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Health Reports

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–   nil or zero

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Research Articles

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

Food insecurity in Canadian households

Janet Che and Jiajian Chen

Abstract

Objectives
This article examines the prevalence of food insecurity in Canada, the characteristics of people most likely to live in households lacking sufficient funds for food, and several related health problems.

Data source
The data are from the cross-sectional household component of the 1998/99 National Population Health Survey and the Food Insecurity Supplement to that survey.

Analytical techniques
Cross-tabulations were used to estimate the percentage of Canadians experiencing food insecurity and the prevalence of five selected health outcomes among people who were and were not food insecure. Multivariate logistic regression was used to assess the association of several socio-demographic and economic factors with food insecurity and to determine the association of food insecurity with the selected health outcomes.

Main results
In 1998/99, 10% of Canadians, or about 3 million people, were living in food-insecure households. Low-income households, households depending on social assistance, lone-parent families headed by women, tenants, children, and Aboriginal people had significantly high odds of experiencing food insecurity. Food insecurity was significantly associated with poor/fair health, multiple chronic conditions, obesity, distress and depression.

Key words
nutrition, food deprivation, diet

Authors
Janet Che (613-951-2544; cheajan@statcan.ca) and Jiajian Chen (613-951-5059; chenjia@statcan.ca) are with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

In North America, hunger rarely reaches the drastic levels of deprivation that exist in poorer parts of the world. Consequently, to suit the North American context, researchers look beyond hunger to a broader concept, food insecurity.[1] Food insecurity tends to be a continuum, progressing from uncertainty and anxiety about the household's food supplies, to depletion of those supplies, altering the eating patterns of adults, and ultimately, when food supplies and resources are exhausted, hunger among children (see *Food insecurity*).[2-4]

A number of studies have examined the impact of food insecurity on nutrient intake and health.[5-11] Compromised nutrition can affect an individual's physical and mental health and quality of life. At the community level, the consequences of poor nutrition are felt by the health care system. Poorly nourished people are usually less resistant to infections, and they tend to heal more slowly, have more diseases and longer hospital stays, and incur higher health care costs.[12,13]

Lack of food is not a problem generally associated with Canada. Canadians enjoy a high standard of living,[14] and the prospect of hunger should be remote. Nonetheless, the number of food banks across the country continues to

increase,[15] and their substantial presence suggests that food insecurity not only exists, but persists.[16-18]

Until recently, estimating the prevalence of food insecurity in Canada has been constrained by a lack of data at the national level. Several studies have been conducted, but they were based on relatively small samples,[10,20-22] such as food bank users, and therefore cannot be used to describe food insecurity across the country.

In 1998/99, on behalf of Human Resources Development Canada, Statistics Canada asked questions about food insecurity on the National

Methods

Data source

This analysis is based on cross-sectional data from Statistics Canada's National Population Health Survey (NPHS), weighted to represent the household population in the 10 provinces. The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both a longitudinal and a cross-sectional component. The analyses in this article are based on the 1998/99 (cycle 3) cross-sectional household component, which is made up mostly of longitudinal respondents and their cohabitants.

Socio-demographic and some health information was obtained for each member of participating households and is found in the General file. In-depth health information, which was collected for one randomly selected household member, as well as the information in the General file pertaining to that person, is in the Health file.

In 1998/99, individuals who were part of the longitudinal sample usually provided information on all household members for the General file, as well as in-depth health information about themselves. The overall response rate for cycle 3 was 88.2% at the household level.

For cycle 3, Statistics Canada added three questions about food insecurity to the NPHS questionnaire on behalf of Human Resources Development Canada[19] to select respondents to participate in the Food Insecurity Supplement.

The analysis of the socio-demographic and economic characteristics associated with food insecurity in this article was based on the General file. Estimates from this file have the advantage of a large sample size, as they pertain to all members of selected households. The sample used for this analysis comprises the 48,952 respondents for whom food insecurity information was available (Appendix Table A).

With data from the Health file, residents of food-insecure households were compared with those in food-secure households with respect to five health outcomes. The sample for this analysis consists of the 17,226 respondents who answered the questions on food insecurity (Appendix Table B).

This article also includes data from the Food Insecurity Supplement. Respondents identified as living in food-insecure households were asked additional questions on topics such as food bank use and problems feeding children. The sample from the Supplement file used for this analysis comprises 1,265 respondents (Appendix Table C).

The estimates of individuals living in food-insecure households were similar for the three files: 10.4% from the General file, 10.2% from the Health file, and 10.1% from the Supplement file.

More detailed descriptions of the NPHS design, sample and interview procedures can be found in other reports.[23-25]

Analytical techniques

Cross-tabulations were used to estimate the percentage of people living in food-insecure households and the prevalence of five health outcomes among people who were and were not food insecure: self-reported poor or fair health, multiple chronic conditions, obesity, high distress, and depression. Multiple logistic regression was used to assess relationships between selected factors and food insecurity. Based on a review of the literature and availability from the NPHS, several variables were included in the regression model: age, sex, household income, major source of income, household type, home ownership, marital status, immigrant status, and Aboriginal status. The regression models for associations between the five health outcomes and "any" food insecurity controlled for age, sex and household income. The standard errors for the prevalence and odds ratios of food insecurity and health outcomes were calculated using the bootstrap technique, which fully accounts for the design effects of the NPHS.[26-28]

Population Health Survey (NPHS) in order to select respondents to participate in a Food Insecurity Supplement. The result was data from a nationally representative sample (see *Methods* and *Definitions*). This article uses those data to examine the extent and possible determinants of food insecurity, several related health outcomes, and the use of food banks, soup kitchens or other charitable agencies by people who were food insecure.

One in ten affected

Food insecurity tends to follow a predictable sequence, from worrying about not having enough money to buy food, to compromising the quality, and then the quantity, of food.[29]

According to the 1998/99 NPHS, over 10% of Canadians, or an estimated 3 million people, were living in food-insecure households (Table 1). That is, because of a lack of money, at least once in the previous 12 months they worried that there would not be enough to eat, and/or they did not eat the variety or quality of food that they wanted, and/or they did not have enough to eat.

When those who worried about having enough money to buy food but who had not experienced compromised quality and/or quantity of food were excluded, the prevalence of food insecurity dropped to 8%.

Associated with household income

Since food insecurity is defined as stemming from a lack of money, it was strongly associated with household income. Close to 35% of people in low-income households reported some form of food insecurity in 1998/99 (30% had compromised their food intake) (Chart 1; Table 1). However, consistent with findings from the United States,[36,37] food insecurity was not limited to low-income households. About 14% of people in middle-income households

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Food insecurity

Substantial effort has been devoted to defining and measuring food insecurity.[2,30-33] A widely accepted definition is that of the Life Sciences Research Office of the Federation of American Societies for Experimental Biology.[34] It states that *food insecurity* exists "whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain." *Food security* is "assured access at all times to enough food for an active, healthy life."

Respondents to the National Population Health Survey were considered to be living in a food-insecure household if they answered "yes" to at least one of the following questions:

In the past 12 months, did you or anyone in your household:

(1) worry that there would not be enough to eat because of a lack of money?

(2) not eat the quality or variety of foods that you wanted because of a lack of money?

(3) not have enough food to eat because of a lack of money?

Response patterns to food insecurity questions generally follow this progression. That is, people who reply affirmatively to a question at a given level of food insecurity also reply affirmatively to the questions at less severe levels.[35]

For this analysis, respondents who reported only that they had worried about not having enough to eat because of a lack of money (question 1) were considered to be "worried." Those who answered "yes" to questions (2) or (3) were defined as having a "compromised diet," whether the reduction was in quality or quantity of food.

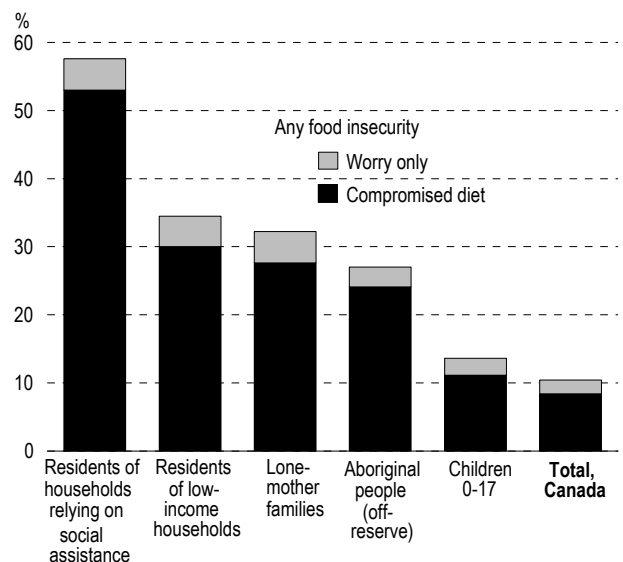Chart 1

Prevalence of food insecurity, by level and selected characteristics, household population, Canada excluding territories, 1998/99

Data source: *1998/99 National Population Health Survey, cross-sectional sample, General file*

Definitions

Information on age at the time of the 1998/99 National Population Health Survey (NPHS) interview was collected for each member of participating households. For this analysis, four *age groups* were established: 0 to 17, 18 to 44, 45 to 64, and 65 or older.

Household income groups were based on household size and total household income from all sources in the 12 months before the interview. The following income groups were derived:

Household income group	People in household	Total household income
Low	1 or 2	Less than $14,999
	3 or 4	Less than $19,999
	5 or more	Less than $29,999
Middle	1 or 2	$15,000 to $29,999
	3 or 4	$20,000 to $39,999
	5 or more	$30,000 to $59,999
Upper-middle/High	1 or 2	$30,000 or more
	3 or 4	$40,000 or more
	5 or more	$60,000 or more

Major source of income was grouped into five categories: wages, salaries, self-employment; Employment Insurance (EI), Workers' Compensation, Child Tax Benefit, support, alimony, none; social assistance, welfare; Canada or Québec Pension Plan (CPP or QPP), Old Age Security (OAS), Guaranteed Income Supplement (GIS); and other (for example, dividends and interest, rental income, scholarships).

Based on the relationship of each respondent to other household members, six *household types* were defined: couple with child(ren) younger than 25; couple without child(ren) younger than 25; lone mother with child(ren) younger than 25; lone father with child(ren) younger than 25; unattached individual; and others.

Home ownership refers to whether the respondent resided in an owned or rented dwelling.

Respondents were asked their *marital status*. Five groups were established: married; common-law (including living with partner); single (never-married); widowed; and divorced or separated.

Immigrant status was defined by place of birth. For this analysis, immigrants who had been in Canada for less than 10 years were considered to be recent immigrants.

Aboriginal status was based on responses to NPHS questions on race (or colour) and the ethnic (or cultural) groups with which respondents identified. Those who indicated Native or Aboriginal peoples of North America, such as North American Indian, Métis, Inuit or Eskimo, were considered to be Aboriginal persons. The NPHS includes only Aboriginal people living off reserves.

Respondents rated their health as excellent, very good, good, fair or poor. For this analysis, two categories were established: poor/fair and good/very good/excellent.

Respondents were asked if they had chronic conditions that had lasted or were expected to last six months or more and that had been diagnosed by a health professional. The conditions listed were: food allergies, other allergies, asthma, arthritis or rheumatism, back problems, high blood pressure, migraine headaches, chronic bronchitis or emphysema, sinusitis, diabetes, epilepsy, heart disease, cancer, stomach or intestinal ulcers, effects of stroke, urinary incontinence, bowel disorders, Alzheimer's disease or other dementia, cataracts, glaucoma, thyroid condition, and any other long-term condition. In this article, respondents were considered to have *multiple chronic conditions* if they reported having at least three.

Body mass index (BMI), which was calculated by dividing weight in kilograms by the square of height in metres, was grouped into two categories: *obese* (BMI of 30 or more) and not obese. Values were calculated for all age groups except pregnant women.

The distress index was based on six questions. Respondents were asked: "During the past month, 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 response options—all of the time, most of the time, some of the time, a little of the time, and none of the time—were given weights of 5, 4, 3, 2, and 1, respectively. The index was the sum of the assigned weights from the six questions. Respondents scoring 7 or more were classified as having *distress*; this amounted to about 12% of the respondents who answered the food insecurity questions.

Using the methodology of Kessler et al.,[38] the NPHS identifies a major depressive episode (MDE) with a subset of questions from the Composite International Diagnostic Interview. These questions cover a cluster of symptoms for depressive disorder that are listed in the *Diagnostic and Statistical Manual of Mental Disorders (DSM III-R).*[39] Responses to these questions were scored on a scale and transformed into a probability estimate of a diagnosis of MDE. If the estimate was 0.9 (90% certainty of a positive diagnosis), the respondent was considered to have experienced *depression* in the previous 12 months.

The Food Insecurity Supplement to the 1998/99 NPHS asked respondents identified as food insecure: "In the past 12 months, how often did you or anyone else in your household receive food from a food bank, soup kitchen or other charitable agency because there was not enough money for food?" The response options were: often, sometimes and never. Those who had used *food assistance* were asked if this happened mostly at the end of the month.

The Supplement also contained questions about children younger than 16 who were living in food-insecure households. Responsible adults were asked if, because of a lack of money, in the past year: he/she worried that he/she could not afford to feed the child(ren); if he/she was unable to give the child(ren) balanced meals; if she/he had to reduce the size of the child(ren)'s meals; if the child(ren) missed any meals; or if the child(ren) had ever been hungry. In this analysis, a three-level hierarchy was used to determine the *food security status of children*: food-secure; worry only; and compromised diet.

