stated	Not stated	Respondents who were currently working, but did not state an occupation	...

Sources: *1994/95 National Population Health Survey; References 9,11 and 12*

Note: *Some occupations classified to one major group in 1971 were coded to another in 1980.*

... Not applicable

Work stress and health

Kathryn Wilkins and Marie P. Beaudet

Abstract

Objectives

This article describes work stress experienced by the employed population. It examines associations between job strain, job insecurity, physical demands, low co-worker support and low supervisor support, and four health outcomes: migraine, work injury, high blood pressure and psychological distress.

Data source

The data are from the household component of the 1994/95 National Population Health Survey conducted by Statistics Canada. Results are based on a sample of 9,023 employed Canadians aged 18 to 64.

Analytical techniques

Multivariate analyses were used to estimate associations between work stress and health problems, while controlling for other potential stressors.

Main results

Among men, job strain was associated with migraine and psychological distress, and among women, with work injury. Job insecurity was associated with migraine among women. High physical demands were related to work injury in both sexes. Low co-worker support was related to migraine among men, and to work injury and psychological distress among women.

Key words

occupational health, job strain, hypertension, migraine, occupational injury

Authors

Kathryn Wilkins (613-951-1769; wilkkat@statcan.ca) and Marie P. Beaudet (613-951-7025; beaumar@statcan.ca) are with the Health Statistics Division at Statistics Canada, Ottawa K1A 0T6.

In today's rapidly changing labour market, the consequences of stress in the workplace have become an issue. Previous studies have suggested that adverse work conditions are related to a variety of health problems. Research has focused on associations between factors such as work organization, job control and worker support, and health outcomes such as depression, anxiety, high blood pressure and coronary heart disease.[1-3]

Job strain, defined as a measure of the balance between the psychological demands of a job and the amount of control or decision-making power it affords, has been proposed as a key component of work stress.[4] Workers in high-strain jobs have been shown to have higher rates of a wide variety of diseases than their counterparts in low-strain jobs.[5] Job strain, however, is only one element of work stress. Job insecurity, physical demands, and the amount of support provided by supervisors and co-workers also come into play in the work stress–illness relationship.

Methods

Data source

The analysis in this article is based on data from the household component of Statistics Canada's 1994/95 National Population Health Survey (NPHS) for the 10 provinces. This component of the NPHS sample consisted of 27,263 households, of which 88.7% agreed to participate. After applying a screening rule (to keep the sample representative),[6] 20,725 households remained in scope.

In each household, one person was randomly selected to provide detailed information about his or her own health. The response rate to these questions was 96.1%, or 17,626 respondents. The data base containing this in-depth health information is called the Health file.

Data provided by 9,023 adults (4,709 men and 4,314 women) aged 18 through 64 who were employed at the time of the survey and who answered questions pertaining to work stress were analyzed for this article. These data were weighted using the age and sex distribution of the Canadian population to represent nearly 12.8 million people.

Analytical techniques

All analyses are based on weighted data. Descriptive statistics were used to profile the population who were working at the time of the survey (Appendix Table A). The average values for five measures of work stress (job strain, job insecurity, physical demands, co-worker support and supervisor support) and the prevalence of four health outcomes (migraine, work injury, high blood pressure and psychological distress) were calculated by sex and occupational category (see *Measures of work stress* and *Health outcomes)*. Multiple logistic regression was used to model the relationship between work stress and work injury, migraine, and high blood pressure. Multiple linear regression was used to model the relationship of work stress to psychological distress. Separate regression models were fitted for men and women. Coefficients of variation and standard errors were estimated using a weighted bootstrap procedure that fully accounts for the design effect of the survey.

Based on face validity and availability from the NPHS, selected stress-related factors were included in the regression models as control variables.[7] Work-related variables were occupation and employment status. Personal characteristics included age, marital status, educational attainment, household income and presence of children younger than age 12 in the household. Health behaviours comprised smoking status and level of energy expenditure in recreational activities. Psychological variables were recent negative life events, chronic strain, lack of closeness and sense of mastery (see *Measures of socioeconomic characteristics and health behaviours* and *Measures of stress and psychological resources).*

Limitations

Questions about work stress were asked only of people who were currently employed and able to go to work. No information was provided about individuals whose health problems or work injuries were serious enough to prevent them from working at the time of the survey. Therefore, the observed relationship between work stress and health outcomes is likely weaker than it would be if those who were not able to work because of injury or illness had been included.

It is well known that response to stress varies across individuals. Information on individual tolerance to particular stressors is not available from the NPHS. This may affect the observed relationships between the work stress variables and the selected health outcomes.

Cronbach's alpha was used to assess the internal consistency of the work stress indices that were measured by at least two items. The internal consistency estimate was 0.34 for psychological demands of work, 0.61 for decision latitude, and 0.22 for support from co-workers. Previous studies[8,9] based on Karasek's Job Content Questionnaire,[10] which contains 5, 8 and 4 items respectively for these scales, have reported internal consistency estimates of 0.7 or above for all three scales. The relatively low estimates of internal consistency found here are in part due to the limited number of items available from the NPHS to measure work stress. Likewise, the occurrence of fewer associations than expected between work stress and the selected health indicators might also be partly attributable to the low number of items.

No information is available on the timing of diagnosis or on the severity of chronic conditions. To minimize the reporting error related to chronic conditions (in this analysis, high blood pressure and migraine), respondents were instructed to report only conditions that were, or that were expected to be, of at least six months' duration, and that had been diagnosed by a health professional.

The NPHS data impose some limitations on the interpretation of the results. Because the data are cross-sectional, causality cannot be inferred from the observed associations. The data are also self-reported, so individual differences in perception may influence their accuracy.

Although its impact is important, work generates only part of an individual's total stress. In addition to stressors on the job, workers may experience home, social and individual situations that contribute to their stress levels.[7] However, many recent reports on the health effects of work stress are confined to job strain.[1,11-16] An important exception is provided in a study by Karasek, Gardell and Lindell, which takes into account the influence of family life as well as the work environment.[17]

Using data from the 1994/95 National Population Health Survey (NPHS), this article describes levels of work stress among employed Canadians, and highlights some differences among occupational categories and between the sexes. It also examines associations between selected health conditions and work stress, taking into account the influence of factors originating outside the workplace (see *Methods*). Four health outcomes are considered: work injury, migraine, high blood pressure and psychological distress. Although numerous articles have focused on associations between work stress and specific health problems, including high blood pressure and psychological distress, this is the first to examine the relationship of work stress to work injury and migraine.

Work stress among occupational groups

Men and women differ significantly on a number of work stress dimensions (Table 1) (see *Measures of work stress*). In 1994/95, on average, women reported a higher level of job strain. This is consistent with other research showing that men

Measures of work stress

To measure *work stress*, the 1994/95 National Population Health Survey (NPHS) asked participants to rank their responses to the following 12 statements using a five-point scale ranging from "strongly agree" (a score of 1) to "strongly disagree" (a score of 5).

a) Your job requires that you learn new things (reverse scored).
b) Your job requires a high level of skill (reverse scored).
c) Your job allows you freedom to decide how you do your job (reverse scored).
d) Your job requires that you do things over and over.
e) Your job is very hectic (reverse scored).
f) You are free from conflicting demands that others make.
g) Your job security is good.
h) Your job requires a lot of physical effort (reverse scored).
i) You have a lot to say about what happens in your job (reverse scored).
j) You are exposed to hostility or conflict from the people you work with (reverse scored).
k) Your supervisor is helpful in getting the job done.
l) The people you work with are helpful in getting the job done.

Five components of work stress were assessed:

1) *Job strain*, measured as a ratio of psychological demands (items *e* and *f*) to decision latitude. Items pertaining to decision latitude include skill discretion (*a, b* and *d*) and decision authority (*c* and *i*). So that the potential contribution of each item to the scores for decision latitude and psychological demands would be equal, the summed scores of the 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 fall in the upper quartile of the distribution (scores equal to or greater than 1.18), the respondent was categorized as being in a high-strain job.

2) *Job insecurity,* measured by item *g*. Respondents who answered "neither agree nor disagree," "disagree," or "strongly disagree" were categorized as experiencing job insecurity (29%).

3) *Physical demands*, measured by item *h*. Respondents who answered "strongly agree" or "agree" (41%) were categorized as experiencing high physical demands.

4) *Co-worker support*, measured by items *j* and *l*. Responses to the items were summed, yielding a range of 1 to 10. Respondents with a score of greater than or equal to 7 were considered to have low support (27%).

5) *Supervisor support,* measured by item *k*. Respondents who answered "strongly disagree" or "disagree" were categorized as receiving low support from their supervisor (32%).

report having more job control than do women.[18] And, to some extent, it may reflect differences in the types of occupations in which men and women are employed (Appendix Table A).[5,19] As well, women tended to report less support from co-workers than men did. On the other hand, men reported a higher level of physical demands and less support from supervisors. The average scores for job insecurity did not differ significantly between men and women.

For both sexes, work stress scores tended to be relatively high in service and blue-collar occupations, but low in the administrative and professional categories (Table 2 and Appendix Table B). These findings corroborate earlier Canadian research,[20] which concluded that workers' reactions to their jobs are determined by the nature of the jobs themselves, rather than by the workers' sex.

Men in blue-collar occupations had significantly higher average levels of physical demands than those in other occupational groups. Average levels of physical demands were also high for men in clerical and service occupations, compared with those in administrative, professional or sales positions. However, men in sales experienced high physical demands compared with those in administrative or professional occupations. Job strain was high for men in clerical, sales and service occupations, compared with those in professional positions. As well, men in service occupations experienced significantly high job strain relative to administrative or blue-collar workers. And compared with male clerical workers, men in administration and services had low supervisor support. Job insecurity and co-worker support did not differ significantly among men in various occupational groups.

Women in service and in blue-collar occupations had on average significantly higher levels of job strain and physical demands, relative to women in most other occupational groups. Women in service occupations also scored low on supervisor support, compared with those in professional or blue-collar jobs. Physical demands were high for women in professional and sales positions, relative to those in administrative or clerical jobs. The high scores for the professional group may be influenced by women

Table 1
Average score on work stress dimensions, by sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Both sexes	Men	Women
Job strain†	0.99	0.95	1.04 *
Job insecurity†	2.37	2.34	2.40
Physical demands†	3.08	3.19 *	2.94
Co-worker support‡	3.62	3.58	3.68 *
Supervisor support‡	2.40	2.43 *	2.35

Data source: *1994/95 National Population Health Survey, Health file*
† Coded low to high
‡ Coded high to low
** Average score is significantly different compared with other sex (p = 0.05). Standard errors used in the calculations of the confidence intervals were estimated with the bootstrap technique.*

Measures of socioeconomic characteristics and health behaviours

To establish *marital status*, respondents were asked "What is . . . 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 classed as "never married," and "widowed," "separated" and "divorced" were categorized as "previously married."

Respondents were grouped into five *educational attainment* categories: less than secondary graduation; secondary graduation; some postsecondary; college, trade or university graduation; and not stated.

Household income was based on total household income and the number of people in the household:

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

Occupations were categorized as administrative, professional, clerical, sales, service, blue-collar, and not stated.

Employment status was classed as full-time (30 or more hours per week) or part-time (less than 30 hours per week), or not stated.

Respondents were asked about *smoking*. Their answers were grouped into five categories: daily; former, occasional; never; and not stated.

Levels of *recreational physical activity* were defined (based on energy expenditure) as low, moderate, high or not stated.

working in nursing and teaching, both of which can be physically demanding. Average levels of job strain were high for women in clerical positions, compared with those in administrative or professional occupations. As with men, job insecurity and support from co-workers did not differ significantly among women in the different occupational groups.

Health problems

Previous studies have shown a number of physical and emotional health problems to be related to the work environment.[5,8,13,16,17,21-32] This analysis examines four conditions in relation to work stress: work injuries, migraine, high blood pressure and psychological distress. According to the 1994/95

Table 2
Significant differences in dimensions of work stress, by occupation and sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Men						Women					
	Occupation						Occupation					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
	(X indicates that the mean of the occupational group listed in the row is significantly higher than the mean of the occupational group listed in the column)											
Administrative (1)												
Job strain†	...						...					
Job insecurity†	...						...					
Physical demands†	...						...					
Co-worker support‡	...						...					
Supervisor support‡	...		X				...					
Professional (2)												
Job strain†		...						...				
Job insecurity†		...						...				
Physical demands†		...					X	...	X			
Co-worker support‡		...						...				
Supervisor support‡		...						...				
Clerical (3)												
Job strain†		X	...				X	X	...			
Job insecurity†			...						...			
Physical demands†	X	X	...	X					...			
Co-worker support‡			...						...			
Supervisor support‡			...						...			
Sales (4)												
Job strain†		X		...						...		
Job insecurity†				...						...		
Physical demands†	X	X		...			X		X	...		
Co-worker support‡				...						...		
Supervisor support‡				...						...		
Service (5)												
Job strain†	X	X			...	X	X	X		X	...	
Job insecurity†					...						...	
Physical demands†	X	X		X	...		X	X	X	X	...	
Co-worker support‡					...						...	
Supervisor support‡			X		...			X			...	X
Blue-collar§ (6)												
Job strain†						...	X	X		X		...
Job insecurity†						...						...
Physical demands†	X	X	X	X	X	...	X	X	X	X		...
Co-worker support‡						...						...
Supervisor support‡						...						...

Data source: *1994/95 National Population Health Survey, Health file*
Note: *Tests with p values equal to 0.003 (instead of 0.05) were considered significant to account for the multiple comparisons. Standard errors were estimated with the bootstrap technique. (See Appendix Table B for average scores on components of work stress.)*
† Coded low to high
‡ Coded high to low
§ Includes primary, processing/machining, product fabricating, and construction occupations.
... Not applicable

NPHS, the prevalence of these problems varied between male and female workers, and among occupations (Table 3). However, because the data are not age-adjusted, some of the differences in prevalence may be related to the age of the workers in the occupational categories.

The proportion of men who had sustained a work-related injury considerably exceeded that for women: 9% compared with 5%. Work injuries among men were most common in blue-collar occupations. For women, work injuries were most prevalent in service occupations.

Unlike work injuries, migraine afflicted a larger proportion of women than men. The percentage of female workers reporting migraine (12%) was triple that for men (4%). People in administrative jobs, both men and women, were the most likely to report migraine.

Health outcomes

The following question was used to measure *chronic conditions*: "I'd like to ask about any chronic health conditions . . . may have. 'Long-term conditions' refers to conditions that have lasted or are expected to last 6 months or more. Does . . . have any of the following long-term conditions that have been diagnosed by a health professional?" The list included high blood pressure and migraine.

To measure *work injuries*, respondents were asked two "yes/no" questions: "In the past 12 months, did . . . have any injuries that were serious enough to limit your/his/her normal activities?" and "Was this a work-related injury?"

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 of the time":

"During the past month, 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; higher scores indicated more distress (Cronbach's alpha = 0.77). Respondents with a score that fell in the upper quartile of the distribution were considered to be experiencing high psychological distress.

About 5% of both male and female workers reported high blood pressure. The prevalence of high blood pressure did not differ significantly across occupational groups.

Consistent with the findings of a recent Quebec study,[24] the NPHS shows higher levels of psychological distress among female than male workers. The women with the highest average psychological distress score worked in service

Table 3
Prevalence of selected health problems, by occupation and sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Work injury in past 12 months	Migraine	High blood pressure	Psychological distress score
	%	%	%	average
Men				
Total	**9**	**4**	**5**	**2.97**
Administrative	2‡	7	6	2.83
Professional	4	5	4	2.85
Clerical	--	--	5‡	3.61
Sales	5‡	--	4‡	2.93
Service	7	4‡	5	3.48
Blue-collar†	13	3	4	2.85
Women				
Total	**5**	**12**	**5**	**3.50**
Administrative	--	14	4	3.38
Professional	6	12	4‡	3.22
Clerical	3	11	5	3.48
Sales	--	12	4‡	3.48
Service	7	13	5	3.92
Blue-collar†	6	10	7‡	3.60

Data source: *1994/95 National Population Health Survey, Health file*
† Includes primary, processing/machining, product fabricating, and construction occupations.
‡ Coefficient of variation between 25.1% and 33.3%
-- Coefficient of variation greater than 33.3%

Table 4
Percentage of workers reporting high psychological distress, by job decision latitude and job demands, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Job decision latitude			
Job demands	**High**	**Moderate**	**Low**	**Very low**
	% with high psychological distress score†			
High	27	33	33	40
Moderate	24	26	30	35
Low	19	20	21	30
Very low	16	18	22	20

Data source: *1994/95 National Population Health Survey, Health file*
† Upper quartile of the distribution

occupations; women in professional occupations had the lowest.

Among men, the average level of psychological distress was highest in clerical positions, higher, in fact, than for women in this category. The male workers with the lowest average psychological distress scores were in administrative occupations, although scores in professional and blue-collar occupations were almost as low.

Psychological distress tended to be high among workers in jobs with high demands, but little latitude for decision-making. Fully 40% of workers in such jobs scored high on psychological distress (Table 4). Among those in high-demand jobs who had considerable decision latitude, the proportion experiencing high psychological distress was a much lower 27%. Not surprisingly, workers in jobs with very low demands were least likely to report high levels of psychological distress. Yet even in these jobs, the percentage with high distress generally increased as decision latitude declined.

Measures of stress and psychological resources

To measure *recent negative life events*,[33-35] the NPHS asked respondents 10 "yes/no" questions. Individuals who reported one or more such events (38%) were categorized as having experienced this kind of stress.

- "In the past 12 months, were you (or was anyone close to you—that is, your spouse or partner, children, relatives or close friends) beaten up or physically attacked?"
- "In the past 12 months, did you or someone in your family have an unwanted pregnancy?"
- "In the past 12 months, did you or someone in your family have an abortion or miscarriage?"
- "In the past 12 months, did you or someone in your family have a major financial crisis?"
- "In the past 12 months, did you or someone in your family fail school or a training program?"
- "In the past 12 months, did you (or your partner) experience a change of job for a worse one?"
- "In the past 12 months, were you (or your partner) demoted at work or did you/either of you take a cut in pay?"
- "In the past 12 months, did you have increased arguments with your partner?"
- "Now, just you personally, in the past 12 months, did you go on welfare?"
- "In the past 12 months, did you have a child move back into the house?"

Chronic strain[36] was measured by asking respondents to reply "true" or "false" to 11 statements:

- "You are trying to take on too many things at once."
- "There is too much pressure on you to be like other people."
- "Too much is expected of you by others."
- "You don't have enough money to buy the things you need."
- "Your work around the home is not appreciated."
- "Your friends are a bad influence."
- "You would like to move but you cannot."
- "Your neighbourhood or community is too noisy or too polluted."
- "You have a parent, a child or partner who is in very bad health and may die."
- "Someone in your family has an alcohol or drug problem."
- "People are too critical of you or what you do."

A score of 1 was assigned to each "true" response. High chronic strain was defined as a score of 2 to 11 (60%).

Lack of closeness was assessed with two "true/false" statements: one for people who were married, living with a partner or in a common-law union, and one for people who were single, widowed, divorced or separated. Those who responded "true" (20%) were categorized as lacking closeness.

- "Your partner doesn't understand you."
- "You find it is very difficult to find someone compatible with you."

To measure *mastery*,[37] respondents were asked to react to seven items, which were ranked on a five-point scale ranging from "strongly agree" (0) to "strongly disagree" (4). (The coding on the last two items was reversed.)

- "You have little control over the things that happen to you."
- "There is really no way you can solve some of the problems you have."
- "There is little you can do to change many of the important things in your life."
- "You often feel helpless in dealing with problems of life."
- "Sometimes you feel that you are being pushed around in life."
- "What happens to you in the future mostly depends on you."
- "You can do just about anything you really set your mind to."

The responses to all items were summed (ranging from 0 to 28) and higher scores indicated superior mastery (Cronbach's alpha = 0.76). Respondents with total scores of less than 20 were categorized as having low mastery (39%).

Health problems and work stress

Health problems are related to many conditions and situations that have little to do with stress, such as age, education and physical activity. Nonetheless, even when the effects of a number of such variables were taken into account, several dimensions of work stress were significantly associated with specific health outcomes (Table 5).

Among men, job strain was significantly related to migraine and psychological distress (Appendix Tables C and D). Among women, job strain was significantly associated with work injury, even though people whose injuries were serious enough to keep them from employment were excluded from the analysis. Therefore, the calculated odds ratio likely underestimates the true strength of association (Appendix Table E). Although a number of studies have reported an association between job strain and high blood pressure,[8,11,23,24,32,38] such a relationship was not observed in the NPHS data for either sex (see *Methods*).

After other potentially confounding factors were taken into account, job insecurity was associated with migraine among women. This is consistent with the medical literature, which suggests a link between emotional stress and migraine.[39]

As might be expected, high physical demands on the job were associated with work injury for both sexes. Previous research has also reported associations between physically demanding jobs and various musculoskeletal problems, usually involving the back or neck.[25-29]

Some interpersonal aspects of the work setting appear to adversely affect workers' health. Men with low support from their co-workers had significantly high odds of suffering from migraine. Among women, low support from co-workers was linked to psychological distress and increased the odds of work injury (Table 5 and Appendix Tables C, D and E).

Researchers have theorized that social support buffers psychological stress at work, reducing adverse health outcomes.[17,18,30,31] One previous study reported that a modifying effect of work control on job demand was observed only when co-worker support was present;[13] it did not find an association

Table 5
Adjusted odds ratios and regression coefficients relating work stress dimensions to health outcomes, by sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Work injury in past 12 months		Migraine		High blood pressure		Psychological distress†	
Work stress dimensions	Odds ratio	95% confidence interval‡	Odds ratio	95% confidence interval‡	Odds ratio	95% confidence interval	Unstandardized coefficient (b)	95% confidence interval§
Men								
High job strain	1.2	0.8, 1.7	1.6 *	1.0, 2.6	0.9	0.6, 1.5	0.63 *	0.28, 0.99
High job insecurity	1.1	0.8, 1.7	1.4	0.9, 2.2	1.0	0.7, 1.5	-0.05	-0.14, 0.05
High physical demands	3.3 *	2.3, 4.8	0.8	0.5, 1.4	1.0	0.6, 1.6	-0.02	-0.11, 0.06
Low co-worker support	1.2	0.8, 1.6	1.5 *	1.0, 2.3	1.1	0.7, 1.7	0.03	-0.04, 0.11
Low supervisor support	0.9	0.7, 1.3	1.0	0.7, 1.5	0.8	0.5, 1.1	0.01	-0.09, 0.10
Women								
High job strain	1.2 *	1.0, 1.4	1.1	0.8, 1.5	1.4	0.8, 2.3	0.05	-0.31, 0.42
High job insecurity	1.7	0.7, 4.0	1.4 *	1.0, 1.8	0.8	0.5, 1.3	0.02	-0.09, 0.13
High physical demands	1.9 *	1.7, 2.1	1.1	0.9, 1.5	1.0	0.6, 1.6	-0.02	-0.12, 0.09
Low co-worker support	1.8 *	1.7, 1.8	1.2	0.9, 1.6	0.9	0.6, 1.4	0.08 *	0.00, 0.16
Low supervisor support	1.1	1.0, 1.3	1.1	0.8, 1.4	0.9	0.6, 1.4	-0.09	-0.20, 0.02

Data source: *1994/95 National Population Health Survey, Health file*
Note: *See Appendix Tables C through F for information on all variables included in the models.*
† In modelling psychological distress, the variables job strain, job insecurity and physical demands were coded low to high; co-worker support and supervisor support were coded high to low.
‡ Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.
§ Because of rounding, some confidence intervals with 0 as the lower limit were significant.
** p = 0.05*

with support from one's supervisor. Similarly, this analysis of NPHS data found no significant relationship between supervisor support and the four health problems examined, possibly because only one item was available to measure this dimension.