Table 1
Prevalence of food insecurity, by level and selected characteristics, household population, Canada excluding territories, 1998/99

	Estimated population	Level of food insecurity	
		Any	Compro- mised diet
	'000	%	
Total	**29,439**	**10.4**	**8.4**
Sex			
Males	14,587	9.9*	8.0*
Females†	14,852	10.8	8.8
Age group			
0-17	7,091	13.6*	11.1*
18-44	12,200	11.9*	9.7*
45-64	6,666	7.5*	6.0*
65+†	3,481	3.9	3.2
Household income			
Low	3,886	34.5*	30.1*
Middle	7,361	14.3*	11.5*
Upper-middle/High†	16,202	3.3	2.3
Missing	1,990	5.7*	4.6*
Major source of income			
Wages, salaries, self-employment†	22,628	8.1	6.2
EI, Worker's Compensation, Child Tax Benefit, support, alimony, none	497	27.7*	23.3*
Social assistance, welfare	1,270	57.6*	53.0*
CPP, QPP, OAS, GIS	4,008	5.8*	4.8*
Other	1,034	10.3	8.7
Household type			
Couple with child(ren) < 25†	15,564	8.5	6.6
Couple without child(ren) < 25	6,602	5.5*	4.3*
Lone mother with child(ren)< 25	2,185	32.2*	27.6*
Lone father with child(ren) < 25	397	16.9*	13.2*
Unattached individual	4,096	13.0*	11.3*
Other	595	9.9	7.8
Home ownership			
Owner†	21,099	5.8	4.5
Tenant	8,315	21.9*	18.4*
Missing	25	--	--
Marital status			
Married†	12,539	6.5	5.1
Common-law/With partner	1,531	11.7*	9.1*
Single (never married)	12,111	12.9*	10.6*
Widowed	1,383	7.1	5.9
Divorced/Separated	1,874	21.3*	18.2*
Missing	--	--	--
Immigration status			
Canadian-born†	24,110	10.5	8.6
Immigrated 0-9 years	1,621	13.0	11.1
Immigrated 10+ years	3,660	8.2*	6.4*
Missing	47	--	--
Aboriginal status			
Yes	789	27.0*	24.1*
No†	28,650	9.9	8.0

Data source: *1998/99 National Population Health Survey, cross-sectional sample, General file*
Note: *Because of rounding, detail may not add to totals.*
† Reference category
* Significantly different from reference category (p ≤ 0.05)
-- Sample size too small to provide reliable estimate

were food insecure to some extent at least once in the previous year (nearly 12% reported having compromised their diet).

Of course, many other factors may be related to both food insecurity and household income: sex, age, source of income, household type, home ownership, marital status, immigrant status, and Aboriginal status, for instance. But even when these factors were taken into account, household income remained significantly associated with food insecurity (Table 2). The odds that people in low-income households would report experiencing food insecurity at least once in the past year were about 8 times those for people in upper-middle/high-income households. Even residents of middle-income households had over 4 times the odds of being food insecure, compared with those in more affluent households.

The reason why food insecurity exists at higher income levels may have to do with the fact that annual income is a static measure and may not be sensitive to sudden economic changes that contribute to temporary bouts of food insecurity.[36] For instance, the impact of a job loss or the death of the sole breadwinner around the time of the NPHS interview would not be reflected in reported income, which covered the previous 12 months.

Varies by source of income

People in households relying on social assistance were at much greater risk of experiencing food insecurity than those in households depending on other income sources (Table 1). The prevalence of at least one episode of food insecurity was 58% for residents of households where the major source of income was social assistance. Food insecurity was also relatively common among people in households dependent upon Employment Insurance, Workers' Compensation, Child Tax Benefit, support or alimony, or with no income (28%). Even when the other factors such as household income and age were taken into consideration, residents of households depending on social assistance, Employment Insurance, Workers' Compensation, Child Tax Benefit, support or alimony, or with no income had significantly high odds of food

Table 2
Adjusted odds ratios for food insecurity, by level and selected characteristics, household population, Canada excluding territories, 1998/99

	Any food insecurity		Compromised diet	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex				
Males	1.06	0.99, 1.15	1.07	0.98, 1.17
Females†	1.00	...	1.00	...
Age group				
0-17	4.82*	3.32, 7.00	4.86*	3.18, 7.42
18-44	4.22*	3.07, 5.81	4.32*	2.98, 6.25
45-64	2.71*	2.04, 3.60	2.75*	2.00, 3.79
65+†	1.00	...	1.00	...
Household income				
Low	7.96*	6.21,10.20	8.79*	6.51, 11.87
Middle	4.31*	3.50, 5.30	4.86*	3.78, 6.25
Upper-middle/High†	1.00	...	1.00	...
Major source of income				
Wages, salaries, self-employment†	1.00	...	1.00	...
EI, Workers' Compensation, Child Tax Benefit, support, alimony, none	1.71*	1.15, 2.56	1.79*	1.12, 2.84
Social assistance, welfare	3.06*	2.32, 4.03	3.43*	2.60, 4.52
CPP, QPP, OAS, GIS	0.93	0.71, 1.22	1.02	0.76, 1.37
Other	1.02	0.71, 1.46	1.08	0.73, 1.57
Household type				
Couple with child(ren) <25†	1.00	...	1.00	...
Couple without child(ren) <25	0.98	0.78, 1.23	1.01	0.78, 1.31
Lone mother with child(ren) <25	1.41*	1.10, 1.81	1.39*	1.07, 1.80
Lone father with child(ren) <25	1.02	0.59, 1.78	0.92	0.50, 1.70
Unattached individual	0.95	0.74, 1.24	1.08	0.81, 1.43
Other	0.99	0.58, 1.71	0.99	0.55, 1.77
Home ownership				
Owner†	1.00	...	1.00	...
Tenant	2.01*	1.67, 2.41	1.91*	1.56, 2.33
Marital status				
Married†	1.00	...	1.00	...
Common-law/With partner	1.06	0.80, 1.41	1.02	0.76, 1.38
Single (never married)	0.79*	0.66, 0.93	0.80*	0.66, 0.95
Widowed	1.04	0.75, 1.44	0.98	0.70, 1.38
Divorced/Separated	1.45*	1.20, 1.75	1.41*	1.15, 1.73
Immigration status				
Canadian-born†	1.00	...	1.00	...
Immigrated 0-9 years	0.66*	0.49, 0.88	0.71*	0.52, 0.98
Immigrated 10+ years	1.05	0.87, 1.28	1.02	0.81, 1.27
Aboriginal status				
Yes	1.48*	1.08, 2.05	1.62*	1.16, 2.26
No†	1.00	...	1.00	...

Data source: *1998/99 National Population Health Survey, cross-sectional sample, General file*
Notes: *Analysis is based on the sample of 48,872 who answered the questions on food insecurity and the other covariates. A missing category for the household income variable was included in the model to maximize sample size, but the odds ratios are not shown.*
† Reference category, for which odds ratio is always 1.00
... Not applicable
* p ≤ 0.05

insecurity, compared with those in households that relied on employment income (Table 2).

Few people in households depending on employment (wages, salaries or self-employment) or government pension income (Canada Pension Plan/ Québec Pension Plan, Old Age Security, Guaranteed Income Supplement) reported having experienced food insecurity in the previous year.

Lone-parent households at high risk

The variations in the prevalence of food insecurity by level and source of household income suggest which groups are at risk. Many lone-parent households, particularly those headed by women, have low incomes and depend on social assistance. Consequently, it is not surprising that 32% of lone-mother households had been food insecure to some extent in the previous year, and 28% reported a compromised diet (Table 1). While the corresponding rates were only about half this high in households headed by male lone-parents (17% and 13%), they were still well above the national figures. When household income, source of income, and the other factors were taken into account, the odds that people in lone-mother households would experience food insecurity were about one and a half times those for people in couple-with-child households (Table 2).

Food insecurity was also relatively common among unattached individuals (13%). However, this high percentage largely reflects the fact that unattached individuals often have other characteristics associated with food insecurity. When these characteristics were taken into account, the odds that unattached individuals would live in a food-insecure household were no greater than the odds for couples with children.

Divorced/Separated vulnerable

To some extent, the prevalence of food insecurity by household type reflects marital status. More than one in five (21%) divorced or separated people, many of whom were lone parents, lived in households that had experienced food insecurity at least once in the past year (Table 1). Food insecurity was also relatively common among single people (13%). By

contrast, just 7% of married people lived in food-insecure households.

When household income, household type and the other factors were taken into account, the odds that divorced or separated people would experience food insecurity were about one and a half times the odds for married people, but the odds for single people were actually significantly low.

More prevalent among children

Children were the age group most likely to live in food-insecure households, while seniors were least likely to do so. In 1998/99, about 14% of children younger than 18 were in where there had been at least one instance of food insecurity in the past year, and 11% were in households reporting a compromised diet (Table 1). At ages 18 to 44, the figures were only slightly lower: 12% and 10%, respectively. By contrast, just 4% of seniors were in food-insecure households, and only 3% were in households where diet had been compromised (see *Limitations*).

Even when the other potentially confounding factors such as household income and household type were considered, children still had almost 5 times the odds of living in a food-insecure household as did seniors (Table 2). But children in such households are not necessarily undernourished. Adult caregivers tend to sacrifice their own diet so that children will not be hungry.[29] In fact, data from the Food Insecurity Supplement to the 1998/99 NPHS indicate that fully half of children younger than 16 in food-insecure households were food secure, and another fifth experienced worry only. However, the remaining 29% had compromised their diet (data not shown).

To some degree, the low prevalence of food insecurity among seniors may be related to the tendency for calorie needs and food consumption to decline with age.[40] Nonetheless, it is unclear if seniors were more reluctant than other age groups to state that they did not have enough to eat, which would contribute to a lower estimate of food insecurity.[41]

Less risk for home owners

Given that food insecurity is defined in the context of a lack of money, it is not surprising that it was uncommon among people who owned a home. Just 6% of home owners reported at least one episode of food insecurity in the past year, and about 5% reported a compromised diet (Table 1). On the other hand, 22% of people in rented dwellings had at least some degree of food insecurity, and for 18% of them, diet was compromised. Even when factors such as household income and age were considered, those in rented dwellings had twice the odds of experiencing food insecurity as did individuals in owned units. This echoes US research showing that home owners are less likely than tenants to have insufficient food.[36,42]

Limitations

In some respects, the number of people experiencing food insecurity is likely to be underestimated by the National Population Health Survey (NPHS). The NPHS is household-based and thereby excludes homeless people among whom food insecurity is high. Also, because food insecurity is defined as lacking funds for food, this analysis may underestimate the percentage of seniors who were food insecure. Seniors may have other risk factors that can contribute to food insecurity: health problems, disabilities, and functional impairments that limit one's ability to purchase food or prepare meals.

On the other hand, all members of a food-insecure household are not necessarily food insecure. The person chosen to respond to the NPHS provided information on behalf of everyone in the household. The degree of food insecurity that person reported was applied to all household members, whether or not they had the same experience.

Because this analysis is based on cross-sectional data, relationships between variables can be described, but causality cannot be inferred. As well, the cross-sectional nature of the data means that long-term consequences of food insecurity cannot be assessed.

Finally, the three screening questions focus on "lacking sufficient funds for food." Dimensions of food insecurity such as the length of deprivation or its periodicity are not covered.

Low among immigrants/High among Aboriginal people

It might be expected that recent immigrants (those who came to Canada within the last 10 years) would be more likely than the Canadian-born population to feel financial pressure as they adjust to a new culture. They may therefore be more at risk of food insecurity. However, the proportion of recent immigrants reporting at least one episode of food insecurity in the past year was not significantly higher than the figure among the Canadian-born (13% versus 11%) (Table 1). In fact, when the other factors were taken into account, recent immigrants actually had lower odds of living in a food-insecure household than did the Canadian-born (Table 2).

By contrast, the prevalence of food insecurity was high among Aboriginal people living off reserves. More than one-quarter (27%) reported at least some food insecurity, and 24% experienced a compromised diet (Table 1). Even controlling for the other factors, the odds that Aboriginal people would live in a food-insecure household were about one and a half times those for non-Aboriginal people.

Food insecurity and health

Inadequate nutrition is significantly correlated with food insecurity.[5,6,11,43] In turn, prolonged inadequate nutrition that may derive from food insecurity can have serious health implications. For example, poor nutrition in children can affect the development of the intellectual, social and emotional skills needed to function in society.[44,45] During infancy and childhood, poor nutrition is related to growth retardation and impaired psychomotor development.[46] Inadequate nutrition has also been associated with decreased ability to concentrate and poor school performance.[47]

At any age, insufficient consumption of fruits and vegetables can put individuals at greater risk of chronic diseases such as cancer and cardiovascular disease.[48] A deficiency in nutrients such as zinc, copper, selenium, and Vitamins A, C and D can compromise the immune system and increase susceptibility to infections.[49,50]

Seniors are at particular risk. Malnutrition in older people results in loss of muscle mass and strength, which can lead to disability and loss of independence.[51] A compromised immune system also leaves elderly people more susceptible to pneumonia and other infections that may be life-threatening.[51]

According to the 1998/99 NPHS, several health problems were more prevalent among residents of food-insecure households than among people in households where the ability to pay for food was not a concern (Chart 2). Those in food-insecure households were significantly more likely to describe their health as "fair" or "poor": 17% versus 7%. This disparity held even when the effects of age, sex and household income were taken into account (Table 3).

A comparatively high percentage—21%—of residents of food-insecure households reported having at least three chronic conditions. The figure was significantly less (14%) for those in food-secure households, and remained so when age, sex and household income were considered.

Paradoxically, food insecurity is associated with obesity. Some research has shown food-insecure people to be more likely to binge eat or choose

Chart 2
Prevalence of selected health outcomes, by food security status, household population, Canada excluding territories, 1998/99
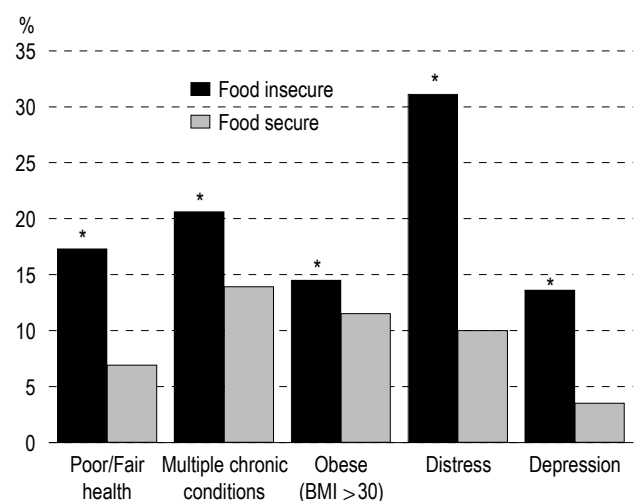
Data source: *1998/99 National Population Health Survey, cross-sectional sample, Health file*
* Significantly higher than food secure (p ≤ 0.05)

higher calorie foods when food is available.[43,52,53] Other studies found that women in food-insecure households had, on average, a higher body mass index (BMI) than those in food-secure household.[54,55] NPHS data, too, show that 15% of residents of food-insecure households were obese (a BMI of 30 or more), a significantly higher percentage than for residents of food-secure households (12%). When age, sex and household income were taken into account, food-insecure people still had significantly higher odds of being obese.

Worry that food is running out can create emotional upset.[10,56,57] In 1998/99, 31% of people in food-insecure households reported distress, compared with 10% in food-secure households. As well, 14% of residents of food-insecure households reported symptoms suggesting a high probability of having had a major depressive episode in the previous year, compared with just 4% of residents

Table 3
Adjusted† odds ratios for selected health outcomes, by food security status, household population, Canada excluding territories, 1998/99

	Odds ratio	95% confidence interval
Poor/Fair health		
Food secure‡	1.0	…
Food insecure	3.2*	2.6, 4.0
Multiple chronic conditions		
Food secure‡	1.0	…
Food insecure	2.2*	1.8, 2.7
Obese (BMI ≥ 30)		
Food secure‡	1.0	…
Food insecure	1.5*	1.2, 1.8
High distress		
Food secure‡	1.0	…
Food insecure	3.2*	2.7, 3.8
Depression		
Food secure‡	1.0	…
Food insecure	3.7*	2.9, 4.7

Data source: *1998/99 National Population Health Survey, cross-sectional sample, Health file*
Note: *Analyses are based on the sample of 17,226 who answered the questions on food insecurity, health and the other covariates.*
† Adjusted for age, sex and household income
‡ Reference category, for which odds ratio is always 1.00
… Not applicable
* p ≤ 0.05

of food-secure households. Even controlling for age, sex and household income, the odds that food-insecure people would experience distress or a major depressive episode were at least three times the odds for people who were food-secure.

Food banks, soup kitchens

Past research has shown that about 20% of food-insecure or economically disadvantaged people use food banks.[56,58] Similarly, the 1998/99 Food Insecurity Supplement to the NPHS found that 22% of respondents in food-insecure households had sought help from food banks, soup kitchens or other charitable agencies in the past year (19% reported occasional use; 3% used food assistance often) (data not shown). Use of food assistance, of course, may be related to accessibility. Some municipalities may not offer such services, and in those that do, many people who are food insecure may live some distance away.

For people with limited budgets, money is most likely to be scarce near the end of the month. In fact, the majority who used food assistance (60%) reported receiving it mainly at the end of the month (data not shown).

Concluding remarks

Estimates of the extent of food insecurity in Canada from the 1998/99 National Population Health Survey establish a benchmark for future monitoring. Overall, about 1 in 10 Canadians were living in food-insecure households in 1998/99, and 8% reported that they had compromised their diet.

The factors shown to be associated with food insecurity in this analysis are consistent with earlier US studies.[36,42] Compromised diets were particularly prevalent among specific groups: households depending on social assistance, low-income households, lone-mother families, off-reserve Aboriginal people, and children.

Children in food-insecure households are a particular concern because more than adults, they need calories and nutrients. And while the NPHS shows that the majority of children in food-insecure households are not undernourished, over one-quarter had compromised their diet.

Although a cross-sectional analysis such as this cannot determine causality, it does identify socio-economic correlates of food insecurity—information that is essential for planning preventive strategies and devising measures to reach the population at risk. As well, food insecurity was shown to be associated with health problems, both physical and emotional. Thus, efforts to reduce food insecurity might eventually contribute to reductions in the costs of treating the associated medical problems. ●

References ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●

1 Carlson SJ, Andrews MS, Bickel GW. Measuring food insecurity and hunger in the United States: Development of a national benchmark measure and prevalence estimates. *Journal of Nutrition* 1999; 129(suppl): S510-6.

2 Olson CM. Food insecurity and hunger: Poverty policy issues for the 1990s and beyond. *Focus* 1996-1997; 18(2): 61-4.

3 Kendall A, Olson CM, Frongillo EA Jr. Validation of the Radimer/Cornell measure of hunger and food insecurity. *Journal of Nutrition* 1995; 125: 2793-801.

4 Nord M, Jemison K, Bickel G. *Measuring Food Security in the United States: Prevalence of Food Insecurity and Hunger, by State, 1996-1998.* Food Assistance and Nutrition Research Report No. 2. Washington, DC: US Department of Agriculture, 1999.

5 Cristofar SP, Basiotis PP. Dietary intakes and selected characteristics of women ages 19-50 years and their children ages 1-5 years by reported perception of food sufficiency. *Journal of Nutrition Education* 1992; 24: 53-8.

6 Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient households in the United States. *American Journal of Public Health* 1997; 87(12): 1956-61.

7 Murphy JM, Wehler CA, Pagano ME, et al. Relationship between hunger and psychosocial functioning in low-income American children. *Journal of the American Academy of Child and Adolescent Psychiatry* 1998; 37: 163-70.

8 Vailas LI, Nitzke SA, Becker M, et al. Risk indicators for malnutrition are associated inversely with quality of life for participants in meal programs for older adults. *Journal of the American Dietetic Association* 1998; 98(5): 548-53.

9 Seipel MO. Social consequences of malnutrition. *Social Work* 1999; 44(5): 416-25.

10 Hamelin A-M, Habicht J-P, Beaudry M. Food insecurity: Consequences for the household and broader social implications. *Journal of Nutrition* 1999; 129(suppl): S525-8.

11 Tarasuk VS, Beaton GH. Women's dietary intakes in the context of household food insecurity. *Journal of Nutrition* 1999; 129(suppl): S672-9.

12 Wellman NS, Weddle DO, Kranz S, et al. Elder insecurities: Poverty, hunger, and malnutrition. *Journal of the American Dietetic Association* 1997; 97(suppl 2): S120-2.

13 University of Southern Mississippi News. *U.S. Hunger.* Released November 10, 1998. Available at: http://www.pr.usm.edu/prnews/nov 98/LIFELECT.HTM/. Accessed February 3, 2000.

14 World notes: UN gives Canada top spot. *Maclean's*, July 12, 1999: 30.

15 Wilson B, Steinman C. *Hunger Count 2000. A Surplus of Hunger.* Toronto: Canadian Association of Food Banks, 2000.

16 Riches G. Responding to hunger in a wealthy society: Issues and options. *Journal of the Canadian Dietetic Association* 1989; 50(3): 150-4.

17 Tarasuk VS, MacLean H. The institutionalization of food banks in Canada: A public health concern. *Canadian Journal of Public Health* 1990; 81: 331-2.

18 Tarasuk VS, Davis B. Responses to food insecurity in the changing Canadian welfare state. *Journal of Nutrition Education* 1996; 28(2): 71-5.

19 Applied Research Branch, Human Resources Development Canada. *Lack of Food Security: A Research Framework for Human Resources Development Canada.* Ottawa: Human Resources Development Canada, 1997.

20 Tarasuk VS, Beaton GH. Household food insecurity and hunger among families using food banks. *Canadian Journal of Public Health* 1999; 90(2): 109-13.

21 Starkey LJ, Kuhnlein HV, Gray-Donald K. Food bank users: Sociodemographic and nutritional characteristics. *Canadian Medical Association Journal* 1998; 158(9): 1143-9.

22 Antoniades M, Tarasuk V. A survey of food problems experienced by Toronto street youth. *Canadian Journal of Public Health* 1998; 89(6): 371-5.

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

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

25 Statistics Canada. *1998-1999 NPHS—Food Insecurity Supplement.* Unpublished document. Ottawa: Statistics Canada, 2000

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

27 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 281-310.

28 Yeo D, Mantel H, Liu TP. Bootstrap variance estimation for the National Population Health Survey. *American Statistical Association: Proceedings of the Survey Research Methods Section.* Baltimore: August 1999.

29 Radimer KL, Olson CM, Greene JC, et al. Understanding hunger and developing indicators to assess it in women and children. *Journal of Nutrition Education* 1992; 24(1): S36-44.

30 Frongillo EA, Jr. Validation of measures of food insecurity and hunger. *Journal of Nutrition* 1999; 129(suppl): S506-9.

31 Briefel RR, Woteki CE. Development of food sufficiency questions for the Third National Health and Nutrition Examination Survey. *Journal of Nutrition Education* 1992; 24(1): S24-8.

32 Wehler CA, Scott RI, Anderson JJ. The Community Childhood Hunger Identification Project: A model of domestic hunger—demonstration projects in Seattle, Washington. *Journal of Nutrition Education* 1992; 24(1): S29-35.

33 Radimer KL, Olson CM, Campbell CC. Development of indicators to assess hunger. *Journal of Nutrition* 1990; 120: 1544-8.

34 Anderson SA, ed. Core indicators of nutritional state for difficult-to-sample populations. *Journal of Nutrition* 1990; 120(suppl): 1557-1660.

35 Hamilton WL, Cook JT, Thompson WW, et al. *Household Food Security in the United States in 1995: Summary Report of the Food Security Measurement Project.* Alexandria, Virginia: USDA Food and Consumer Service, 1997.

36 Rose D. Economic determinants and dietary consequences of food insecurity in the United States. *Journal of Nutrition* 1999; 129(suppl): S517-20.

37 Alaimo K, Brietel RR, Frongillo EA. Food insufficiency exists in the United States: Results from the Third National Health and Nutrition Examination Survey (NHANES III). *American Journal of Public Health* 1998; 88(3): 419-26.

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

39 American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders,* 3rd edition, revised. Washington, DC: American Psychiatric Association, 1987.

40 United States Department of Argiculture. Nutrient intakes: Individuals in 48 states, year 1977-78. In: Human Nutrition Information Service, Consumer Nutrition Division. *National Food Consumption Survey, 1977-78* (Report 1-2). Hyattsville, Maryland: US Department of Agriculture, 1984.

41 Wolfe WS, Olson CM, Kendall A, et al. Understanding food insecurity in the elderly: a conceptual framework. *Journal of Nutrition Education* 1996; 28: 92-100.

42 Rose D, Gundersen C, Oliveira V. *Socio-economic Determinants of Food Insecurity in the United States: Evidence from the SIPP and CSFII Datasets* (Technical Bulletin No. 1869) Washington, DC: USDA Economic Research Service, 1998.

43 Kendall A, Olson CM, Frongillo EA. Relationship of hunger and food insecurity to food availability and consumption. *Journal of the American Dietetic Association* 1996; 96: 1019-24.

44 Brown JL, Pollitt E. Malnutrition, poverty and intellectual development. *Scientific American,* February 1996; 38-43.

45 Kleinman RE, Murphy JM, Little M, et al. Hunger in children in the United States: Potential behavioural and emotional correlates. *Pediatrics* 1998; 101: 1-6.

46 Levitsky DA, Strupp BS. *The Enduring Effects of Early Malnutrition: A History and a Perspective.* Ithaca, New York: Division of Nutritional Sciences, Cornell University, 1997.

47 Wachs TD. Relation of mild-to-moderate malnutrition to human development: correlational studies. *Journal of Nutrition* 1995; 125(suppl): S2245-54.

48 American Dietetic Association. Domestic food and nutrition security—Position of ADA. *Journal of the American Dietetic Association* 1998; 98: 337-42.

49 Kubena KS, McMurray DN. Nutrition and the immune system: a review of nutrient-nutrient interactions. *Journal of the American Dietetic Association* 1996; 96: 1156-64.

50 Mainous MR, Deitch EA. Nutrition and infection. *Surgical Clinics of North America* 1994; 74: 659-76.

51 Codispoti CL, Bartlett BJ. *Food and Nutrition for Life: Malnutrition and Older Americans* (Publication No. NAIC-12) Washington, DC: National Aging Information Center, 1994.

52 Dietz WH. Does hunger cause obesity? *Pediatrics* 1995; 85: 776-7.

53 Cornell University Science News. Cornell studies find women in food-insecure homes engage in more binge eating and eat fewer fruits and vegetables. Released June 18, 1997. Available at: http://www.news.cornell.edu/releases/June97/consequences.ssl.html. Accessed February 6, 2001.

54 Olson CM. Food insecurity, a new measure of nutritional well-being. Cornell University Ask the Nutrition Expert Site. Updated July 1, 1999. Available at: http://www.cce.cornel.edu/food/expfiles/topics/olson/olsonoverview.html. Accessed February 6, 2001.

55 Olson CM. Nutrition and health outcomes associated with food insecurity. *Journal of Nutrition* 1999; 129(suppl): S521-4.

56 Campbell CC, Desjardins E. A model and research approach for studying the management of limited food resources by low income families. *Journal of Nutrition Education* 1989; 21: 162-71.

57 Leather S. Food poverty: the making of modern malnutrition. *Health Visitor* 1997; 70(1): 21-4.

58 Badun C, Evers S, Hooper M. Food security and nutritional concerns of parents in an economically disadvantaged community. *Journal of the Canadian Dietetic Association* 1995; 56(2): 75-80.