Negative life events and other stressors

Other research suggests that experiencing one or more recent negative life events can independently influence susceptibility to a variety of health problems.[40] The NPHS, too, shows negative life events to be fairly consistently associated with health problems (the exception was work injury) (Appendix Tables C, D and F). For both sexes, such events were associated with migraine and psychological distress. Among men, an association with high blood pressure was revealed.

Individual characteristics, along with the home and social environments, seem to be more strongly associated with psychological distress than with any of the other three health problems examined. For both sexes, chronic strain, lack of closeness and a low sense of mastery were associated with psychological distress. While the association of these emotional and social factors with psychological distress is not surprising, it is noteworthy that each remained independently and simultaneously associated after other variables that might have had an effect were taken into account.

The literature on the effects of parenthood on working women is contradictory and inconclusive. The NPHS finding that having one or more children under age 12 was associated with low psychological distress in women is consistent with some, but not all, previous reports.[17,41]

Concluding remarks

This analysis of the relationship between health and work stress controls for a greater range of potentially confounding variables outside the workplace than are usually reported. The lower-than-expected number of associations between work stress and health problems can be partly attributed to the lack of information on the timing of diagnosis and the severity of illness. Nonetheless, there is evidence of a weak to moderate relationship between work stress and some health outcomes.

Workers who experienced job strain, job insecurity, physical demands or low support from their co-workers reported physical and emotional health problems. Of course, it is not possible to know from this cross-sectional study whether the work environment has adverse health effects, or whether workers with specific health problems are more susceptible to workplace stress. ●

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Appendix

Table A

Characteristics of employed population aged 18 to 64, Canada excluding territories, 1994/95

	Both sexes		Men		Women	
	Number ('000)	%	Number ('000)	%	Number ('000)	%
Total	12,760	100.0	7,086	100.0	5,672	100.0
Occupation						
Administrative	1,845	14.5	1,120	15.8	725	12.8
Professional	2,298	18.0	970	13.7	1,329	23.4
Clerical	1,884	14.8	470	6.6	1,413	24.9
Sales	1,041	8.2	524	7.4	516	9.1
Service	1,638	12.8	698	9.8	940	16.6
Blue-collar†	3,641	28.5	3,075	43.4	566	10.0
Not stated	413	3.2	230	3.2	184	3.2
Employment status						
Full-time	10,724	84.0	6,522	92.0	4,202	74.1
Part-time	1,990	15.6	531	7.5	1,459	25.7
Not stated	46	0.4	33	0.5	12	0.2
Age						
18-24	1,599	12.5	843	11.9	756	13.3
25-34	3,630	28.4	1,978	27.9	1,651	29.1
35-44	3,818	29.9	2,124	30.0	1,694	29.9
45-54	2,633	20.6	1,524	21.5	1,109	19.5
55-64	1,080	8.5	617	8.7	462	8.2
Marital status						
Married	8,904	69.8	5,068	71.5	3,836	67.6
Never married	2,827	22.2	1,624	22.9	1,203	21.2
Previously married	1,025	8.0	394	5.6	631	11.1
Not stated	4	–	1	–	3	0.1
Educational attainment						
Less than secondary graduation	2,052	16.1	1,307	18.4	746	13.1
Secondary graduation	2,150	16.8	1,169	16.5	981	17.3
Some postsecondary	3,426	26.8	1,803	25.4	1,623	28.6
College, trade or university graduation	5,117	40.1	2,798	39.5	2,319	40.9
Not stated	15	0.1	10	0.1	5	0.1
Household income group						
Lowest	401	3.1	186	2.6	215	3.8
Lower-middle	767	6.0	390	5.5	377	6.6
Middle	3,068	24.0	1,642	23.2	1,426	25.1
Upper-middle	5,317	41.7	3,001	42.3	2,317	40.8
Highest	2,639	20.7	1,510	21.3	1,129	19.9
Not stated	568	4.4	357	5.0	210	3.7
Child(ren) under age 12 in household						
Yes	4,437	34.8	2,463	34.8	1,974	34.8
No	8,323	65.2	4,623	65.2	3,699	65.2
Smoking						
Daily	3,451	27.0	2,054	29.0	1,397	24.6
Former/Occasional	4,456	35.0	2,552	36.0	1,904	33.6
Never	4,848	38.0	2,475	34.9	2,373	41.8
Not stated	5	–	5	0.1	–	–
Recreational physical activities						
Low	7,417	58.1	3,830	54.0	3,587	63.2
Moderate	2,700	21.2	1,518	21.4	1,182	20.8
High	2,045	16.0	1,246	17.6	799	14.1
Not stated	598	4.7	492	6.9	106	1.9
One or more recent negative life events						
No	7,316	57.3	4,062	57.3	3,254	57.4
Yes	4,817	37.8	2,510	35.4	2,307	40.7
Not stated	627	4.9	515	7.3	112	2.0
High chronic strain						
Yes	7,378	57.8	3,790	53.5	3,588	63.2
No	4,739	37.1	2,770	39.1	1,969	34.7
Not stated	643	5.0	526	7.4	117	2.1
Closeness						
Difficulty finding	2,419	19.0	1,250	17.6	1,168	20.6
No difficulty finding	9,694	76.0	5,312	75.0	4,382	77.2
Not stated	647	5.1	524	7.4	123	2.2
Sense of mastery						
Low	4,851	38.0	2,499	35.3	2,352	41.5
High	7,222	56.6	4,051	57.2	3,171	55.9
Not stated	687	5.4	536	7.6	151	2.7

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

Note: *Detail may not add to totals because of rounding.*

† Includes primary, processing/machining, product fabricating, and construction occupations.

– Nil

Table B
Average scores on work stress dimensions, by occupation and sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Job strain†	Job insecurity†	Physical demands†	Co-worker support‡	Supervisor support‡
Men					
Administrative	0.92	2.20	2.36	3.57	2.56
Professional	0.90	2.32	2.45	3.52	2.38
Clerical	1.01	2.36	3.27	3.76	2.17
Sales	1.00	2.34	2.78	3.63	2.53
Service	1.02	2.33	3.49	3.77	2.54
Blue-collar§	0.94	2.39	3.78	3.51	2.41
Women					
Administrative	0.97	2.30	2.31	3.73	2.32
Professional	0.99	2.50	3.09	3.68	2.27
Clerical	1.05	2.32	2.34	3.59	2.39
Sales	0.98	2.44	2.88	3.51	2.25
Service	1.13	2.40	3.76	3.84	2.53
Blue-collar§	1.11	2.47	3.66	3.57	2.24

Data source: *1994/95 National Population Health Survey, Health file*
Note: *The scores for each component of work stress are based on different scales; therefore, they cannot be compared with one another.*
† Coded from low to high
‡ Coded from high to low
§ Includes primary, processing/machining, product fabricating, and construction occupations.

Table C
Adjusted odds ratios relating selected characteristics to migraine, by sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Work stress				
High job strain†	1.6 *	1.0, 2.6	1.1	0.8, 1.5
High job insecurity†	1.4	0.9, 2.2	1.4 *	1.0, 1.8
High physical demands†	0.8	0.5, 1.4	1.1	0.9, 1.5
Low co-worker support†	1.5 *	1.0, 2.3	1.2	0.9, 1.6
Low supervisor support†	1.0	0.7, 1.5	1.1	0.8, 1.4
Occupation				
Administrative‡	1.0	…	1.0	…
Professional	0.7	0.4, 1.6	0.8	0.5, 1.3
Clerical	1.1	0.4, 3.0	0.8	0.5, 1.2
Sales	0.4	0.1, 1.5	1.0	0.6, 1.6
Service	0.7	0.3, 1.7	0.8	0.5, 1.4
Blue-collar§	0.5 *	0.2, 1.0	0.8	0.5, 1.5
Full-time employment†	1.0	0.4, 2.6	1.2	0.9, 1.6
Age				
18-24	2.8	0.2, 35.1	1.3	0.7, 2.8
25-34	1.8	0.2, 20.2	2.0 *	1.0, 4.0
35-44	3.9	0.3, 43.0	1.8	0.9, 3.5
45-54	3.8	0.3, 42.8	2.2 *	1.1, 4.1
55-64‡	1.0	…	1.0	…
Marital status				
Married‡	1.0	…	1.0	…
Never married	1.0	0.4, 2.3	0.8	0.5, 1.2
Previously married	0.7	0.3, 1.9	1.2	0.8, 1.7
Child(ren) under age 12 in household†	1.3	0.8, 2.4	1.0	0.8, 1.4
Educational attainment				
Less than secondary graduation	1.2	0.6, 2.4	1.0	0.7, 1.6
Secondary graduation	1.0	0.5, 2.1	0.8	0.5, 1.2
Some postsecondary	1.3	0.7, 2.2	1.2	0.9, 1.6
College, trade or university graduation‡	1.0	…	1.0	…
Lowest, lower-middle, or middle household income group†	1.1	0.7, 1.9	0.8	0.6, 1.1
Smokes daily†	1.1	0.7, 1.7	1.1	0.9, 1.5
Recreational physical activities				
Low	1.2	0.7, 2.2	1.0	0.7, 1.4
Moderate	0.7	0.4, 1.5	1.1	0.7, 1.6
High‡	1.0	…	1.0	…
One or more recent negative life events†	2.1 *	1.3, 3.4	1.8 *	1.4, 2.4
High chronic strain†	1.3	0.8, 2.0	1.6 *	1.2, 2.2
Lack of closeness†	0.7	0.4, 1.3	0.7 *	0.5, 1.0
Low sense of mastery†	0.8	0.5, 1.2	1.0	0.7, 1.3

Data source: *1994/95 National Population Health Survey, Health file*
Notes: *Analysis is based on 4,172 men and 4,004 women. Approximately 13% of male respondents and 8% of female respondents with a missing value on one or more variables were excluded from the analysis. "Unknown" categories for occupation and income were included in the model to maximize the sample; however, their respective odds ratios are not shown. Confidence intervals are based on standard errors that were derived from the bootstrap technique for estimating the variance. Because of rounding, some confidence intervals with 1.0 as the lower or upper limit were significant.*
† Reference category is absence of the characteristic; for example, the reference for high job strain is low job strain.
‡ Reference category for which odds ratio is always 1.00
§ Includes primary, processing/machining, product fabricating, and construction occupations.
** p = 0.05*
··· Figures not appropriate