Appendix

Table A
Distribution of selected characteristics, household population, cross-sectional sample, General file, National Population Health Survey, Canada excluding territories, 1998/99

	Sample size	Estimated population	
		'000	%
Total	**48,952**	**29,439**	**100.0**
Sex			
Males	23,902	14,587	49.6
Females	25,050	14,852	50.5
Age group			
0-17	14,472	7,091	24.1
18-44	19,868	12,200	41.4
45-64	9,891	6,666	22.6
65+	4,721	3,481	11.8
Household income			
Low	6,569	3,886	13.2
Middle	13,343	7,361	25.0
Upper-middle/High	25,874	16,202	55.0
Missing	3,166	1,990	6.8
Major source of income			
Wages, salaries, self-employment	38,968	22,628	76.9
EI, Workers' Compensation, Child Tax Benefit, support, alimony, none	823	4,971	1.7
Social assistance, welfare	2,123	1,270	4.3
CPP, QPP, OAS, GIS	5,621	4,008	13.6
Other	1,417	1,034	3.5
Household type			
Couple with child(ren) <25	30,565	15,564	52.9
Couple without child(ren) <25	9,172	6,602	22.4
Lone mother with child(ren) <25	3,727	2,185	7.4
Lone father with child(ren) <25	518	397	1.4
Unattached individual	4,100	4,096	13.9
Other	870	595	2.0
Home ownership			
Owner	37,471	21,099	71.7
Tenant	11,460	8,315	28.3
Missing	21	25	0.1
Marital status			
Married	20,910	12,539	42.6
Common-law/With partner	2,489	1,531	5.2
Single (never married)	21,435	12,111	41.1
Widowed	1,817	1,383	4.7
Divorced/Separated	2,300	1,874	6.4
Missing	1	--	--
Immigration status			
Canadian-born	42,382	24,110	81.9
Immigrated 0-9 years	2,135	1,621	5.5
Immigrated 10+ years	4,377	3,660	12.4
Missing	58	47	0.2
Aboriginal status			
Yes	1,635	789	2.7
No	47,317	28,650	97.3

Note: *Because of rounding, detail may not add to totals. As a result of sampling variation, estimates in the General file, Health file and Food Insecurity Supplement are not identical.*
-- Sample size too small to provide reliable estimate

Table B
Distribution of selected characteristics, household population, cross-sectional sample, Health file, National Population Health Survey, Canada excluding territories, 1998/99

	Sample size	Estimated population	
		'000	%
Total	**17,226**	**29,469**	**100.0**
Sex			
Males	8,015	14,585	49.5
Females	9,211	14,884	50.5
Age group			
0-17	3,087	6,927	23.5
18-44	7,194	12,383	42.0
45-64	4,096	6,675	22.7
65+	2,489	3,484	11.8
Household income			
Low	2,781	3,870	13.1
Middle	4,625	7,375	25.0
Upper-middle/High	8,730	16,202	55.0
Missing	1,090	2,022	6.9
Food insecurity			
Yes	1,837	2,992	10.2
No	15,389	26,477	89.8

Note: *Because of rounding, detail may not add to totals. As a result of sampling variation, estimates in the General file, Health file and Food Insecurity Supplement are not identical.*

Table C
Age distribution of population in food-insecure households, cross-sectional sample, Food Insecurity Supplement, National Population Health Survey, Canada excluding territories, 1998/99

	Sample size	Estimated population	
		'000	%
Total	**1,265**	**3,015**	**100.0**
Age group			
0-15	296	853	28.3
16-64	906	2,038	67.6
65+	63	123	4.1

Note: *Because of rounding, detail may not add to totals. As a result of sampling variation, estimates in the General file, Health file and Food Insecurity Supplement are not identical.*

Heart disease, family history and physical activity

Jiajian Chen and Wayne J. Millar

Abstract

Objectives
This article examines the association of family history of heart disease and leisure-time physical activity with incident heart disease.

Data source
The data are from the 1994/95, 1996/97 and 1998/99 longitudinal household components of Statistics Canada's National Population Health Survey. This study is based on information provided by 9,255 respondents aged 20 or older who reported that, in 1994/95, they were free of diagnosed heart disease and in good health.

Analytical techniques
Multiple logistic regression was used to estimate the association of family history and physical activity with a new diagnosis of heart disease, while controlling for age, sex, educational attainment, smoking, high blood pressure, diabetes, and body mass index.

Main results
When family history and other risk factors were taken into account, people who, in 1994/95, engaged in regular physical activity at a moderate level or beyond had lower odds of receiving a new diagnosis of heart disease than did sedentary individuals. People with a family history of heart disease who regularly participated in at least moderate physical activity had lower odds of developing heart disease than did their sedentary counterparts.

Key words
exercise, family health, longitudinal studies

Authors
Jiajian Chen (613-951-5059; chenjia@statcan.ca) and Wayne J. Millar (613-951-1631; millway@statcan.ca) are with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Canada, like many developed countries, has experienced a steady decline in mortality due to heart disease over the past several decades. The decrease has been attributed to improvements in nutrition, exercise and other health habits, as well as to medical management.[1-3] Despite falling mortality rates, heart disease remains a leading cause of death.[1-3] In 1997, heart disease was the second leading cause of death for Canadian men and women, behind cancer.[4]

To prevent or delay the onset of heart disease, health promotion programs advocate increasing the level of physical activity.[5,6] Several studies have shown that regular physical activity confers major heart health benefits and that inactivity is a major risk factor for heart disease.[7-17]

For a number of years, researchers have focused on the role family history plays in heart disease (see *Family history*). Accumulating evidence indicates that family history is associated with increased risk of heart disease, even when controlling for other risk factors, such as serum lipids, blood pressure, diabetes, obesity and social class, and shared behaviours, including cigarette smoking, alcohol use and diet.[18-20] Nevertheless, several studies have concluded that

there is much to learn about genetic susceptibility and its interaction with lifestyle, behaviour, and environmental exposures.[3,18-28]

This article examines the association of a new diagnosis of heart disease with a family history of heart disease (presence of the condition in at least one first-degree relataive) and leisure-time physical activity (see *Methods, Limitations* and *Definitions*). The analysis focuses on the household population of adults who were in good health and did not have diagnosed heart disease in 1994/95. The results control for the effects of sex, age, education, household income, smoking status, high blood pressure, diabetes, and body mass index, family history of heart disease and physical inactivity. Further analysis explores the relationship between physical activity and incident heart disease among only those with a family history of heart disease.

Methods

Data source

The analysis is based on longitudinal data from Statistics Canada's National Population Health Survey (NPHS), weighted to represent the household population in the 10 provinces in 1994. The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian 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.

The data used for this analysis are from the first three NPHS cycles: 1994/95, 1996/97 and 1998/99. Of the 17,626 randomly selected respondents in 1994/95, 14,786 were eligible members of the longitudinal panel, along with 468 persons for whom only general information was collected. An additional 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible for the longitudinal panel. Thus, 17,276 respondents were eligible for re-interview in 1996/97, and 16,677 were still alive in 1998/99. A response rate of 93.6% was achieved for the longitudinal panel in 1996/97, and a response rate of 88.9%, based on the entire panel, was achieved in 1998/99.[29]

This study is based on information collected from the 9,255 respondents aged 20 or older who reported in 1994/95 that they were in good, very good or excellent health and who had not been told by a health professional that they had heart disease (Appendix Table A). People younger than 20 were excluded because of the low incidence of heart disease in this age group. As well, individuals who reported their health as fair or poor in 1994/95 were excluded to minimize selection bias due to pre-clinical, undiagnosed heart disease that may have resulted in a low level of physical activity.[9]

Further analysis focuses on the 3,936 respondents from the sample described above who reported that one or both birth parent(s) and/or any biological sibling(s) had ever had heart disease (Appendix Table A).

Analytical techniques

The incidence rate of heart disease was calculated by dividing the sum of newly reported cases of heart disease by the amount of person-time of follow-up contributed by respondents.[30-32] Person-time of follow-up accumulated from the time of the survey interview in 1994/95 until a new diagnosis of heart disease was reported in 1996/97 or 1998/99, or until the end of the follow-up period in 1998/99. For example, people who reported in 1996/97 that they had been diagnosed with heart disease were considered to have contributed one unit of person-time. Because information was collected every two years, the unit of person-time in this study represents a two-year interval, and thus, the rate is a two-year incidence rate. Individuals who died or who were institutionalized at follow-up were excluded from the analysis because information on family history was not available.

Multivariate pooled logistic regression was used to study the relationships of family history of heart disease and physical activity with a new diagnosis of heart disease, while controlling for other known risk factors.[15,32] The control variables were: sex, age, education, smoking status, high blood pressure, diabetes and body mass index.

For all independent variables except family history of heart disease, data from the 1994/95 interview were used. Information on family history of heart disease was collected in 1998/99 only (see *Limitations*).

To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap resampling technique.[33]

Family history, inactivity raise likelihood of heart disease

People aged 20 or older with a family history of heart disease were more likely than those with no such family history to receive a new diagnosis of the condition sometime between 1994/95 and 1998/99. The age-adjusted two-year incidence of heart disease was 4 cases per 100 person-years for those with a family history, compared with 1 case per 100 person-years for those with no family history (Chart 1).

The risk of heart disease was also lower at higher levels of physical activity. Among people who were sedentary in their leisure time, the two-year incidence of heart disease was almost twice that of individuals who were at least moderately active.

As expected, heart disease incidence also varied by age, educational attainment, smoking status, presence of high blood pressure or diabetes, and body mass index (Table 1). Many of these factors are, of course, interrelated. However, even when the effects of these risk factors were taken into

account, the association between a new diagnosis of heart disease and a family history of heart disease persisted. That is, individuals with no family history of heart disease had about one-quarter the odds of developing the condition, compared with people

Table 1

Two-year incidence of heart disease, by selected characteristics, household population aged 20 or older,[†] Canada excluding territories, 1994/95 to 1998/99

	Incidence	95% confidence interval	
	Cases per 100 person-years		
Total	2.60	2.17,	3.03
Sex			
Men	2.80	2.08,	3.51
Women‡	2.41	1.88,	2.94
Age group			
20-64‡	1.81	1.39,	2.23
65+	9.22*	7.13,	11.32
Family history			
Parent(s)/Sibling(s) with heart disease‡	4.69	3.73,	5.66
Parent(s)/Sibling(s) without heart disease	0.94*	0.65,	1.23
Missing	2.72*	1.53,	3.90
Physical activity			
Active	1.68*	1.09,	2.27
Moderate	1.69*	1.10,	2.28
Light	2.83	1.81,	3.85
Sedentary‡	3.36	2.49,	4.23
Educational attainment			
Less than high school graduation	4.69*	3.50,	5.87
High school graduation/Some postsecondary	2.16	1.49,	2.84
Postsecondary graduation‡	1.94	1.43,	2.45
Smoking status			
Current (daily/occasional)	2.40	1.55,	3.26
Former	3.31*	2.54,	4.09
Never‡	2.13	1.51,	2.74
High blood pressure			
Yes	6.87*	4.80,	8.95
No‡	2.26	1.82,	2.70
Diabetes			
Yes	9.63*	4.40,	14.86
No‡	2.46	2.03,	2.88
Body mass index (BMI)			
Overweight (BMI > 27)	3.92*	2.69,	5.15
Not overweight (BMI ≤ 27)‡	2.06	1.68,	2.43

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
† Population with no diagnosis of heart disease and good health in 1994/95
‡ Reference category
* Significantly different from value for reference category (p < 0.05)

Chart 1

Age-adjusted two-year incidence of heart disease, by family history of heart disease and physical activity, household population aged 20 or older,[†] Canada excluding territories, 1994/95 to 1998/99

Data sources: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
† Population with no diagnosis of heart disease and good health in 1994/95
‡ Reference category
* Significantly different from reference category (p < 0.05)

National Population Health Survey (NPHS) data representing the entire household population show that the percentage of people with a family history of heart disease is appreciable. In 1998/99, about 42% of the population aged 18 or older reported a family history of heart disease. The age of onset of heart disease and the number of first-degree relataives affected were not available from the NPHS.

Percentage of household population with family history of heart disease, by age group, Canada excluding territories, 1998/99
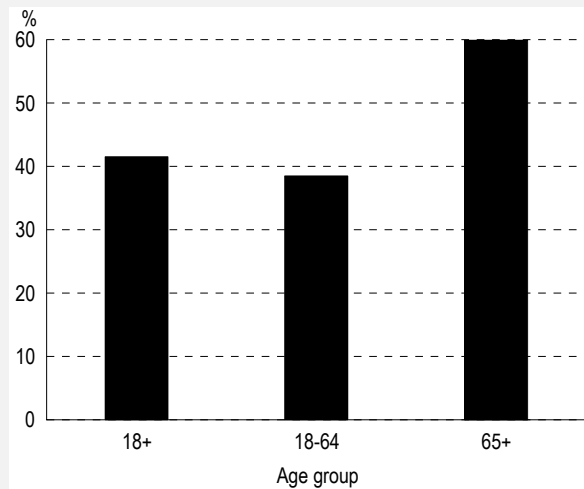
Data source: 1998/99 National Population Health Survey, cross-sectional sample, Health file

who did have a family history of heart disease (Table 2).

Moreover, the effect of physical activity on incident heart disease persisted even when family history was taken into account. The odds of developing heart disease were significantly lower for people who were active or moderately active during their leisure-time, compared with those who were sedentary. This is consistent with previous studies showing that regular physical activity, even at a moderate level of energy expenditure, is beneficial to heart health.[7-15]

Not surprisingly, the odds of developing heart disease increased with age. As well, individuals who were overweight had higher odds of a new diagnosis of heart disease, compared with those who were not overweight.

Table 2
Adjusted odds ratios for newly diagnosed heart disease, by selected characteristics, household population aged 20 or older,[†] Canada excluding territories, 1994/95 to 1998/99

	Odds ratio	95% confidence interval
Sex		
Men	1.29	0.87, 1.91
Women[‡]	1.00	…
Age (in years)[§]	1.05 *	1.04, 1.07
Family history		
Parent(s)/Sibling(s) with heart disease[‡]	1.00	…
Parent(s)/Sibling(s) without heart disease	0.28 *	0.18, 0.43
Physical activity		
Active	0.44 *	0.26, 0.73
Moderate	0.52 *	0.32, 0.84
Light	0.78	0.46, 1.30
Sedentary[‡]	1.00	…
Educational attainment		
Less than high school graduation	1.23	0.82, 1.86
High school graduation/Some postsecondary	0.95	0.59, 1.51
Postsecondary graduation[‡]	1.00	…
Smoking status		
Current (daily/occasional)	1.34	0.81, 2.20
Former	1.22	0.83, 1.79
Never[‡]	1.00	…
High blood pressure		
Yes	1.15	0.71, 1.84
No[‡]	1.00	…
Diabetes		
Yes	1.71	0.75, 3.92
No[‡]	1.00	…
Body mass index (BMI)		
Overweight (BMI > 27)	1.62 *	1.06, 2.49
Not overweight (BMI ≤ 27)[‡]	1.00	…

Data source: 1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file
† Population with no diagnosis of heart disease and good health in 1994/95
‡ Reference category, for which odds ratio is always 1.00
§ Treated as a continuous variable
* $p < 0.05$
… Not applicable

Exercise beneficial, even with family history

NPHS data suggest that physical activity has heart health benefits for people with a family history of heart disease. When the other factors were taken into consideration, for this group, the odds of being diagnosed with heart disease at some point between 1994/95 and 1998/99 were lower for people who

Table 3
Adjusted odds ratios for newly diagnosed heart disease, by selected characteristics, household population aged 20 or older[†] with family history of heart disease, Canada excluding territories, 1994/95 to 1998/99

	Odds ratio	95% confidence interval
Sex		
Men	1.46	0.96, 2.23
Women[‡]	1.00	…
Age (in years)[§]	1.06 *	1.04, 1.08
Physical activity		
Active	0.44 *	0.24, 0.81
Moderate	0.46 *	0.27, 0.80
Light	0.66	0.35, 1.24
Sedentary[‡]	1.00	…
Educational attainment		
Less than high school graduation	1.32	0.83, 2.12
High school graduation/Some postsecondary	0.92	0.51, 1.66
Postsecondary graduation[‡]	1.00	…
Smoking status		
Current (daily/occasional)	1.10	0.61, 1.97
Former	0.94	0.61, 1.46
Never[‡]	1.00	…
High blood pressure		
Yes	0.82	0.48, 1.41
No[‡]	1.00	…
Diabetes		
Yes	1.57	0.63, 3.94
No[‡]	1.00	…
Body mass index (BMI)		
Overweight (BMI > 27)	1.60	0.96, 2.67
Not overweight (BMI ≤ 27)[‡]	1.00	…

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
*† Population with no diagnosis of heart disease and good health in 1994/95*
‡ Reference category, for which odds ratio is always 1.00
§ Treated as a continuous variable
* p < 0.05
… Not applicable

engaged in active or moderate physical activity, compared with those who were sedentary during leisure time (Table 3).

Concluding remarks

This analysis, based on longitudinal data from the first three cycles of the National Population Health Survey, is consistent with clinical and epidemiological observations indicating that people with a family history of heart disease have higher odds of developing the condition than people who do not

Limitations

National Population Health Survey (NPHS) data are self- or proxy-reported, and the degree to which they are inaccurate because of reporting error is unknown. Although respondents were asked if heart disease or other chronic conditions had been diagnosed by a health professional, there was no independent source to confirm diagnosis. Nor was family history of heart disease validated through medical record review.

In this analysis, as is commonly done, family history of heart disease is defined as the presence of the condition in any first-degree relative; that is, biological parent(s) and/or biological sibling(s). The age at onset and the number of first-degree relatives would have been useful in a definition of family history,[34-37] but this information is not available from the NPHS. To explore the association between family history and early onset of heart disease, additional analysis was performed with the sample restricted to respondents aged 20 to 64. The independent associations between family history and physical activity with a new diagnosis of heart disease persisted (Appendix Table B). For this group, risk factors associated with increased odds of developing premature heart disease also included age, current smoking, diabetes, and overweight.

A substantial number (707) of the sample respondents reported that they did not know if their parents and/or siblings had a history of heart disease. These respondents, who tended to have a higher incidence of heart disease than respondents without a family history of heart disease (Appendix Table A), were excluded from the first analysis (Table 2). However, additional analysis showed that the independent associations of family history and physical activity with incident heart disease emerged even when the 707 respondents who did not provide information on family history were included and categorized as having no family history of heart disease (Appendix Table C).

Research indicates that direct assessments of physical fitness may yield more accurate measurements of activity levels than self-reports.[38] Self-reported physical activity may be susceptible to misclassification, which tends to underestimate the true association.[12,17,39] But, despite this possible attenuation, self-reported physical activity remained associated with reduced odds of developing heart disease when family history and other potential risk factors were controlled.

Although individuals may expend considerable energy at work or while doing household chores, information on non-leisure time physical activity is not available from the NPHS. However, a recent study indicates that the inverse association between physical activity and cardiovascular disease mortality was even *stronger* in women when total energy expenditure was based on both leisure- and non-leisure activities.[40]

Body mass index based on self-reported weight and height may be somewhat inaccurate, especially for people aged 65 or older.

Definitions

In the 1994/95, 1996/97 and 1998/99 cycles of the National Population Health Survey (NPHS), respondents were asked if they had any of a number of "long-term health conditions that have lasted or are to expected to last six months or more and that have been diagnosed by a health professional." An interviewer read a list of conditions, which included heart disease, high blood pressure and diabetes.

The incidence rate of heart disease was defined as the reported number of new diagnoses of heart disease among respondents who, in 1994/95, reported that they had not been diagnosed with heart disease by a health care professional. The incidence rate had as its numerator the number of new cases that accumulated over the four-year period between 1994/95 and 1998/99, and as its denominator the number of person-years contributed by the population who were at risk over the four-year period of follow-up. Rates were expressed as cases per 100 person-years in each two-year interval.

The 1998/99 NPHS asked respondents about the medical history of their immediate family. For this analysis, *family history* of heart disease was considered to be present if the respondent reported that at least one first-degree relative (biological parent(s) and/or biological sibling(s)) had ever had heart disease.

The level (or amount) of physical activity was based on total energy expenditure (EE) during leisure time. Information about energy expenditure at work was not available. Values for energy expenditure were calculated using information on the frequency and duration of respondents' reported leisure-time activities in the previous three months, as well as the metabolic energy demand (MET) of each of these activities. The MET value is the metabolic cost (oxygen consumption) of physical activity. NPHS respondents were not asked to specify the intensity of their activities, since individuals tend to overestimate this aspect of physical activity. The MET values, which correspond to the low intensity value of each type of reported activity, were independently established and provided by the Canadian Fitness and Lifestyle Research Institute.[41]

$$EE = \sum(N_i * D_i * MET_i / 365 \text{ days}), \text{ where}$$

N_i = number of occasions of activity i in a year,

D_i = average duration in hours of activity i, and

MET_i = a constant value for metabolic energy requirement of activity i.

EE was expressed as total kilocalories expended per kilogram of body weight per day (kcal/kg/day or KKD).

Frequency of physical activity was based on the number of times in the previous three months that respondents had participated in a physical activity for more than 15 minutes. Categories were defined as regular (12 or more times per month) or irregular (11 or fewer times per month).

Four *physical activity* categories were defined:[41]

• Active: 3 or more KKD of regular activity

• Moderate: 1.5 to 2.9 KKD of regular activity

• Light: under 1.5 KKD of regular activity

• Sedentary: irregular activity regardless of EE

Age (in years) was defined as a continuous variable in all analytical models. For descriptive analysis, age was grouped as: 20 to 64 and 65 or older (Table 1; Appendix Table A).

Educational attainment was categorized as less than high school graduation; high school graduation/some postsecondary; and postsecondary graduation.

Smoking status was determined by asking individuals if they smoked cigarettes daily, occasionally, or not at all. Three groups were established: current (daily and occasional), former, and never smokers.

Body mass index (BMI), which was calculated by dividing weight in kilograms by the square of height in metres, was grouped into two categories: overweight (a BMI of more than 27) and not overweight (a BMI of 27 or less).[42]

have such a history. The extent to which the genetic component of the familial risk, as opposed to acquired risk factors such as diet or smoking, contributes to the risk of heart disease could not be addressed in this analysis. Nevertheless, the excess incidence of heart disease among individuals with a family history of the condition may be attributable both to genetic and to other risk factors.[3,18,19,27,43]

The findings based on the NPHS also provide suggestive evidence that, even among people with a family history of heart disease, physical activity confers some protection against its development. This is in line with other studies suggesting that, through participation in physical activity, people with a family history of heart disease may be able to prevent or delay its onset.[25,37]●

References ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●

1 Duchesne D, Nault F, Gilmour H, et al. *Vital Statistics Compendium, 1996* (Statistics Canada, Catalogue 84-214-XPE) Ottawa: 1999.

2 Heart and Stroke Foundation of Canada. *The Changing Face of Heart Disease and Stroke in Canada.* Ottawa: Heart and Stroke Foundation, 1999.

3 Tyroler HA. Coronary heart disease epidemiology in the 21st century. *Epidemiologic Reviews* 2000; 22(1): 7-13.

4 Statistics Canada. Death—Shifting trends. In: *The Health Divide—How the Sexes Differ* (*Health Reports* special issue, Catalogue 82-003) 2001; 12(3): 41-6.

5 Health Canada and Canadian Society for Exercise Physiology. *Handbook for Canada's Physical Activity. Guide to Healthy Active Living* (Catalogue H39-429-1998-2E) Ottawa: Health Canada, 1998.

6 NIH Consensus Development Panel on Physical Activity and Cardiovascular Health. Physical activity and cardiovascular health. *Journal of the American Medical Association* 1996; 276(3): 241-6.

7 Paffenbarger RS Jr, Wing AL, Hyde T. Physical activity as an index of heart attack risk in college alumni. *American Journal of Epidemiology* 1978; 108(3): 161-75.

8 Leon AS, Connett J, Jacobs DR, et al. Leisure-time physical activity levels and risk of coronary heart disease and death. The multiple risk factor intervention trial. *Journal of the American Medical Association* 1987; 258(17): 2388-95.

9 Powell KE, Thompson PD, Caspersen CJ, et al. Physical activity and the incidence of heart disease. *Annual Review of Public Health* 1987; 8: 253-87.

10 Smith JK, Dykes R, Douglas JE, et al. Long-term exercise and atherogenic activity of blood mononuclear cells in persons at risk of developing ischemic heart disease. *Journal of the American Medical Association* 1999; 281(18): 1722-7.

11 Chen J, Millar WJ. Health effects of physical activity. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(1): 21-30.

12 Manson JE, Hu FB, Rich-Edwards JW, et al. A prospective study of walking as compared with vigorous exercise in the prevention of coronary heart disease in women. *The New England Journal of Medicine* 1999; 341(9): 650-8.

13 Hakim AA, Curb JD, Petrovitch H, et al. Effects of walking on coronary heart disease in elderly men: the Honolulu Heart Program. *Circulation* 1999; 100: 9-13.

14 Lee IM, Sesso HD, Paffenbarger RS. Physical activity and coronary heart disease risk in men: does the duration of exercise episodes predict risk? *Circulation* 2000; 102: 981-6.

15 Rockhill B, Willett WC, Manson JE, et al. Physical activity and mortality: a prospective study among women. *American Journal of Public Health* 2001; 91(4): 578-83.

16 Pate RR, Pratt M, Blair SN, et al. A prospective study of physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine *Journal of the American Medical Association* 1995; 273: 402-7.

17 Sesso HD, Paffenbarger RS, Lee IM. Physical activity and coronary heart disease in men: the Harvard Alumni Health Study. *Circulation* 2000; 102: 975-80.

18 Tonstad S. Do genetic determinants of ischaemic heart disease imply that prevention may become more difficult? *Journal of Internal Medicine* 1998; 243: 333-7.

19 Hopkins PN, Williams RR. Human genetics and coronary heart disease: a public health perspective. *Annual Review of Nutrition* 1989; 9: 303-45.

20 Grech ED, Ramsdale DR, Bray CL, et al. Family history as an independent risk factor of coronary artery disease. *European Heart Journal* 1992; 13(10): 1311-5.

21 Perkins KA. Family history of coronary heart disease: is it an independent risk factor? *American Journal of Epidemiology* 1986; 124(2): 182-94.

22 Khoury MJ, Beaty TH, Liang K. Can familial aggregation of disease be explained by familial aggregation of environmental risk factors? *American Journal of Epidemiology* 1988; 127(3); 674-83.

23 Burke GL, Savage PJ, Sprafka JM, et al. Relation of risk factor levels in young adulthood to parental history of disease: the CARDIA Study. *Circulation* 1991; 84(3): 1176-87.

24 Superko HR. Did grandma give you heart disease? The new battle against coronary artery disease. *American Journal of Cardiology* 1998; 82(9A)(5): 34Q-46Q.

25 Hippe M, Vestbo J, Hein HO, et al. Familial predisposition and susceptibility to the effect of other risk factors for myocardial infarction. *Journal of Epidemiology and Community Health* 1999; 53: 269-76.

26 Hippe M, Vestbo J, Bjerg AM, et al. Cardiovascular risk profile in subjects with familial predisposition to myocardial infarction in Denmark. *Journal of Epidemiology and Community Health* 1997; 1(3): 266-71.

27 Steeds RP, Channer KS. How important is family history in ischaemic heart disease? *Quarterly Journal of Medicine* 1997; 90(6): 427-30.

28 Higgins M, Province M, Heiss G, et al. NHLBI family heart study: objectives and design. *American Journal of Epidemiology* 1996; 143(12): 1219-28.