Table D
Multivariate regression results predicting psychological distress from selected characteristics, by sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Men			Women		
	Unstandardized coefficient (b)	se	Standardized coefficient (beta)	Unstandardized coefficient (b)	se	Standardized coefficient (beta)
Work stress						
Job strain†	.63*	.18	.07*	.05	.19	.01
Job insecurity†	-.05	.05	-.02	.02	.05	.01
Physical demands†	-.02	.04	-.01	-.02	.05	-.01
Co-worker support‡	.03	.04	.02	.08*	.04	.04 *
Supervisor support‡	.01	.05	.003	-.09	.05	-.03
Occupation						
Administrative††						
Professionals	-.07	.17	-.01	.17	.20	.02
Clerical	.29	.27	.02	-.09	.19	-.01
Sales	-.25	.22	-.02	-.17	.24	-.01
Service	-.15	.24	-.02	.10	.21	.01
Blue-collar§	-.36*	.16	-.06*	.01	.27	.001
Full-time employment	.02	.22	.002	-.06	.13	-.01
Age†	-.04*	.01	-.14 *	-.04 *	.01	-.12 *
Marital status						
Married††						
Never married	.04	.16	.01	.29	.18	.04
Previously married	.34	.21	.03	.33	.19	.03
Child(ren) under age 12 in household	-.15	.13	-.02	-.34*	.14	-.05 *
Educational attainment						
Less than secondary graduation	-.12	.17	-.02	.28	.22	.03
Secondary graduation	-.23	.14	-.03	-.23	.18	-.03
Some postsecondary	-.09	.12	-.01	.07	.14	.01
College, trade or university graduation††						
Lowest, lower-middle, middle household income group	-.02	.12	-.003	.12	.14	.02
Smokes daily	.13	.13	.02	.24	.14	.03
Recreational physical activities						
Low	.17	.12	.03	.10	.15	.01
Moderate	.18	.14	.03	.003	.17	.0004
High††						
One or more recent negative life events	.37*	.06	.13*	.31*	.06	.10 *
Chronic strain†	.41*	.03	.25*	.39*	.04	.22 *
Lack of closeness	.45*	.15	.06*	.65*	.17	.08 *
Sense of mastery†	-.17*	.02	-.24*	-.21*	.01	-.27 *
Intercept	6.3			7.3		
Total R^2	.29			.29		

Data source: *1994/95 National Population Health Survey, Health file*
Notes: *Analysis is based on 4,166 men and 4,002 women. "Unknown" categories for occupation and income were included in the model to maximize the sample size; however, their respective b and beta coefficients are not shown. Approximately 11% of male respondents and 7% of female respondents were excluded from the analysis because of missing values. Standard errors were estimated with the bootstrap technique.*
† Coded from low to high
‡ Coded from high to low
§ Includes primary, processing/machining, product fabricating, and construction occupations.
†† Reference category
** $p = 0.05$*
R^2 = .29 for men and .29 for women; adjusted R^2 = .28 for men and .28 for women
d.f. men = 28, 4137; d.f. women = 28, 3973

Table E
Adjusted odds ratios relating selected characteristics to work injury, by sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Work stress				
High job strain†	1.2	0.8, 1.7	1.2 *	1.0, 1.4
High job insecurity†	1.1	0.8, 1.7	1.7	0.7, 4.0
High physical demands†	3.3 *	2.3, 4.8	1.9 *	1.7, 2.1
Low co-worker support†	1.2	0.8, 1.6	1.8 *	1.7, 1.8
Low supervisor support†	0.9	0.7, 1.3	1.1	1.0, 1.3
Occupation				
Administrative‡	1.0	…	1.0	…
Professional	1.7	0.7, 3.9	0.9	0.9, 1.0
Clerical	3.7 *	1.3,10.3	0.5	0.2, 1.0
Sales	1.7	0.6, 4.9	0.9	0.7, 1.2
Service	1.9	0.9, 4.2	0.8 *	0.8, 0.9
Blue-collar§	3.2 *	1.6, 6.2	0.9	0.4, 1.8
Full-time employment†	3.1 *	1.2, 8.1	1.3 *	1.1, 1.7
Age				
18-24	2.2	1.0, 5.0	1.0	0.9, 1.1
25-34	1.6	0.8, 3.2	1.6	1.0, 4.2
35-44	1.3	0.6, 2.7	1.6	0.8, 3.2
45-54	1.0	0.5, 2.2	1.1	0.3, 4.5
55-64‡	1.0	…	1.0	…
Marital status				
Married‡	1.0	…	1.0	…
Never married	0.7	0.5, 1.0	0.7 *	0.6, 0.8
Previously married	0.7	0.4, 1.3	0.8	0.4, 1.4
Child(ren) under age 12 in household†	1.0	0.7, 1.4	0.9	0.8, 1.2
Educational attainment				
Less than secondary graduation	0.7	0.4, 1.1	1.3	0.4, 4.0
Secondary graduation	0.7	0.4, 1.1	0.9	0.6, 1.2
Some postsecondary	0.9	0.6, 1.2	1.2	0.9, 1.5
College, trade or university graduation‡	1.0	…	1.0	…
Lowest, lower-middle, middle household income group†	0.8	0.5, 1.0	1.3 *	1.2, 1.4
Smokes daily†	1.9 *	1.3, 2.6	0.8	0.6, 1.1
Recreational physical activities				
Low	1.3	0.9, 2.0	1.4	1.3, 1.5
Moderate	1.7	1.0, 2.7	1.3 *	0.5, 3.1
High‡	1.0	…	1.0	…
One or more recent negative life events†	1.2	0.9, 1.7	1.5	0.9, 2.4
High chronic strain†	1.2	0.8, 1.6	1.0	0.6, 1.6
Lack of closeness†	0.9	0.6, 1.3	1.1	0.6, 1.9
Low sense of mastery†	1.0	0.8, 1.4	1.3 *	1.2, 1.4

Data source: *1994/95 National Population Health Survey, Health file*
Notes: *Analysis is based on 4,176 men and 4,007 women. Approximately 13% of male respondents and 8% of female respondents with a mis sing value on one or more of the variables were excluded from the analysis. "Unknown" categories for occupation and income were included in the model to maximize the sample size; however, their respective odds ratios are not shown. Confidence intervals are based on standard errors that were derived from the bootstrap technique for estimating the variance. Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.*
† Reference category is the absence of the characteristic; for example, the reference for high job strain is low job strain.
‡ Reference category for which odds ratio is always 1.00
§ Includes primary, processing/machining, product fabricating, and construction occupations.
** $p = 0.05$*
… Figures not appropriate

Table F
Adjusted odds ratios relating selected characteristics to high blood pressure, by sex, employed population aged 18 to 64, Canada excluding territories, 1994/95

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Work stress				
High job strain†	0.9	0.6, 1.5	1.4	0.8, 2.3
High job insecurity†	1.0	0.7, 1.5	0.8	0.5, 1.3
High physical demands†	1.0	0.6, 1.6	1.0	0.6, 1.6
Low co-worker support†	1.1	0.7, 1.7	0.9	0.6, 1.4
Low supervisor support†	0.8	0.5, 1.1	0.9	0.6, 1.4
Occupation				
Administrative‡	1.0	…	1.0	…
Professional	0.7	0.4, 1.5	0.6	0.3, 1.1
Clerical	1.2	0.5, 3.1	1.2	0.6, 2.4
Sales	0.7	0.3, 1.7	0.9	0.4, 2.2
Service	1.0	0.5, 2.1	1.2	0.5, 2.7
Blue-collar§	0.8	0.4, 1.5	1.5	0.5, 4.4
Full-time employment†	0.6	0.3, 1.6	1.0	0.7, 1.5
Age				
18-24	0.04 *	0.00, 0.5	0.02 *	0.00, 0.1
25-34	0.06 *	0.03, 0.1	0.05 *	0.02, 0.1
35-44	0.3 *	0.2, 0.5	0.2 *	0.1, 0.4
45-54	0.6 *	0.3, 1.0	0.4 *	0.2, 0.6
55-64‡	1.0	…	1.0	…
Marital status				
Married‡	1.0	…	1.0	…
Never married	0.6	0.3, 1.2	1.6	0.8, 3.3
Previously married	0.7	0.4, 1.4	1.3	0.8, 2.3
Child(ren) under age 12 in household†	0.9	0.5, 1.5	1.1	0.7, 2.0
Educational attainment				
Less than secondary graduation	1.1	0.6, 2.0	1.1	0.5, 2.1
Secondary graduation	1.3	0.7, 2.5	0.9	0.5, 1.7
Some postsecondary	1.3	0.8, 2.2	1.1	0.7, 1.9
College, trade or university graduation‡	1.0	…	1.0	…
Lowest, lower-middle, middle household income group†	0.7	0.5, 1.2	1.0	0.6, 1.7
Smokes daily†	0.8	0.5, 1.3	0.9	0.6, 1.3
Recreational physical activities				
Low	1.2	0.7, 2.0	1.3	0.7, 2.2
Moderate	1.6	0.9, 2.8	1.0	0.5, 1.8
High‡	1.0	…	1.0	…
One or more recent negative life events†	1.4 *	1.0, 2.1	1.4	0.9, 2.1
High chronic strain†	1.3	0.8, 2.0	1.3	0.8, 2.1
Lack of closeness†	1.5	0.9, 2.7	1.0	0.6, 1.6
Low sense of mastery†	1.5	1.0, 2.2	0.9	0.6, 1.4

Data source: *1994/95 National Population Health Survey, Health file*
Notes: *Analysis is based on 4,172 men and 4,004 women. Approximately 13% of male respondents and 8% of female respondents with a missing value on one or more variables were excluded from the analysis. "Unknown" categories for occupation and income were included in the model to maximize the sample size; however, their respective odds ratios are not shown. Confidence intervals are based on standard errors that were derived from the bootstrap technique for estimating the variance. Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.*
† Reference category is absence of the characteristic; for example, the reference for high job strain is low job strain.
‡ Reference category for which odds ratio is always 1.00
§ Includes primary, processing/machining, product fabricating, and construction occupations.
** $p = 0.05$*
··· Figures not appropriate

Variations in angioplasty and bypass surgery

Helen Johansen, Cyril Nair and Gregory Taylor

Abstract

Objectives

This article describes rates of and times to revascularization procedures for heart attack patients.

Data source

The data are from Statistics Canada's Person-Oriented Information Data Base. Hospital discharge records for heart attack patients were linked for fiscal years 1992/93 and 1993/94.

Analytical techniques

Hospital patients admitted between April 1 and September 30, 1993 with a primary diagnosis of acute myocardial infarction (AMI) were followed for six months to determine what percentage underwent percutaneous transluminal coronary angioplasty and/or coronary artery bypass graft surgery. Analyses of time-to-procedure were performed for those patients who had not been hospitalized for AMI in the previous 12 months.

Main results

Approximately 24,000 Canadians were discharged from hospital during the first half of fiscal year 1993/94 with a diagnosis of AMI. Within six months, 8.7% had an angioplasty and 6.7% had a bypass; overall, 14.9% were revascularized. Women were less likely than men to have a bypass, but angioplasty rates did not differ significantly. The rate of revascularization declined with age. After adjusting for age and sex, rates were higher in the western provinces.

Key words

myocardial infarction, percutaneous transluminal coronary angioplasty, coronary artery bypass, patient readmission, medical record linkage

Authors

Helen Johansen (613-722-5570; johahel@statcan.ca) and Cyril Nair are with the Health Statistics Division at Statistics Canada, Ottawa K1A 0T6. Greg Taylor is with the Laboratory Centre for Disease Control at Health Canada.

The use of revascularization, a therapeutic approach for coronary heart disease, has increased over the past two decades (see *Cardiac procedures*).[1-3] Geographic variations in revascularization rates within Canadian provinces[4-7] and between Canada and the United States[8-10] have sparked debate on the appropriate rate of use of these procedures and raised questions about waiting times.[11-15]

This article uses Statistics Canada's Person-Oriented Information Data Base to examine rates of revascularization—percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass graft (CABG) surgery—among people who were admitted to hospital with a heart attack (acute myocardial infarction or AMI) from April 1 to September 30, 1993. Hospital records for these patients for the succeeding six months were analysed to calculate revascularization rates by age, sex and province (see *Methods* and *Limitations*). Time-to-procedure was calculated for patients who had not been hospitalized for an earlier heart attack during the previous 12 months.