29 Statistics Canada. Annex: National Population Health Survey (NPHS). *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(3): 112.

30 Last JM, ed. *A Dictionary of Epidemiology,* Third Edition. New York: Oxford University Press, 1995: 83.

31 Rothman KJ, Greenland S. Measures of disease frequency. In: Rothman KJ, Greenland S, eds. *Modern Epidemiology.* Second Edition. Philadelphia: Lippincott-Raven, 1998: 29-64.

32 Cupples LA, D'Agostino RB, Anderson K, et al. Comparison of baseline and repeated measure covariate techniques in the Framingham Heart Study. *Statistics in Medicine* 1988; 7: 205-18.

33 Yeo D, Mantel H, Liu TP. Bootstrap variance estimation for the National Population Health Survey. *American Statistical Association: Proceedings of the Survey Research Methods Section.* Baltimore: August 1999.

34 Hunt SC, Williams RR, Barlow GK. A comparison of positive family history definitions for defining risk of future disease. *Journal of Chronic Diseases* 1986; 39(10): 809-21.

35 Silberberg JS, Wlodarczyk J, Fryer J, et al. Risk associated with various definitions of family history of coronary heart disease: the Newcastle Family Study I. *American Journal of Epidemiology* 1998; 147(12): 1133-9.

36 Khoury MJ, Flanders WD. Bias in using family history as a risk factor in case-control studies of disease. *Epidemiology* 1995; 6(5): 511-9.

37 Higgins M. Epidemiology and prevention of coronary heart disease in families. *The American Journal of Medicine* 2000; 108: 387-95.

38 United States Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996: 11-57.

39 Mensink GBM, Ziese T, Kof F. Benefits of leisure-time physical activity on the cardiovascular risk profile at older age. *International Journal of Epidemiology* 2000; 151: 293-9.

40 Weller I, Corey P. The impact of excluding non-leisure energy expenditure on the relation between physical activity and mortality in women. *Epidemiology* 1998; 9(6): 632-5.

41 Statistics Canada. Appendix F: Derived variables in *National Population Health Survey, 1994/95 Public Use Microdata Files* (Catalogue 82F0001XCB) Ottawa: Minister of Industry, 1995: 17-20.

42 Health and Welfare Canada, Expert Group convened by Health Promotion Directorate, Health Services and Promotion Branch. *Canadian Guidelines for Healthy Weights.* Ottawa: Health and Welfare Canada, 1988.

43 Harrap SB. Hypertension: genes versus environment. *The Lancet* 1994; 344(8916): 169-71.

Appendix

Table A

Characteristics of household population aged 20 or older with no diagnosis of heart disease and good health, Canada excluding territories, 1994/95

	Sample size	Estimated population	
		'000	%
Total	**9,255**	**17,056**	**100**
Sex			
Men	4,162	8,437	49
Women	5,093	8,620	51
Age group			
20-64	7,917	15,235	89
65+	1,338	1,822	11
Family history			
Parent(s)/Sibling(s) with heart disease	3,936	6,849	40
Parent(s)/Sibling(s) without heart disease	4,612	8,739	51
Missing	707	1,468	9
Physical activity			
Active	1,548	2,798	16
Moderate	1,991	3,558	21
Light	1,451	2,559	15
Sedentary	3,882	7,284	43
Missing	383	858	5
Educational attainment			
Less than high school graduation	2,192	3,511	21
Secondary graduation/Some postsecondary	3,871	7,333	43
Postsecondary graduation	3,180	6,188	36
Missing	12	24	0
Smoking status			
Current (daily/occasional)	2,851	5,091	30
Former	2,922	5,241	31
Never	3,478	6,708	39
Missing	4	16	0
High blood pressure			
Yes	804	1,265	7
No	8,451	15,792	93
Diabetes			
Yes	191	348	2
No	9,064	16,709	98
Body mass index (BMI)			
Overweight (BMI > 27)	2,778	4,891	29
Not overweight (BMI ≤ 27)	6,253	11,762	69
Missing	224	404	2

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
Note: *Because of rounding, detail may not add to totals.*

Table B

Adjusted odds ratios for newly diagnosed heart disease, by selected characteristics, household population aged 20 to 64,[†] Canada excluding territories, 1994/95 to 1998/99

	Odds ratio	95% confidence interval
Sex		
Men	1.35	0.82, 2.22
Women[‡]	1.00	…
Age (in years)[§]	1.05 *	1.03, 1.08
Family history		
Parent(s)/Sibling(s) with heart disease[‡]	1.00	…
Parent(s)/Sibling(s) without heart disease	0.32 *	0.18, 0.57
Physical activity		
Active	0.37 *	0.17, 0.80
Moderate	0.50 *	0.27, 0.90
Light	0.90	0.47, 1.73
Sedentary[‡]	1.00	…
Educational attainment		
Less than high school graduation	0.93	0.53, 1.64
High school graduation/Some postsecondary	0.91	0.51, 1.61
Postsecondary graduation[‡]	1.00	…
Smoking status		
Current (daily/occasional)	2.18 *	1.15, 4.14
Former	1.61	0.87, 2.88
Never[‡]	1.00	…
High blood pressure		
Yes	1.16	0.55, 2.42
No[‡]	1.00	…
Diabetes		
Yes	4.00 *	1.26, 12.70
No[‡]	1.00	…
Body mass index (BMI)		
Overweight (BMI > 27)	1.98 *	1.16, 3.37
Not overweight (BMI ≤ 27)[‡]	1.00	…

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
† Population with no diagnosis of heart disease and good health in 1994/95
‡ Reference category, for which odds ratio is always 1.00
§ Treated as a continuous variable
* p < 0.05
… Not applicable

Table C
Adjusted odds ratios for newly diagnosed heart disease, by selected characteristics, household population aged 20 or older† including those who did not respond to family history question, Canada excluding territories, 1994/95 to 1998/99

	Odds ratio	95% confidence interval
Sex		
Men	1.41	0.97, 2.04
Women‡	1.00	…
Age (in years)§	1.06 *	1.04, 1.07
Family history		
Parent(s)/Sibling(s) with heart disease‡	1.00	…
Parent(s)/Sibling(s) without heart disease	0.34 *	0.23, 0.48
Physical activity		
Active	0.52 *	0.33, 0.81
Moderate	0.47 *	0.30, 0.75
Light	0.78	0.48, 1.25
Sedentary‡	1.00	…
Educational attainment		
Less than high school graduation	1.21	0.81, 1.80
High school graduation/Some postsecondary	1.01	0.65, 1.56
Postsecondary graduation‡	1.00	…
Smoking status		
Current (daily/occasional)	1.51	0.96, 2.39
Former	1.24	0.85, 1.80
Never‡	1.00	…
High blood pressure		
Yes	1.25	0.77, 2.02
No‡	1.00	…
Diabetes		
Yes	1.63	0.75, 3.53
No‡	1.00	…
Body mass index (BMI)		
Overweight (BMI > 27)	1.60 *	1.07, 2.39
Not overweight (BMI ≤ 27)‡	1.00	…

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
Note: *Respondents who did not provide information on family history were included and categorized as having no family history of heart disease.*
† Population with no diagnosis of heart disease and good health in 1994/95
‡ Reference category, for which odds ratio is always 1.00
§ Treated as a continuous variable
* p < 0.05
… Not applicable

Starting and sustaining physical activity

Jiajian Chen and Wayne J. Millar

Abstract

Objectives
This article examines factors associated with starting or sustaining physical activity during leisure time.

Data source
The data are from the longitudinal household components of the National Population Health Survey. The sample consisted of 11,026 respondents who were aged 20 and older in 1994/95.

Analytical techniques
Multiple logistic regression was used to identify variables that independently predicted the adoption or maintenance of leisure-time physical activity.

Main results
Among people who had been inactive in 1994/95, the two-year incidence of starting at least moderate physical activity by 1996/97 or 1998/99 was 24 cases per 100 person-years. For people who had been at least moderately active in 1994/95, the two-year incidence of ceasing to maintain that level of activity was 32 cases per 100 person-years. Many predictors of starting or sustaining activity were the same: sex, age, educational attainment, smoking, and sense of mastery. However, some factors were significant for one sex only. For instance, overweight and the presence of children were deterrents for women, but not for men. Social involvement and smoking status were significant for men, but not for women.

Key words
exercise, physical fitness, body weight, health behaviour, socio-economic factors, health survey

Authors
Jiajian Chen (613-951-5059; chenjia@statcan.ca) and Wayne J. Millar (613-951-1631; millway@statcan.ca) are with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Physical activity has long been recognized as beneficial to physical and mental health.[1-5] Yet despite strong health promotion efforts, the majority of Canadian adults are inactive in their leisure-time.[6] For those who are active, sustaining that level of energy expenditure is also a challenge, as evidenced by the substantial dropout rate.[7,8]

Relatively little is known about what prompts sedentary people to become active,[9,10] and having done so, to remain active. Earlier studies, which have relied primarily on cross-sectional survey data, have shown a variety of factors to be related to physical activity.[11-14] However, findings are not consistent. For example, some studies suggest that education is associated with becoming active, while others do not find this relationship.[7,8,15,16] In addition, the adoption and maintenance of physical activity may involve different factors.[8] Understanding what influences each process is necessary if effective public health interventions are to be developed.

The 1994/95, 1996/97 and 1998/99 longitudinal components of the National Population Health Survey (NPHS) provide an opportunity to examine the adoption of physical activity by *inactive* people and the maintenance of activity among *active* people (see *Data source, Analytical techniques* and *Limitations*). The analysis looks at socio-demographic and psychological characteristics and health behaviour that have been shown to be related to physical activity (see *Definitions*).[7-10,15-18]

Starting up/Slowing down

According to the NPHS, changes in the level of exertion involved in leisure-time activities are relatively common. Among sedentary people aged 20 or older, the two-year incidence of starting at least moderate physical activity was 24 cases per 100 person-years over the period from 1994/95 to 1998/99 (Table 1). During the same time, among people who had been at least moderately active, the two-year incidence of ceasing activity requiring that amount of effort was 32 cases per 100 person-years (see *Physical activity*).

Not surprisingly, the predictors of starting and maintaining physical activity were often the same. For instance, people who were young, well-educated, healthy, former smokers, or had a high sense of mastery tended to begin or continue to be physically

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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, on Canadian Forces bases, and in some remote areas. The NPHS has both a longitudinal and a cross-sectional component. Respondents who are part of the longitudinal component will be followed for up to 20 years. The analysis in this article is based on longitudinal data for the 10 provinces for the 1994/95, 1996/97 and 1998/99 survey cycles.

In 1994/95, one knowledgeable person in every participating household provided general socio-demographic and health information about each household member. In addition, one randomly selected member, not necessarily the same person, was chosen to provide in-depth information about his or her own health.

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

Among individuals in the longitudinal component in 1996/97 and 1998/99, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for the household in 1994/95, and was usually the person who provided information on all household members in 1996/97 and 1998/99.

The 1994/95 provincial, non-institutional sample consisted of 27,263 households, of which 88.7% agreed to participate. After application of a screening rule to maintain the representativeness of the sample, 20,725 households remained in scope. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents.

Of the 17,626 randomly selected respondents in 1994/95, 14,786 were eligible members of the longitudinal panel, along with 468 persons for whom only general information was collected. An additional 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible for the longitudinal panel. Thus, 17,276 respondents were eligible for re-interview in 1996/97, and 16,677 were still alive in 1998/99. A response rate of 93.6% was achieved for the longitudinal panel in 1996/97, and a response rate of 88.9%, based on the entire panel, was achieved in 1998/99. Of the 16,168 participants in 1996/97, full information (that is, general and in-depth health information for the first two survey cycles or an outcome of death or institutionalization) was available for 15,670. The corresponding number for 1998/99 was 14,619. More detailed descriptions of the NPHS design, sample, and interview procedures can be found in published reports.[19-21]

The population examined in this study consisted of 11,026 respondents who were aged 20 or older in 1994/95. The majority of them—6,869 or 62%—were classified as inactive and were selected for the analysis of the adoption of at least moderate physical activity. The remaining 4,157 (38%), classified as active, were examined in the analysis of the maintenance of physical activity (Appendix Table A).

Analytical techniques

Longitudinal data from the National Population Health Survey (NPHS) were used to identify two incident events: (1) initiating at least moderate physical activity by people who had been sedentary in 1994/95, and (2) quitting at least moderate physical activity by people who had been active in 1994/95. The analysis is restricted to adults aged 20 or older because the variables associated with physical activity among children and teenagers may be different.

The "person-time incidence rate" was used to measure the rate at which sedentary people started at least moderate physical activity or active people became sedentary. The rates were calculated by dividing the sum of new cases (of starting or stopping activity) by the total amount of "person-time."[22]

The numerator for becoming at least moderately active is the number of sedentary people in 1994/95 who were physically active by 1996/97 or 1998/99. The denominator—expressed in person-years—is the time contributed by people who were "eligible" to become active (that is, people who were sedentary in 1994/95). An inactive respondent who became active by 1996/97 was no longer eligible and contributed no time to the denominator after that point; those who did not become active until 1998/99 and those who remained inactive continued to contribute time to the denominator. Respondents who were institutionalized or died during the period ceased to contribute person-time.

The person-time incidence rate for becoming sedentary is calculated similarly. The numerator is the number of people who were active in 1994/95 who had become inactive by 1996/97 or 1998/99. The denominator is the person-time contributed by people who were eligible to become inactive. An active person who had become physically inactive by 1996/97 could contribute person-time to the denominator only for the first half of the 1994/95 to 1998/99 period.

The NPHS operates on a two-year cycle. Since respondents in this analysis could potentially be followed from 1994/95 to 1998/99, each individual could contribute two units of person-time (one unit every two years) over approximately four years of follow-up. The exact timing of starting or stopping physical activity is not known beyond the fact that it occurred sometime between survey dates. A person who changed his or her activity status in, for instance, 1995 would be considered to have contributed one unit of person-time (a two-year interval) to the denominator.