Methods

Data source

Hospital morbidity files are provided annually to Statistics Canada by the provinces and territories. Each record contains information abstracted from a patient's hospital chart and pertains to one hospital separation. The data in this analysis are from the Person-Oriented Information Data Base. Hospital records for each province (data for the territories were excluded) for the fiscal years 1992/93 and 1993/94 were linked using patient identification numbers. (Patient names are not provided to Statistics Canada.)

Analytical techniques

Hospital patients often receive several diagnoses. Of these, the one accounting for the longest length of stay is known as the "tabulation diagnosis." The tabulation diagnosis is usually the same as the primary diagnosis—the condition responsible for the hospital stay. In this article, the term "primary diagnosis" is used for tabulation diagnosis.

For this analysis, a heart attack patient was defined as someone who had one or more hospital stays for acute myocardial infarction (AMI) during the year. Individuals with AMI who died in hospital are included.[7,10,16] The diagnosis for AMI in the International Classification of Diseases, Ninth Revision (ICD-9)[17] —410—was used to identify heart attack patients.

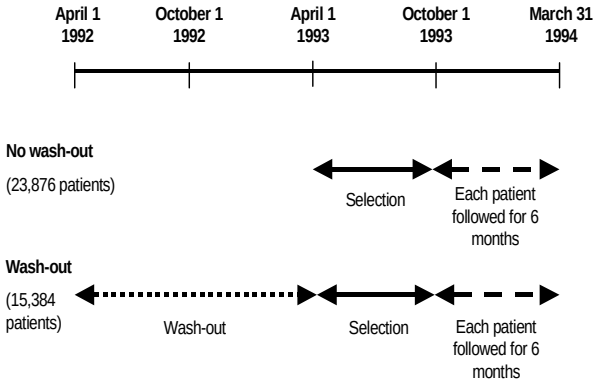
The first primary diagnosis of heart attack in the period between April 1 and September 30, 1993 was considered the "index event." The use of an index event measures the elapsed time from heart attack to revascularization and does not depend on referral time for angiography. Information on cardiac procedures and deaths in hospital (deaths occurring outside hospital were not included) was obtained for each of these heart attack patients for the six months after their index event.

All patients were followed for six months to determine if they underwent percutaneous transluminal coronary angioplasty (PTCA) and/or coronary artery bypass graft (CABG) surgery (see *Cardiac procedures*). The Canadian Classification of Procedures (CCP)[18] was used to identify CABG (48.11-48.19) and PTCA (48.00-48.08, 51.59).[7]

The inclusion of patients admitted to hospital for tests to rule out a diagnosis of heart attack can artificially inflate the numbers. To reduce false-positive diagnoses, patients discharged alive within four days and who did not have a PTCA were excluded from this analysis.[7,10,16]

A variety of methods might be used to calculate time-to-procedure.[19] For this analysis, time-to-procedure was estimated by subtracting the admission date of the first hospital stay during which the revascularization procedure was done from the admission date of the index visit, as this includes variations in the time to see a specialist and be placed on a waiting list. If the procedure occurred during the index visit, time-to-procedure was considered half the length of stay. This arbitrary cut-off was necessary because some jurisdictions report the date when each procedure was performed, but others do not.

Calculations of time-to-procedure are based on patients who had a heart attack in the first half of fiscal year 1993/94 **and** who had *not* been hospitalized for heart attack in the preceding 12 months. They are referred to as having a 12-month "wash-out" period. This restriction was necessary for calculations of time-to-procedure. Without the wash-out period, the index event would not have been identified. This is because patients who had had a heart attack in the previous year might have been waiting for revascularization when they had the attack that caused their admission to hospital in the six months from April 1 to September 30, 1993. The second heart attack may have increased their priority on the waiting list, so that a relatively short time would elapse until they had an angioplasty or bypass. However, their actual time-to-procedure would not be recorded.



No wash-out uses 10 provinces. Wash-out excludes Prince Edward Island, Nova Scotia and Quebec.

Wash-out periods could not be applied to Quebec and Nova Scotia data because those provinces scrambled the patient identifiers differently each year. As well, all revascularizations of Prince Edward Island residents were performed out of province and were not captured. Consequently, the analysis of time-to-procedure excludes Prince Edward Island, Nova Scotia and Quebec.

To determine the extent to which exclusion of these provinces affects the results, data for the other provinces were compared with those for all patients who suffered a heart attack in the first half of fiscal year 1993/94. Calculations based on these provinces (Appendix Tables A to E) were similar to those based on all 10 provinces.

Logistic regression was used to adjust provincial rates for age and sex. The median time-to-procedure was tested by the Wilcoxon test for the comparison of men and women, and by the Kruskal-Wallis test for the comparison of age and province.[20] Age comparisons were done starting from age 35.

This analysis is intended to provide empirical data on revascularization rates and waiting times for heart attack patients in Canada. It does not indicate whether rates are too low or too high, or whether tiime-to-procedure is too long or too short.

Few undergo revascularization

During the first half of fiscal year 1993/94, 23,876 Canadians were discharged from hospital with a primary diagnosis of heart attack (Table 1). Almost two-thirds of these patients were men, and one-third were aged 75 or older.

In the six months after their heart attack, 8.7% of patients underwent percutaneous transluminal coronary angioplasty, and 6.7% had coronary artery bypass graft surgery (Table 2). The total revascularized was 14.9%, slightly less than the sum of those who had an angioplasty and those who had bypass surgery, indicating that some patients had both procedures within the six months.[21,22] Rates calculated for the seven provinces for which a 12-month wash-out period could be determined (that is, they had not been hospitalized for a heart attack, ICD-9 410, in the preceding year) show that of the 2,170 patients who underwent revascularization, 47.3% had one angioplasty, 43.4% had bypass surgery, 6.4% had more than one angioplasty, and 2.9% had both procedures.

Table 1
Number of heart attack patients hospitalized between April 1 and September 30, 1993, by sex and province, Canada excluding territories

	Total	Men	Women
All provinces	23,876	15,218	8,658
Newfoundland	635	384	251
Prince Edward Island	110	71	39
Nova Scotia	713	455	258
New Brunswick	819	524	295
Quebec	6,362	4,138	2,224
Ontario	9,528	5,967	3,561
Manitoba	885	546	339
Saskatchewan	893	579	314
Alberta	1,638	1,072	566
British Columbia	2,293	1,482	811

Data source: *Person-Oriented Information Data Base*

Procedures vary with age and sex

The revascularization procedures performed on heart attack patients varied with their age and sex. At ages up to 60, angioplasty was generally more common. Among older patients, bypasses were performed as often as, and sometimes more frequently than, angioplasties (Chart 1).

Cardiac procedures

Coronary artery disease is a condition in which fatty deposits accumulate in the cells lining the wall of a coronary artery and obstruct blood flow.[23] Angina, which often results from coronary artery disease, is temporary chest pain or a sensation of pressure that occurs while heart muscle is not receiving enough oxygen. Coronary artery bypass graft (CABG) surgery and percutaneous transluminal coronary angioplasty (PTCA) are revascularization methods that improve the flow of blood to the heart.

Bypass surgery involves grafting veins (usually from the leg) or arteries (usually from beneath the breastbone) from the aorta to the coronary artery, thus "bypassing" the obstructed area.[23] Bypass surgery is highly effective in people who have angina and coronary heart disease that is not widespread. It can improve exercise tolerance, reduce symptoms, and decrease the number or dose of drugs needed. Those most likely to have bypass surgery are persons with: severe angina that has not improved with drug therapy; a normally functioning heart; no previous heart attacks; and no other conditions that would make surgery hazardous.[23]

For angioplasty, a large peripheral artery (usually the femoral artery in the leg) is punctured with a needle.[23] A guide wire is threaded through the needle into the arterial system, through the aorta and into the obstructed coronary artery. A catheter with a balloon attached to the tip is threaded over the guide wire and into the diseased coronary artery to the obstructed area. The balloon is inflated for several seconds. It may be inflated and deflated several times, thereby reducing the obstruction.

The number of revacularizations performed in Canada is rising. From 1990/91 to 1995/96, the annual number of bypasses increased 37% from 13,500 to 18,500. At the same time, angioplasties rose 47% from 16,100 to 23,600. Because the risks associated with surgery are higher for people with damaged heart muscle from a previous heart attack, AMI patients accounted for only a small fraction of these bypasses and angioplasties. However, revascularization may be performed on heart attack patients for whom other therapies are not effective. While the risk is greater among patients with severe disease, the benefits may also be greater.

Table 2
Percentage of heart attack patients hospitalized between April 1 and September 30, 1993 who had revascularization procedure within six months, by sex and province, Canada excluding territories

	Percutaneous transluminal coronary angioplasty (PTCA)			Coronary artery bypass graft surgery (CABG)			At least one revascularization procedure†		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
		%			%			%	
Total	8.7	9.8	7.0	6.7	7.9	4.5	14.9	17.1	11.2
Newfoundland	3.8	3.6	4.0	5.4	5.2	5.6	9.1	8.9	9.6
Prince Edward Island	...	...	...	...	...	...	...	...	...
Nova Scotia	7.0	7.0	7.0	7.6	9.2	4.7	14.2	15.8	11.2
New Brunswick	8.4	10.3	5.1	5.7	6.9	3.7	13.8	16.6	8.8
Quebec	11.0	12.4	8.5	6.7	7.9	4.5	17.1	19.5	12.7
Ontario	5.8	6.5	4.8	6.4	7.8	4.2	11.8	13.6	8.7
Manitoba	6.2	7.5	4.1	5.2	5.9	4.1	11.4	13.4	8.3
Saskatchewan	9.7	10.7	8.0	5.9	7.4	3.2	15.6	18.0	11.2
Alberta	17.7	18.1	17.0	8.5	10.3	5.1	25.9	28.2	21.7
British Columbia	11.1	13.0	7.6	7.8	8.4	6.7	18.2	20.8	13.6

Data source: *Person-Oriented Information Data Base*
† May be less than the sum of those with PTCA and CABG, as some patients had both.
··· Not applicable

Limitations

In the Person-Oriented Information Data Base, record linkage was conducted separately for each province. Thus, a patient with heart attack-related hospital admissions in two different provinces during the same fiscal year would be counted more than once. However, the effect of these events on the overall results is considered small. In fact, because procedures performed outside a patient's province of residence are not always counted, it is more likely that out-of-province procedures could result in an underestimation of the number of residents of a particular province undergoing follow-up surgery. When all bypasses, not just those on heart attack patients, are considered, 279 were performed on non-residents of the province where the surgery took place. Of these, 119 were captured in their province of residence. Of 256 angioplasties performed on non-residents, just 64 were coded in the patients' province of residence.

Six months after patients suffered a heart attack, the time-to-bypass had not reached a plateau, indicating that the six-month period during which patients were tracked is too short to indicate the percentage who eventually undergo the procedure. However, because of constraints in the Person-Oriented Data Base, it was not possible to follow patients for a longer time. Comparisons with other studies of time-to-procedure should take account of the relatively limited period on which this analysis is based.

The deaths reported in this article pertain only to those that occurred in hospitals. AMI patients who died out of hospital (according to vital statistics data, approximately 69% of male AMI deaths and 60% of female AMI deaths[24]) are not included.