While the person-time incidence rate measures the incidence of starting or *stopping* physical activity, multiple logistic regression was used to model relationships between selected factors and becoming or *remaining* active. Based on a review of the literature and availability on the NPHS, several variables were included in the regression model: sex, age, education, marital status, household type, health status, weight, smoking, mastery, social involvement, and chronic stress. For all independent variables, data from the 1994/95 interview were used.

The analysis was based on a weighted sample representing the total population aged 20 or older in the 10 provinces in 1994/95. The standard errors of the estimates were calculated using the bootstrap technique, which fully accounts for the design effects of the NPHS.[23-25] Statistical significance was established at $p < 0.05$.

active. On the other hand, weight was a factor in maintaining activity, but not in starting to be active. And starting or maintaining activity did not differ significantly by marital status, household type, social involvement, or chronic stress.

Of course, many of the factors related to physical activity are interrelated. For example, younger people are generally more highly educated and healthier than older people and less likely to be overweight. As well, non-smokers tend to be in better health than smokers. It is also reasonable to suppose that people who succeed in giving up smoking have a strong sense of mastery. Therefore, to identify significant predictors of initiating and maintaining at least a moderate level of leisure-time physical activity, it is necessary to control for such confounding effects.

Physical activity

In the National Population Health Survey (NPHS), level of physical activity was based on total accumulated energy expenditure (EE) during leisure time. Information about energy expenditure at work was not collected. EE was calculated from the reported frequency and duration of all of a respondent's leisure-time physical activities in the three months before his or her NPHS interview and the metabolic energy demand (MET values) of each activity, which was independently established.[13,26]

$$EE = \Sigma(N_i * D_i * METS_i / 365 \text{ days}), \text{ where}$$

N_i = number of occasions of activity i in a year,

D_i = average duration in hours of activity i, and

$METS_i$ = a constant value for metabolic energy cost of activity i.

For each respondent, daily EE was the sum of energy expenditures of all leisure-time activities, expressed as total kilocalories expended per kilogram of body weight per day (KKD). An EE of 3 or more KKD was defined as high; 1.5 to 2.9 KKD, moderate; and less than 1.5 KKD, low.[26] Respondents with high or moderate EE were considered physically active; those with low EE, inactive.

Respondents who were inactive in 1994/95 were considered to have become active if they reported engaging in at least moderate leisure-time physical activity in either 1996/97 or 1998/99; otherwise, they were defined as remaining inactive. Those who were at least moderately active in 1994/95 were considered to have maintained their activity level if they reported continuing to be active in 1996/97 and 1998/99; if they were sedentary at follow-up, they were considered to have become inactive.

Definitions

Four *age groups*, as of 1994/95, were established for this analysis: 20 to 34, 35 to 44, 45 to 64, and 65 or older. The oldest was used as the reference category.

Education in 1994/95 was collapsed into three categories: less than secondary graduation (reference category); secondary graduation or some postsecondary; and postsecondary graduation.

Marital status in 1994/95 was classified into married/with partner and not currently married (reference category).

Household type in 1994/95 was dichotomized as parent(s) with child(ren) younger than 18 and others (reference category).

Self-perceived health was assessed by asking: "In general, would you say your health is: excellent? very good? good? fair? poor?" Responses were grouped into two categories: excellent/very good/ good and fair/poor (reference category). Since it is closely related to physical activity, health status was defined as of two years before the follow-up used for the analysis. That is, to predict the adoption or maintenance of physical activity by 1996/97, health status was as of 1994/95. To predict the adoption or maintenance of activity by 1998/99, health status was as of 1996/97.

Weight in 1994/95 was defined in terms of body mass index (BMI), which was calculated by dividing weight in kilograms by the square of height in metres. BMI was grouped into two categories: overweight (BMI > 27) and not overweight (BMI $\leq$ 27, the reference group). Some caution is warranted in using BMI based on self-reported weight and height. The loss of height and bone mass that accompanies aging is one factor that may make BMI unreliable, especially among the elderly.

Smoking in 1994/95 was determined by asking: "At the present time do you smoke cigarettes daily, occasionally or not at all?" and "Have you ever smoked cigarettes at all?" Those who answered "daily" or "occasionally" to the first question were defined as current smokers (reference group). Those who responded "not at all" to the first question and "yes" to the second were classified as former smokers. Respondents who answered "no" to both questions were defined as people who had never smoked.

Mastery in 1994/95 was measured by asking seven questions on the extent to which respondents felt in control of their lives.[27] On a five-point scale from "strongly agree" (score 0) to "strongly disagree" (score 4), respondents replied to the following statements:

1. You have little control over the things that happen to you.
2. There is really no way you can solve the problems you have.
3. There is little you can do to change many of the important things in your life.
4. You often feel helpless in dealing with the problems of life.
5. Sometimes you feel that you are being pushed around in life.
6. What happens to you in the future mostly depends on you (scoring reversed).
7. You can do just about anything you really set your mind to (scoring reversed).

A total score of less than 20 was considered a low sense of mastery (reference group); 20 or more, moderate/high mastery. Scores

indicating moderate/high mastery were above the 46th percentile of the weighted distribution of the variable in the 1994/95 cross-sectional file.

Social involvement in 1994/95 was measured by asking respondents how often they had participated in associations or voluntary organizations, or attended religious services in the last year. Respondents were asked:

1. Are you a member of any voluntary organizations or associations such as school groups, church social groups, community centres, ethnic associations or social, civic or fraternal clubs?

If "no," respondents answered question 3. If "yes," they answered the following question:

2. How often did you participate in meetings or activities sponsored by these groups in the past 12 months? If you belong to many, just think of the ones in which you are most active.

All respondents were also asked:

3. Other than on special occasions (such as weddings, funerals or baptisms), how often did you attend religious services or religious meetings in the past 12 months?

Questions 2 and 3 were scored on a five-point scale: 0 ("not at all"), 1 ("at least once a year"), 2 ("at least three or four times a year"), 3 ("at least once a month") and 4 ("at least once a week"). A total score of 0 was classified as low social involvement (reference group); 1 or more, moderate/high social involvement. Scores in the moderate/high range were above the 41st percentile of the weighted distribution of the variable in the 1994/95 cross-sectional file.

Chronic stress in 1994/95 was measured by asking respondents if 11 statements on perceived exposures to stressors were true or false. A score of 1 was assigned to each "true" response. The statements were:

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

A total score of less than 4 was defined as low/moderate stress, and 4 or more as high stress (reference group). Scores in the low/ moderate range were below the 79th percentile of the weighted distribution of the variable in the 1994/95 cross-sectional file.

Table 1
Two-year incidence of change in physical activity, by selected characteristics, household population aged 20 or older, Canada excluding territories, 1994/95 to 1998/99

	Inactive in 1994/95 who began at least moderate activity	Active in 1994/95 no longer at least moderately active
	Cases per 100 person-years	
Total	**24**	**32**
Sex		
Men	27*	30
Women†	22	33
Age group		
20-34	28*	31*
35-44	25*	29*
45-64	23*	32*
65+†	19	40
Educational attainment		
Less than secondary graduation†	20	43
Secondary graduation/Some postsecondary	25*	30*
Postsecondary graduation	27*	28*
Marital status		
Married/With partner	25	32
Not currently married†	23	31
Household type		
Parent(s) with child(ren) < 18	25	31
Other†	24	32
Self-perceived health‡		
Excellent/Very good/Good	25*	30*
Poor/Fair†	19	48
Body mass index (BMI)		
Overweight (BMI > 27)	23	37*
Not overweight (BMI ≤ 27)†	25	30
Smoking status		
Current†	24	36
Former	27*	31*
Never	23	29*
Mastery		
Low†	22	37
Moderate/High	26*	28*
Social involvement		
Low†	24	31
Moderate/High	25	32
Chronic stress		
Low/Moderate	25	31
High†	23	33

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
† Reference category
‡ Two years before follow-up
* Significantly different from reference category (p < 0.05).

As might be expected, even when other variables (sex, education, marital status, household type, self-perceived health, weight, smoking, mastery, social involvement and chronic stress) were taken into consideration, age was still significantly associated with beginning physical activity. Compared with their elderly counterparts, inactive people in all age groups from 20 to 64 had significantly high odds of starting at least moderate activity (Table 2). And among those who were already active, the odds of remaining so were significantly high for 35- to 44-year-olds and 45- to 64-year-olds, compared with seniors.

When the other variables were taken into account, postsecondary graduates still had significantly higher odds of starting and maintaining physical activity than did people who had not graduated from high school. As well, among people who were already active, the odds of maintaining activity were also significantly high for those with secondary graduation or some postsecondary education, compared with those who were not high school graduates.

The odds of beginning physical activity were no greater for people who reported themselves to be in at least good health than for those in poor or fair health. However, being in good health raised the odds that an already active person would continue to be at least moderately active.

Weight was not significantly associated with taking up physical activity, but active people who were overweight had lower odds of continuing that level of exertion, compared with those who were not overweight.

The odds that people who had never smoked would become physically active were no higher than the odds for smokers, but once engaged in active pursuits, never-smokers had higher odds of persevering.

Former smokers had significantly higher odds than current smokers of starting and sustaining physical activity. People who have met so difficult a challenge as smoking cessation may be motivated to take other initiatives to improve their health.

A relatively strong sense of mastery, or feeling of control over one's life, was associated with both

Table 2
Adjusted odds ratios for beginning or sustaining physical activity, by selected characteristics, household population aged 20 or older, Canada excluding territories, 1994/95 to 1998/99

	Begin at least moderate activity versus remain inactive†		Sustain at least moderate activity versus quit‡	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex				
Men	1.24*	1.10, 1.40	1.17*	1.01, 1.36
Women§	1.00	...	1.00	...
Age group				
20-34	1.67*	1.31, 2.14	1.26	0.98, 1.62
35-44	1.43*	1.11, 1.83	1.52*	1.14, 2.04
45-64	1.26*	1.03, 1.54	1.35*	1.07, 1.71
65+§	1.00	...	1.00	...
Educational attainment				
Less than secondary graduation§	1.00	...	1.00	...
Secondary graduation/Some postsecondary	1.15	0.98, 1.35	1.48*	1.21, 1.80
Postsecondary graduation	1.21*	1.01, 1.44	1.59*	1.29, 1.95
Marital status				
Married/With partner	1.09	0.93, 1.27	0.92	0.79, 1.08
Not currently married§	1.00	...	1.00	...
Household type				
Parent(s) with child(ren) < 18	0.87	0.73, 1.04	0.88	0.72, 1.07
Other†	1.00	...	1.00	...
Self-perceived health††				
Excellent/Very good/Good	1.22	0.99, 1.51	1.61*	1.26, 2.05
Poor/Fair§	1.00	...	1.00	...
Body mass index (BMI)				
Overweight (BMI > 27)	0.94	0.82, 1.08	0.76*	0.64, 0.90
Not overweight (BMI ≤ 27)§	1.00	...	1.00	...
Smoking status				
Current§	1.00	...	1.00	...
Former	1.23*	1.06, 1.44	1.31*	1.08, 1.59
Never	0.93	0.80, 1.09	1.30*	1.08, 1.57
Mastery				
Low†	1.00	...	1.00	...
Moderate/High	1.17*	1.03, 1.33	1.32*	1.13, 1.53
Social involvement				
Low†	1.00	...	1.00	...
Moderate/High	1.16*	1.03, 1.31	0.97	0.82, 1.14
Chronic stress				
Low/Moderate	1.05	0.89, 1.23	0.92	0.74, 1.13
High†	1.00	...	1.00	...

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
† People who were inactive in 1994/95
‡ People who were at least moderately active in 1994/95
§ Reference category, for which odds ratio is always 1.00
†† Two years before follow-up
* $p < 0.05$
... Not applicable

starting and sustaining physical activity. Social involvement was predictive of beginning physical activity, but made little difference in maintaining it.

Several other factors that might be expected to be important—marital status, household type and chronic stress—were not significantly associated with either beginning or maintaining leisure-time physical activity.

Limitations

National Population Health Survey (NPHS) data are subject to the problems inherent in self-reporting. Recall errors may affect reported levels of physical activity.

The calculation of energy expenditure is not precise. Nor was there an independent source to confirm if people who reported engaging in various activities actually did so, or did so with the frequency and duration they claimed.[4,28] Thus, caution should be used when comparing NPHS estimates of activity levels with those from other sources. The same is true of data on other variables susceptible to inaccurate reporting, such as smoking and weight.

Information was not collected about employment- or home-related physical activity. Consequently, people identified as remaining inactive might have actually been active at work or at home, and those who had ceased being at least moderately active during their leisure time might still have expended considerable energy on the job or while doing household chores.

Seasonal variations in leisure-time pursuits may affect reported levels of physical activity. Respondents interviewed during the winter (January, February, and March) had a lower activity rate (about 30% were at least moderately active) than those interviewed in other seasons (around 40%).

As well, about 24% of respondents were re-interviewed in a different season at follow-up. However, only 5% of them switched from winter to non-winter months, and about 4% switched from non-winter to winter months. Because people tended to be more active in non-winter months, these changes may have resulted in a slight overestimation of beginning and sustaining leisure-time physical activity.

Because the NPHS is a general health survey, information about physical activity is limited. For instance, a study of factors related to changes in activity levels would ideally include barriers to adopting or maintaining activity. However, the NPHS collected information on barriers only for respondents who answered "yes" to the question: "Do you think there is anything you should do to improve your physical health?" Consequently, data are not available about barriers confronting inactive people who had not considered the need to improve their health.

With all variables considered, men had higher odds of becoming and staying active than did women. Moreover, the characteristics that facilitated or deterred physical activity were not necessarily the same for men and women.

Getting going

For men, three factors were significantly associated with becoming active: being aged 20 to 34, compared with being 65 or older; having quit smoking, compared with currently smoking; and having moderate/high social involvement, compared with low social involvement (Table 3).