A major limitation of this analysis is the lack of data on risk factors, disease severity, medications and specific treatments, and follow-up information on functional status, morbidity and mortality. Ideally, to assess treatments and do epidemiological research, pre-infarction and post-discharge data would be linked to hospital registry data. Linking clinical data to information available in vital statistics and hospital discharge records would provide longer term follow-up without the need for costly direct data collection from the patients.[25]

Tracking an inception cohort of patients, all of whom have had a heart attack (ICD-9 410), reduces but does not completely eliminate geographic variations in disease severity.[7] Results based on co-morbidity as a measure of severity suggest that the average severity of heart attacks varies considerably across provinces.[26]

Provincial differences in coding practices may affect the data. There are up to 12 procedure fields per hospital record. Different provinces record a different number of procedures for each hospital visit.

The validity and reliability of hospital discharge data may have an effect on the results. Some studies have found AMI hospital-discharge diagnoses to be good.[25,27] However, another report[28] found that the reliability of hospital discharge register data should be regularly assessed. Two Canadian studies found false positive rates of 8% to 21%, but they included patients among whom AMI was later ruled out.[29,30]

Men were generally more likely than women to have undergone revascularization: 17% versus 11%. The difference was more pronounced for bypasses (7.9% compared with 4.5%) than for angioplasties (9.8% compared with 7.0%). Other research, too, has shown female heart attack patients to be less likely than male patients to have invasive cardiac procedures.[31,32] An Ontario study[16] found rates of coronary angiography and bypass surgery to be significantly lower among women than men. In the United States, sex differences remained even after matching for the hospital of admission and controlling for other factors that influence procedure rates.[33]

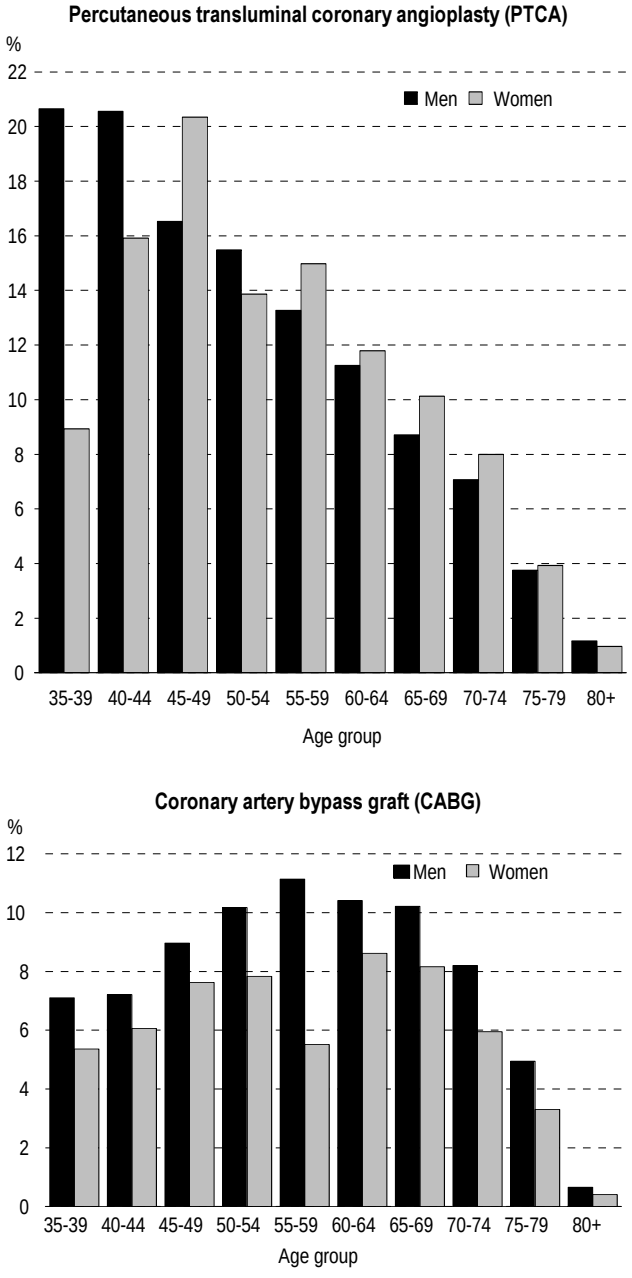
For men, angioplasty rates were highest at ages 35 to 44, whereas bypass surgery peaked among those in their late fifties. For female patients, angioplasty rates peaked at ages 45 to 49 and dropped steadily from ages 55 to 59 onwards. By contrast, with the exception of women aged 55 to 59 whose rate was very low, there was relatively little difference by age in the percentage of female patients who underwent bypass surgery until they reached their seventies.

After age 55, female heart attack patients were more likely than their male counterparts to have an angioplasty. However, at all ages, a higher percentage of male than female patients had bypass surgery.

Rates for both procedures declined sharply among male and female patients after age 70. The management of ischemic heart disease in the elderly is complex. Invasive revascularization therapies are associated with high morbidity and mortality.[34] As well, the elderly are more likely to have complications that contraindicate such procedures. It is not surprising, then, that fewer than 4% of hospitalized heart attack patients older than 74 had a revascularization procedure. However, a higher death rate at older ages helps explain this low percentage.

To some degree, the lower revascularization rate among women compared with men might be influenced by women's longer life expectancy. This results in a higher proportion of women in the oldest age groups, who are the least likely to undergo revascularization. Yet when age and province were taken into account, men's odds of having a bypass were one and a half times the odds for women. For angioplasties, however, there was no significant difference (Table 3).

Chart 1
Percentage of heart attack patients hospitalized between April 1 and September 30, 1993 who had revascularization within six months, by age, sex and procedure, Canada excluding territories



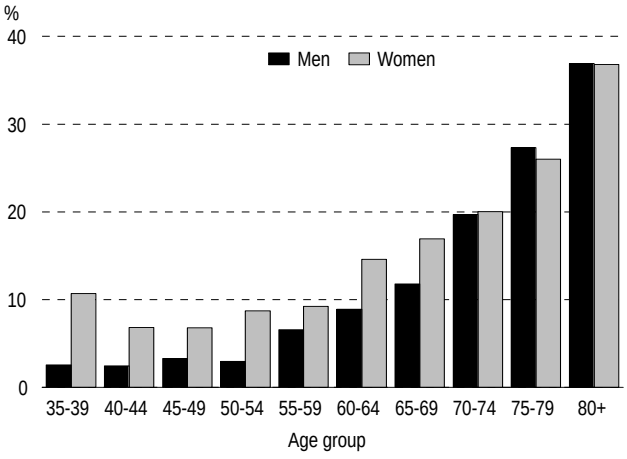
Data source: *Person-Oriented Information Data Base*

Table 3
Odds ratios relating revascularization procedures to age, sex and province, heart attack patients hospitalized between April 1 and September 30, 1993, Canada, nine provinces

	Percutaneous transluminal coronary angioplasty (PTCA)		Coronary artery bypass graft (CABG)		At least one revascularization procedure	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex						
Men	1.0	0.9, 1.1	1.5*	1.3, 1.7	1.2*	1.1, 1.3
Women†	1.0	...	1.0	...	1.0	...
5-year age groups‡	0.8*	0.8, 0.8	0.9*	0.9, 0.9	0.8*	0.8, 0.8
Provinces§						
Newfoundland	0.5*	0.3, 0.8	0.8	0.6, 1.2	0.7*	0.5, 0.9
Nova Scotia	1.1	0.8, 1.5	1.1	0.8, 1.5	1.1	0.9, 1.4
New Brunswick	1.5*	1.1, 2.0	0.9	0.6, 1.2	1.2*	1.0, 1.5
Quebec	1.9*	1.7, 2.1	1.0	0.8, 1.1	1.4*	1.3, 1.6
Ontario†	1.0	...	1.0	...	1.0	...
Manitoba	1.2	0.9, 1.6	0.9	0.6, 1.2	1.1	0.9, 1.3
Saskatchewan	2.1*	1.6, 2.7	0.9	0.6, 1.2	1.5*	1.2, 1.9
Alberta	3.6*	3.0, 4.2	1.3*	1.1, 1.6	2.7*	2.4, 3.1
British Columbia	2.2*	1.8, 2.6	1.3*	1.1, 1.5	1.8*	1.6, 2.1

Data source: *Person-Oriented Information Data Base*
Note: *The analyses were based on 23,766 cases.*
† Reference category, for which odds ratio is always 1.0
‡ Coded from low to high
§ Excludes Prince Edward Island
··· Not applicable
** p < 0.05*

Chart 2
Percentage of heart attack patients hospitalized between April 1 and September 30, 1993 who died in hospital† within six months, by age and sex, Canada excluding territories



Data source: *Person-Oriented Information Data Base*
† Out-of-hospital deaths not included

Overall, 18% of heart attack patients died in hospital within six months of having suffered the attack: 15% of the men and 23% of the women. (Of those who underwent revascularization, 3.7% died in hospital: 3.4% of the men and 4.5% of the women.) These high death rates largely reflect the situation at older ages. A third of heart attack patients aged 75 and older died in hospital within the first six months, most of them within the first two weeks.

Female heart attack patients had higher in-hospital death rates than did male patients before age 70; at older ages, rates were almost the same for men and women (Chart 2). The few (56) women aged 35 to 39 who had a heart attack had a relatively high death rate, higher than that of women twenty years older.

Rates higher in west

In 1993/94, revascularization rates varied substantially by province, with rates generally higher in the west (Table 2). The percentage of heart attack patients undergoing revascularization ranged from 9.1% in Newfoundland to 25.9% in Alberta. Alberta had the highest rates for both procedures: 17.7% of patients had an angioplasty and 8.5% had a bypass within six months of their heart attack. Newfoundland had the lowest angioplasty rate (3.8%); Manitoba, the lowest bypass rate (5.2%). Except for Newfoundland, rates for both procedures in each province were higher for men than women.

When age and sex were taken into account, the odds of undergoing angioplasty were significantly high for heart attack patients in New Brunswick, Quebec, Saskatchewan, Alberta, and British Columbia, compared with the odds for patients in Ontario; the odds were significantly low for Newfoundland patients (Table 3). The odds of bypass surgery were significantly high only for patients in Alberta and British Columbia.

The data on which this analysis is based do not suggest an explanation for the provincial differences in revascularization rates. Data are reported for both angioplasties and bypasses, so the differences are not attributable to provincial preferences for one procedure over the other. Earlier studies have shown

no evidence of inappropriate use of procedures.[35,36] Economic considerations are important, but would be a factor in all provinces. The availability of facilities may play a role, particularly in Atlantic Canada, where patients may go out of province for a procedure, and are therefore not captured on this database. Geographic variations in disease rates were reduced by tracking an inception cohort of heart attack patients. Because all the patients had an acute coronary event, geographic differences in disease severity were minimized, but by no means completely eliminated.[7] A recent study has suggested that the average severity of heart attacks varies considerably across provinces.[26]

Time-to-procedure

In order to start from a new episode of heart disease and not artificially shorten waiting periods, median time-to-procedure was calculated for patients who had not been admitted to hospital for heart attack in the previous year (a 12-month "wash-out" period). These calculations could be made for seven provinces and exclude Quebec, Nova Scotia and Prince Edward Island.

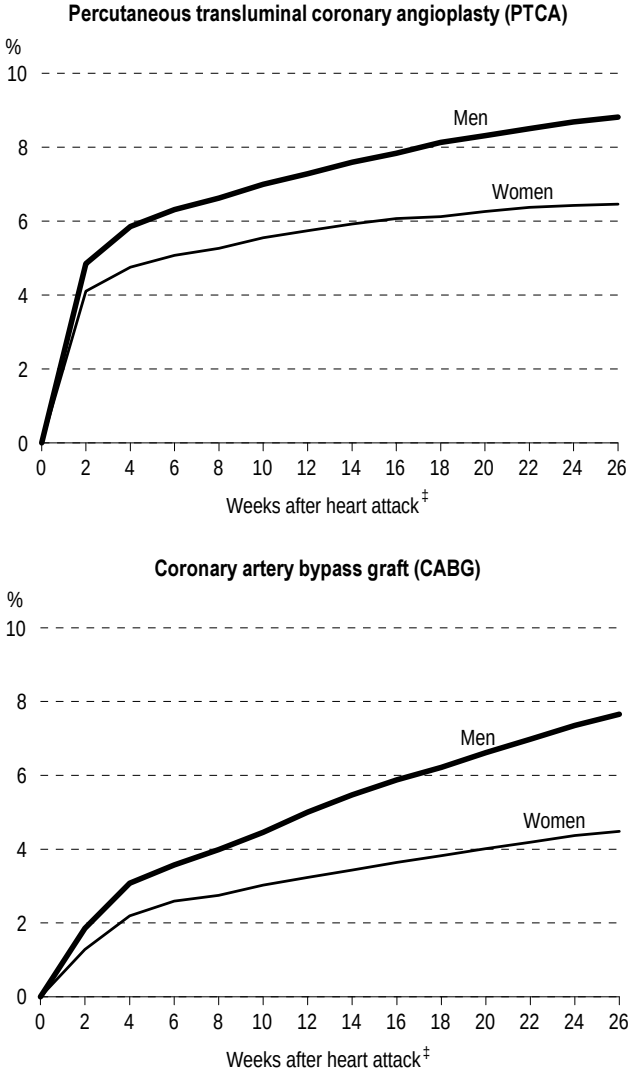
The median time-to-procedure for an angioplasty was 11 days, and for a bypass, 44.5 days (Table 4). Time-to-procedure did not vary substantially by the age of the patient, although younger men tended to wait longer for a bypass than did older men. Women did not wait as long as men for a bypass (30 versus 49 days). Since waiting lists are structured to give priority to patients with the greatest need, this is consistent with women typically having more severe heart disease.[37]

Time-to-procedure for an angioplasty differed substantially by province. For men, the median time ranged from 7 days in Manitoba and Alberta to 24 days in Newfoundland. For women, the range was from 7 days in Alberta to 18 days in Newfoundland. These provincial differences were statistically significant.

Time-to-procedure for a bypass also varied from one province to another, although these differences were not statistically significant. For men, the shortest median times were in Newfoundland and Manitoba (fewer than 28 days), while the longest was in Ontario (57 days). Women's medians ranged from 11 days in New Brunswick to 37 days in British Columbia.

As the relative times-to-procedure indicate, angioplasties tend to be performed much sooner after a heart attack than bypasses. For both men and women, the cumulative rates of angioplasty rose sharply and then levelled off. But even after six

Chart 3
Cumulative rate of revascularization among heart attack patients hospitalized between April 1 and September 30, 1993, based on a 12-month wash-out period, by sex, Canada, seven provinces†



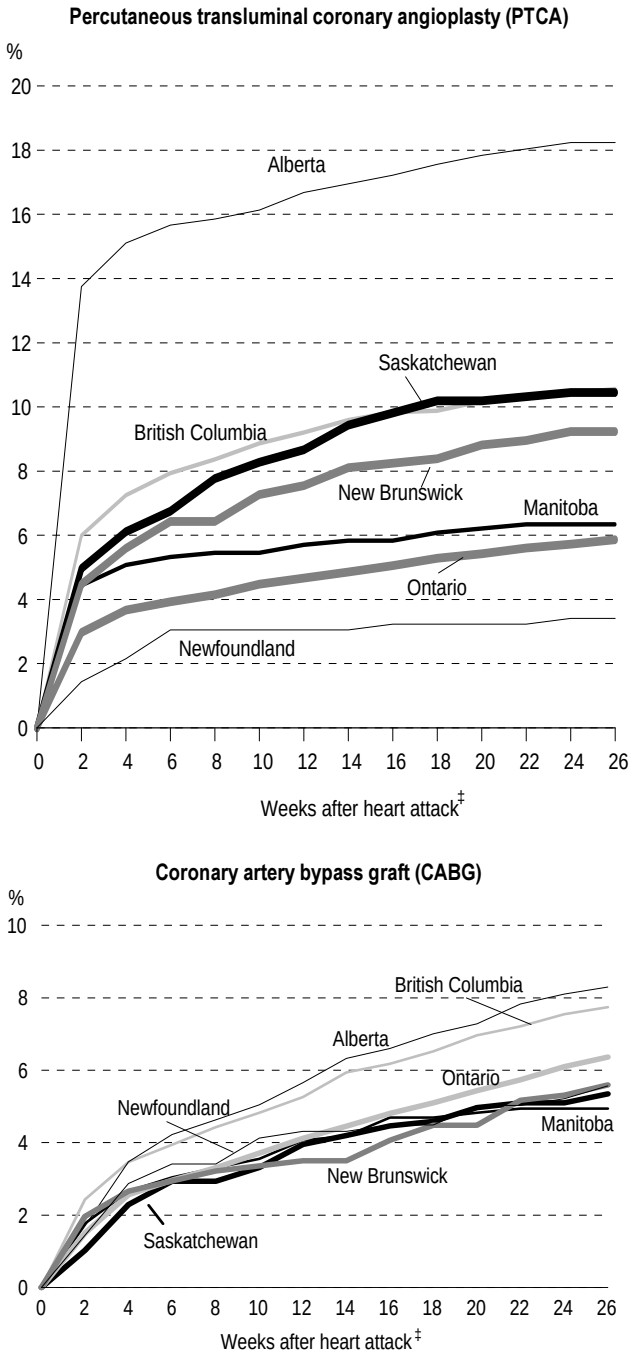
Data source: *Person-Oriented Information Data Base*
† Excludes Prince Edward Island, Nova Scotia and Quebec.
‡ First primary diagnosis of acute myocardial infarction

Table 4
Median time-to-procedure for heart attack patients hospitalized between April 1 and September 30, 1993 who had revascularization within 6 months, by age, sex and province, based on a 12-month wash-out period, Canada, seven provinces

	Percutaneous transluminal coronary angioplasty (PTCA)			Coronary artery bypass graft (CABG)			At least one revascularization procedure		
	Number of patients	Median	Inter-quartile range	Number of patients	Median	Inter-quartile range	Number of patients†	Median	Inter-quartile range
		Days			Days			Days	
Seven provinces‡	1,228	11.0	5.5-48.0	1,004	44.5	14.0-105.5	2,170	19.0	7.0-79.0
Sex									
Men	865	12.0	5.5-57.0	753	49.0	15.0-109.0	1,572	22.0	8.0-84.0
Women	363	9.5	5.5-33.0	251	30.0	12.5-94.0	598	15.0	7.0-62.0
Significance level§			*0.0683*			*0.0070*			*0.0002*
Sex and age									
Men									
20-34	13	7.0	3.5-21.0	2	139.0	98.0-180.0	15	12.0	3.5-98.0
35-49	194	15.0	5.0-70.0	110	65.0	19.0-133.0	297	30.0	7.0-91.0
50-64	398	11.5	5.5-60.0	339	58.0	16.0-114.0	712	23.0	7.5-87.0
65-79	244	10.0	6.0-35.0	294	37.5	14.0-93.0	526	20.0	8.0-74.0
80+	16	13.5	4.0-20.5	8	31.8	15.0-70.0	22	15.3	5.5-31.0
Significance level††			*0.2769*			*0.071*			*0.3505*
Women									
20-34	2	24.0	3.0-45.0	3	89.0	6.0-164.0	5	45.0	6.0-89.0
35-49	45	10.5	5.0-29.0	22	29.0	10.5-68.0	63	14.0	6.0-44.0
50-64	123	9.5	5.0-24.0	74	31.5	14.0-107.0	193	14.0	6.0-59.0
65-79	174	9.0	5.5-33.0	146	29.0	12.0-94.0	312	16.0	7.5-69.0
80+	18	12.0	6.5-26.0	6	22.0	12.5-31.0	24	13.3	9.0-30.5
Significance level††			*0.7315*			*0.732*			*0.5289*
Sex and province									
Men									
Newfoundland	11	24.0	7.0-34.0	19	23.0	12.0-133.0	30	23.5	9.5-72.0
New Brunswick	51	20.0	6.0-75.0	30	54.5	11.0-141.0	78	24.5	8.0-93.0
Ontario	364	16.0	6.0-77.0	435	57.0	17.0-114.0	765	30.0	9.5-98.0
Manitoba	38	6.75	5.0-18.0	26	27.5	9.0-78.0	64	10.5	5.75-39.5
Saskatchewan	58	18.3	5.5-67.0	33	41.0	18.0-86.0	90	25.8	7.0-75.0
Alberta	180	7.0	5.0-19.5	98	50.0	17.0-97.0	277	13.0	6.0-61.0
British Columbia	163	11.0	5.5-41.0	112	40.5	12.0-95.5	268	16.5	7.0-72.5
Significance level††			*0.0001*			*0.256*			*0.0001*
Women									
Newfoundland	8	18.0	5.5-25.5	12	29.0	13.5-59.5	20	24.0	8.5-40.5
New Brunswick	15	9.0	5.5-60.0	11	11.0	6.0-109.0	26	9.5	6.0-60.0
Ontario	160	11.0	6.3-45.0	134	30.0	14.0-104.0	284	19.0	8.5-74.5
Manitoba	12	8.5	7.0-84.5	13	18.0	7.0-77.0	25	12.0	7.0-79.0
Saskatchewan	24	11.0	5.0-43.0	9	28.0	15.5-71.0	33	17.0	8.0-55.0
Alberta	89	7.0	5.0-13.0	25	22.0	13.5-71.0	113	9.0	5.5-16.0
British Columbia	55	11.0	5.0-51.0	47	37.0	12.0-94.0	97	18.0	7.5-68.0
Significance level††			*0.0131*			*0.572*			*0.0001*

Data source: *Person-Oriented Information Data Base*
Note: *Age comparisons were done starting from age 35.*
† May be less than the sum of those with PTCA and CABG, as some patients had both.
‡ Excludes Prince Edward Island, Nova Scotia and Quebec.
§ Wilcoxon test
†† Kruskal-Wallis test

Chart 4
Cumulative rate of revascularization among heart attack patients hospitalized between April 1 and September 30, 1993, based on a 12-month wash-out period, Canada, seven provinces†



Data source: *Person-Oriented Information Data Base*
† Excludes Prince Edward Island, Nova Scotia and Quebec.
‡ First primary diagnosis of acute myocardial infarction

months, bypass rates had not levelled off and could well continue to climb (Chart 3). As a result, the ultimate median time-to-bypass will be much longer than the medians calculated here, which cover only a six-month period. Cumulative rates also show strong provincial variations, particularly for angioplasties (Chart 4). Angioplasty rates in Alberta heart attack patients rose sharply and remained much higher than in the other provinces throughout the six months. Alberta's cumulative rate for bypasses also exceeded that of the other provinces, but the difference was less pronounced.

Concluding remarks

There is no consensus on the optimal rate of revascularization after a heart attack. Studies conducted in North America and Europe have reported revascularization rates ranging from 3%[38] to 15%.[39] As well, much less revascularization is performed in Canada than in the United States,[8,9] particularly among the elderly.[10,36]

The greater use of revascularization in the United States has not been shown to improve mortality rates.[8,9] However, better survival rates have been found for prompt revascularization, compared with drug therapy.[40,41] As well, a significant excess of angina pectoris with resultant diminishing of quality of life has been reported for the lower Canadian surgery levels, compared with those in the United States.[8,9] Yet while overall revascularization rates may be lower in Canada, Canada's universal health insurance system reduces the influence of income on access to bypass surgery that prevails in the United States.[42]

International differences in waiting times for cardiac procedures are also considerable. Patients treated in Canada wait significantly longer than do those in the United States.[36,43]

To treat patients with more severe disease first, scales have been developed to rank them on waiting lists.[44-46] Of course, priority scores are less than perfect assessments of the time that can safely elapse before readmission to hospital.[15] A patient on a waiting list can experience an adverse event much earlier than might have been predicted.[47] Although long waiting times do not seem to affect the success

rate of revascularizations (except in patients with total coronary occlusions[48,49]), quality of life can be compromised, as patients may be anxious and fearful.[7,14,50,51] For instance, among patients on the waiting list for bypasses in Ontario from October 1991 to July 1993, symptoms provoked by very modest exertion were common.[11] Another report found that 30% of patients on waiting lists needed heart-related sick leave, 32% had lost income, and 20% claimed financial hardship.[14]

Prolonged disability before revascularization also appears to reduce the chances of return to work after surgery.[52] It has been suggested that the cumulative wait for coronary angiography and angioplasty or open-heart surgery may lead to major losses of productivity, delayed rehabilitation, and a reduced probability of return to previous levels of productivity.[53]

The data from the Person-Oriented Information Data Base show substantial variations in the rate of and the time to revascularization of heart attack patients by age, sex and province. This analysis is not intended to indicate whether revascularization rates are too low or too high, or whether time-to-procedure is too long or too short. Appropriate revascularization rates and waiting periods depend on the characteristics of each patient. Such information, notably on clinical severity, is not available from the Person-Oriented Information Data Base. However, the variations in the rate of and the time to revascularization of Canadian heart attack patients that were found in this first national study indicate that differences in patterns of practice and available resources may exist. ●

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Appendix

Table A

Number of heart attack patients hospitalized between April 1 and September 30, 1993, by age, sex and wash-out period, Canada excluding territories

	No wash-out period			Wash-out period†		
Age	**Total**	**Men**	**Women**	**Total**	**Men**	**Women**
Total	**23,876**	**15,218**	**8,658**	**15,384**	**9,779**	**5,605**
20-24	7	5	2	7	5	2
25-29	27	19	8	16	11	5
30-34	127	100	27	75	53	22
35-39	366	310	56	228	193	35
40-44	784	652	132	471	386	85
45-49	1,362	1,126	236	797	649	148
50-54	1,708	1,376	332	1,015	793	222
55-59	2,051	1,597	454	1,306	1,035	271
60-64	2,797	2,008	789	1,651	1,131	520
65-69	3,296	2,181	1,115	2,144	1,420	724
70-74	3,585	2,123	1,462	2,368	1,398	970
75-79	3,333	1,757	1,576	2,156	1,171	985
80-84	2,585	1,235	1,350	1,740	848	892
85-89	1,346	552	794	899	382	517
90-94	407	143	264	269	104	165
95+	90	31	59	58	18	40

Data source: *Person-Oriented Information Data Base*
Note: *Detail does not add to totals because of exclusion of a small number of patients younger than age 20.*
† Excludes Nova Scotia and Quebec.

Table B

Number of heart attack patients hospitalized between April 1 and September 30, 1993, based on a 12-month wash-out period, by sex, Canada, eight provinces

	Total	Men	Women
Eight provinces†	15,384	9,779	5,605
Newfoundland	557	337	220
Prince Edward Island	101	65	36
New Brunswick	715	457	258
Ontario	8,914	5,615	3,299
Manitoba	789	492	297
Saskatchewan	785	514	271
Alberta	1,469	966	503
British Columbia	2,054	1,333	721

Data source: *Person-Oriented Information Data Base*
† Excludes Nova Scotia and Quebec.

Table C

Characteristics of heart attack patients hospitalized between April 1 and September 30, 1993, by province and wash-out period, Canada excluding territories

	No wash-out period					12-month wash-out period†				
				6-month death rate					6-month death rate	
	Female	Aged 75-84	Aged 85+	Men	Women	Female	Aged 75-84	Aged 85+	Men	Women
	%									
Total	**36.3**	**24.8**	**7.7**	**14.9**	**23.3**	**36.4**	**25.3**	**8.0**	**16.1**	**23.7**
Newfoundland	39.5	26.0	7.1	15.1	17.9	39.5	24.4	7.2	14.5	17.7
Prince Edward Island	35.5	21.8	10.0	12.7	15.4	35.6	22.8	8.9	10.8	13.9
Nova Scotia	36.2	23.4	5.8	1.3	3.5	...	...	...	...	...
New Brunswick	36.0	22.6	8.5	13.7	25.1	36.1	21.3	8.3	12.9	24.4
Quebec	35.0	22.2	6.6	13.4	25.1	...	...	...	...	...
Ontario	37.4	25.5	7.5	15.4	22.9	37.0	25.1	7.4	15.5	23.5
Manitoba	38.3	26.9	11.9	16.1	23.3	37.6	26.4	10.8	16.3	23.9
Saskatchewan	35.2	29.9	11.1	16.9	27.1	34.5	28.8	9.7	17.3	25.8
Alberta	34.6	24.5	7.6	15.4	22.3	34.2	23.8	7.5	15.7	22.5
British Columbia	35.4	27.6	9.3	20.1	27.0	35.1	27.4	9.3	20.3	26.6

Data source: *Person-Oriented Information Data Base*
† Excludes Nova Scotia and Quebec.
··· Not applicable

Table D

Percentage of heart attack patients hospitalized between April 1 and September 30, 1993 who had revascularization procedure within six months, based on a 12-month wash-out period, by sex, Canada, seven provinces

	Percutaneous transluminal coronary angioplasty (PTCA)			Coronary artery bypass graft (CABG)			At least one revascularization procedure†		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
		%			%			%	
Seven provinces‡	**8.0**	**8.8**	**6.5**	**6.5**	**7.7**	**4.5**	**14.1**	**16.1**	**10.7**
Newfoundland	3.4	3.3	3.6	5.6	5.6	5.5	9.0	8.9	9.1
New Brunswick	9.2	11.2	5.8	5.7	6.6	4.3	14.5	17.1	10.1
Ontario	5.9	6.5	4.8	6.4	7.7	4.1	11.8	13.6	8.6
Manitoba	6.3	7.7	4.0	4.9	5.3	4.4	11.3	13.0	8.4
Saskatchewan	10.4	11.3	8.9	5.4	6.4	3.3	15.7	17.5	12.2
Alberta	18.3	18.6	17.7	8.4	10.1	5.0	26.5	28.7	22.5
British Columbia	10.6	12.2	7.6	7.7	8.4	6.5	17.8	20.1	13.5

Data source: *Person-Oriented Information Data Base*
† May be less than the sum of those with PTCA and CABG, as some patients had both.
‡ Excludes Prince Edward Island, Nova Scotia and Quebec.

Table E
Odds ratios relating revascularization procedures to age, sex and province, heart attack patients hospitalized between April 1 and September 30, 1993, based on a 12-month wash-out period, Canada, seven provinces†

	Percutaneous transluminal coronary angioplasty (PTCA)		Coronary artery bypass graft (CABG)		At least one revascularization procedure	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex						
Men	1.0	0.9, 1.1	1.4*	1.2, 1.7	1.2*	1.1, 1.3
Women‡	1.0	...	1.0	...	1.0	...
5-year age groups§	0.8*	0.8, 0.8	0.9*	0.8, 0.9	0.8*	0.8, 0.8
Seven provinces						
Newfoundland	0.5*	0.3, 0.9	0.9	0.6, 1.3	0.7*	0.5, 1.0
New Brunswick	1.5*	1.2, 2.0	0.8	0.6, 1.2	1.2	1.0, 1.5
Ontario‡	1.0	...	1.0	...	1.0	...
Manitoba	1.2	0.9, 1.6	0.8	0.6, 1.1	1.0	0.8, 1.3
Saskatchewan	2.1*	1.7, 2.7	0.9	0.6, 1.2	1.6*	1.3, 1.9
Alberta	3.7*	3.1, 4.3	1.3*	1.1, 1.6	2.8*	2.4, 3.2
British Columbia	2.1*	1.8, 2.5	1.3*	1.1, 1.6	1.8*	1.6, 2.0

Data source: *Person-Oriented Information Data Base*
Note: *The analyses were based on 15,283 cases.*
† Excludes Prince Edward Island, Nova Scotia and Quebec.
‡ Reference category, for which odds ratio is always 1.0
§ Coded from low to high
··· Not applicable
** $p < 0.05$*

Erratum

Health Reports, Autumn 1998, Volume 10, Number 2 (French version)

Niveau de scolarité de la mère et mortalité fœtale et infantile au Québec
Jiajian Chen, Martha Fair, Russell Wilkins, Margaret Cyr and the Fetal and Infant Mortality Study Group of the Canadian Perinatal Surveillance System

Tableau 3, page 62

The title of the table should be "Rapports ajustés de cotes pour la mortalité fœtale et infantile, selon le niveau de scolarité de la mère, naissances simples, Québec, 1990-1991"

A reprint of the article containing the correction may be obtained by calling (613) 951-5059.

Data Releases

Synopses of recent health information produced by Statistics Canada

Late fetal and perinatal mortality, 1996

In 1996, 2,121 stillbirths of 20 weeks or more gestation were reported for residents of Canada (5.8 per 1,000 total births), compared with 2,353 in 1995 (6.2 per 1,000) and 2,321 in 1986 (6.2 per 1,000). For stillbirths of 28 weeks or more gestation (late fetal deaths), the rates per 1,000 total births were 3.4 in 1996, compared with 3.5 in 1995 and 4.2 in 1986.

The perinatal mortality rate, expressed as the sum of late fetal deaths plus early neonatal deaths (under 1 week) per 1,000 total births was 6.7 in 1996, compared with 6.9 in 1995 and 8.4 in 1986. These figures show a continuation of the long-term trend of declining late fetal and perinatal mortality rates in Canada.

These data were released on October 5, 1998 in the Statistics Canada publication, *The Daily*. For futher information, or to enquire about the concepts, methods and data quality of this release, contact Russell Wilkins, Vital Statistics Data Unit (613-951-5305; fax: 613-951-0792), Health Statistics Division.

Health statistics: Catalogue of products and services

Health statistics: Catalogue of products and services is a comprehensive guide to health information available from Statistics Canada. The products, services and surveys listed in this publication cover broad subject areas such as vital statistics, health status, health determinants and health care.

Health statistics: Catalogue of products and services (82F0058XIE, free) is now available (www.statca.ca). The menu path is "Products and Services" and "Downloadable Publications (free)."

For further information, contact Paula Woollam (613-951-0879; woolpau@statcan.ca), Health Statistics Division.

Postcensal Population Estimates

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

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

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

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

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To order the products listed below, contact:

Client Custom Services Unit
Health Statistics Division
Statistics Canada
Ottawa, Ontario
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National Population Health Survey public-use microdata files		Product number	Format	Price† Canada	Price† Other countries ($ US)
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Health care institutions	Flat ASCII Files	82F0010XDB	Diskette	$250	$250
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	Institutions	82C0015			
Cycle 2, 1996/97					
Household and health care institutions	Cross-sectional Household Beyond 20/20 for Health File and Flat ASCII Files	82M0009XCB First version	CD-ROM	$2,000	$2,000
	First version + Dummy Master Files Bootstrap variance estimation Files and program	Second version			
	Second version + Cross-sectional Institutions Flat ASCII File	Third version			
	Longitudinal Household and Institutions Flat ASCII File (Conditional)				
Household	Documentation only	82M0009XPB	Paper	$50	$50
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