For women, too, starting physical activity was related to age. The odds of becoming active were higher for women in all age groups younger than 65 than for senior women. As well, having attained at least high school graduation was predictive of beginning physical activity for women. But contrary to the situation among men, smoking status and social involvement did not affect women's odds of becoming more active.

Women who were overweight or who were parents with children younger than 18 had significantly low odds of undertaking at least moderate leisure-time physical activity. For men, neither weight nor household composition made any difference to becoming physically active.

Marital status and chronic stress might be expected to affect an individual's ability and inclination to undertake physical activity, and also to differ for men and women. Yet, neither factor was significant.

Staying the course

Among men and women who were at least moderately active in 1994/95, educational attainment was predictive of sustaining that level of activity (Table 4). Even with other variables taken into account, the odds of remaining active were greater for people with at least high school education, compared with those with less formal education.

As well, for both sexes, a moderate/high sense of mastery (control) was significantly associated with continuing to be active.

Table 3

Adjusted odds ratios for beginning physical activity,[†] by sex and selected characteristics, household population aged 20 or older, Canada excluding territories, 1994/95 to 1998/99

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Age group				
20-34	1.62*	1.17, 2.25	1.80*	1.23, 2.63
35-44	1.29	0.93, 1.79	1.63*	1.10, 2.41
45-64	1.14	0.86, 1.52	1.37*	1.02, 1.85
65+[‡]	1.00	...	1.00	...
Educational attainment				
Less than secondary graduation[‡]	1.00	...	1.00	...
Secondary graduation/Some postsecondary	1.01	0.79, 1.28	1.27*	1.00, 1.60
Postsecondary graduation	1.06	0.83, 1.35	1.33*	1.03, 1.72
Marital status				
Married/With partner	1.22	0.96, 1.55	0.96	0.79, 1.17
Not currently married[‡]	1.00	...	1.00	...
Household type				
Parent(s) with child(ren) < 18	0.95	0.74, 1.21	0.77*	0.60, 0.98
Other[‡]	1.00	...	1.00	...
Self-perceived health[§]				
Excellent/Very good/Good	1.09	0.80, 1.47	1.32	0.96, 1.82
Poor/Fair[‡]	1.00	...	1.00	...
Body mass index (BMI)				
Overweight (BMI > 27)	1.18	0.95, 1.45	0.74*	0.61, 0.90
Not overweight (BMI ≤ 27)[‡]	1.00	...	1.00	...
Smoking status				
Current[‡]	1.00	...	1.00	...
Former	1.38*	1.09, 1.75	1.08	0.86, 1.34
Never	1.11	0.87, 1.42	0.82	0.66, 1.02
Mastery				
Low[‡]	1.00	...	1.00	...
Moderate/High	1.14	0.95, 1.37	1.19	1.00, 1.43
Social involvement				
Low[‡]	1.00	...	1.00	...
Moderate/High	1.22*	1.03, 1.44	1.15	0.96, 1.36
Chronic stress				
Low/Moderate	1.02	0.78, 1.33	1.08	0.88, 1.33
High[‡]	1.00	...	1.00	...

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
Note: *Because of rounding, some odds ratios with 1.00 as the lower limit of the confidence interval were significant.*
† People who were inactive in 1994/95
‡ Reference category, for which odds ratio is always 1.00
§ Two years before follow-up
* $p < 0.05$
... Not applicable

Table 4
Adjusted odds ratios for sustaining physical activity,[†] by sex and selected characteristics, household population aged 20 or older, Canada excluding territories, 1994/95 to 1998/99

	Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Age group				
20-34	1.16	0.79, 1.70	1.37	0.98, 1.91
35-44	1.41	0.92, 2.16	1.68*	1.13, 2.51
45-64	1.14	0.82, 1.59	1.67*	1.24, 2.25
65+‡	1.00	...	1.00	...
Educational attainment				
Less than secondary graduation‡	1.00	...	1.00	...
Secondary graduation/Some postsecondary	1.43*	1.07, 1.92	1.52*	1.14, 2.04
Postsecondary graduation	1.57*	1.16, 2.13	1.57*	1.18, 2.09
Marital status				
Married/With partner	1.00	0.78, 1.29	0.83	0.66, 1.04
Not currently married‡	1.00	...	1.00	...
Household type				
Parent(s) with child(ren) < 18	0.83	0.62, 1.12	0.93	0.71, 1.21
Other‡	1.00	...	1.00	...
Self-perceived health§				
Excellent/Very good/Good	1.29	0.87, 1.90	1.96*	1.36, 2.82
Poor/Fair‡	1.00	...	1.00	...
Body mass index (BMI)				
Overweight (BMI > 27)	0.93	0.74, 1.16	0.58*	0.46, 0.74
Not overweight (BMI ≤ 27)‡	1.00	...	1.00	...
Smoking status				
Current‡	1.00	...	1.00	...
Former	1.63*	1.23, 2.16	0.98	0.75, 1.30
Never	1.68*	1.26, 2.23	1.04	0.80, 1.35
Mastery				
Low‡	1.00	...	1.00	...
Moderate/High	1.33*	1.06, 1.66	1.31*	1.05, 1.62
Social involvement				
Low‡	1.00	...	1.00	...
Moderate/High	0.98	0.78, 1.23	0.99	0.80, 1.24
Chronic stress				
Low/Moderate	1.05	0.76, 1.45	0.81	0.62, 1.07
High‡	1.00	...	1.00	...

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
† People who were at least moderately active in 1994/95
‡ Reference category, for which odds ratio is always 1.00
§ Two years before follow-up
* $p < 0.05$
... Not applicable

However, several factors were associated with sustaining activity for one sex, but not for the other. Women aged 35 to 44 or 45 to 64 had significantly high odds of remaining active compared with senior women, but for men, age made no difference. Women in good health also had higher odds of continuing to be active than did those in fair or poor health. By contrast, health status was not predictive of men's remaining active.

Active women who were overweight had low odds of continuing at least moderate physical activity. The odds that overweight men would remain active were no different from the odds for those who were not overweight.

For men, smoking status was associated with continued activity. Compared with current smokers, men who had never smoked or were former smokers had significantly high odds of maintaining activity levels. On the other hand, among women, the odds of maintaining activity were no different for current, former or never-smokers.

As was the case for becoming active, marital status and chronic stress were not significantly related to remaining active for either men or women.

Women face more obstacles

Many of the characteristics associated with starting physical activity were the same as those associated with maintaining it: age, education, smoking, and sense of mastery. However, the factors that were significant sometimes differed for men and women. For example, educational attainment, a socio-economic measure, was associated with both the adoption and maintenance of physical activity for women, but only with maintenance for men.

As well, for women, family responsibilities play a role in leisure-time physical activity. The presence of children younger than 18 lowered the odds that women would become active. However, the presence of children was not associated with activity levels among men.

Women also differed from men in terms of the effect of weight on leisure-time physical activity. Overweight women were less likely than those who were not overweight to start and continue physical activity. For women, the association between weight

and activity is complicated, as overweight can be both a consequence of inactivity and an impediment to being active.

Social involvement was not significantly associated with activity among women, whereas it was predictive of the adoption of physical activity among men. Social involvement may be an avenue to organized activities, such as team sports. However, while it was important in getting men started, being socially involved was not significantly related to the maintenance of activity levels.

For men, but not women, smoking status, particularly being a former smoker, was related to starting physical activity and remaining active. Smoking cessation and physical activity may be part of the same initiative-taking effort. For example, the reason for quitting smoking might have been a chronic illness associated with both smoking and lack of activity.

Mastery, that is, feeling in control of one's life chances in contrast to being fatalistic,[18] was predictive of remaining active for both sexes. Once embarked on a regimen of physical activity, people with a strong sense of mastery had high odds of persisting. This association of mastery with adherence to physical activity, even when other variables were taken into account, suggests that psychological factors may mediate the effects of socio-economic status.[29]

Concluding remarks

Beginning and sustaining physical activity is a complex process. After years of exposure to programs designed to promote the health benefits of an active lifestyle,[1-3,13,14] most Canadians are still inactive in their leisure time. Moreover, a considerable share of formerly active people quit active leisure-time pursuits. This suggests that knowledge of the health benefits is not, in itself, enough to prompt people to become and remain active.

Results based on longitudinal data from the National Population Health Survey show that not all adults are equally likely to become active, and having done so, to persist. Environmental, social and psychological factors may either facilitate or impede physical activity. Environmental factors include community or family characteristics that generate and support a specific health behaviour.[30] For example, some people may have little control over their time as a result of family responsibilities. Psychological factors are differences in the way people perceive their environment and their response to the stresses of everyday life.[31] Personal resources such as coping skills and sense of mastery may determine whether an individual is able to overcome barriers to engaging in physical activity.

Publicizing the health benefits of physical activity is useful if more people are to begin and maintain such activity.[32] However, effective intervention implies understanding environmental, social and psychological impediments to the adoption and maintenance of an active lifestyle.[30] And since NPHS data suggest that the factors related to becoming and remaining active differ, for men and women, strategies may also need to be gender-specific.[15] ●

References ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●

1 Department of National Health and Welfare. *A New Perspective on the Health of Canadians: A Working Document* (Lalonde Report). Ottawa: Department of National Health and Welfare, 1974.

2 Health Canada and Canadian Society for Exercise and Physical Activity. *Handbook for Canadian Activity. Guide to Healthy Active Living* (Catalogue H39-429-1998-2E) Ottawa: Health Canada, 1998.

3 Health Canada. *Canada's Physical Activity Guide to Healthy Active Living for Older Adults* (Catalogue H39-429/1999-2E) Ottawa: Health Canada, 1999.

4 US Department of Health and Human Services. *Physical activity and health. A report of the Surgeon General* (Catalogue S/N 017-023-00196-5) Pittsburgh, Pennsylvania: Superintendent of Documents, 1996.

5 Chen J, Millar WJ. Health effects of physical activity. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(1): 21-30.

6 Statistics Canada. *National Population Health Survey Overview, 1996/97* (Catalogue 82-567) Ottawa: Minister of Industry, 1999.

7 Sallis JF, Haskell WL, Fortmann SP, et al. Predictors of adoption and maintenance of physical activity in a community sample. *Preventive Medicine* 1986; 15: 331-41.

8 Sallis JF, Hovell MF, Hofstetter CR. Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine* 1992; 21: 237-51.

9 Dunn AL. Getting started–a review of physical activity adoption studies. *British Journal of Sport and Medicine* 1996; 30: 193-9.

10 Dishman, RK, Sallis JF. Determinants and interventions for physical activity and exercise. In: Bouchard C, Shephard RJ, Stephens T, eds. *Physical Activity, Fitness, and Health.* Champaign, Illinois: Human Kinetics, 1994: 214-38.

11 Dishman RK, Sallis JF, Orenstein DR. The determinants of physical activity and exercise. *Public Health Reports* 1985; 100(2): 158-71.

12 Stephens T, Jacobs D, White CC. A descriptive epidemiology of leisure-time physical activity. *Public Health Reports* 1985; 100(2): 147-58.

13 Stephens T, Craig CL, Ferris BF. Adult physical activity in Canada: findings from the Canada Fitness Survey. *Canadian Journal of Public Health* 1986; 77(4): 285-90.

14 Stephens T. Leisure-time physical activity. In: Stephens T, Fowler Graham D, eds. *Canada's Health Promotion Survey 1990.* Technical Report, 139-150 (Health and Welfare Canada, Catalogue H39-263/2-1990E) Ottawa: Minister of Supply and Services Canada, 1993.

15 Eaton CB, Reynes J, Assaf AR. Predicting physical activity change in men and women in two New England communities. *American Journal of Preventive Medicine* 1993; 9(4): 209-19.

16 Burton LC, Shapiro S, German PS. Determinants of physical activity initiation and maintenance among community-dwelling older persons. *Preventive Medicine* 1999; 29: 422-30.

17 Macera CA, Croft JB, Brown DR, et al. Predictors of adopting leisure-time physical activity among a biracial community cohort. *American Journal of Epidemiology* 1995; 142(6): 629-35.

18 Kaplan GA, Lazarus NB. Psychosocial factors in the natural history of physical activity. *American Journal of Preventive Medicine* 1991; 7(1): 12-17.

19 Statistics Canada, Health Statistics Division. Annex: National Population Health Survey (NPHS). *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(3): 112.

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

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

22 Rothman KJ, Greenland S. Measures of disease frequency. In: Rothman KJ, Greenland S, eds. *Modern Epidemiology.* Second Edition. Philadelphia: Lippincott-Raven, 1998: 29-64.

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

24 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 281-310.

25 Yeo D, Mantel H, Liu TP. Bootstrap variance estimation for the National Population Health Survey. *American Statistical Association: Proceedings of the Survey Research Methods Section.* Baltimore: August 1999.

26 Statistics Canada. Appendix F: Derived variables. *National Population Health Survey: 1994-95 Public Use Microdata File* (Catalogue 82F0001XCB) Ottawa: Minister of Industry, 1995: 17-20.

27 Perlin LI, Schooler C. The structure of coping. *Journal of Health and Social Behavior* 1978; 19: 2-21.

28 Knapik J. Zoltick J, Rottner HC, et al. Relationships between self-reported physical activity and physical fitness in active men. *American Preventive Medicine* 1993; 9(4): 203-8.

29 Schieman S, Turner HA. Age, disability, and sense of mastery. *Journal of Health and Social Behavior* 1998; 39: 169-86.

30 Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Social Science of Medicine* 1997; 44(6): 809-19.

31 Droomers M, Schrijvers CT, Van de Mheen H, et al. Education differentials in leisure-time physical inactivity: a descriptive and explanatory study. *Social Science and Medicine.* 1998; 47(11): 1665-76.

32 Morrow JR, Jackson AW, Bazzarre TL, et al. A one-year follow-up to physical activity and health: a report of the Surgeon General. *American Journal of Preventive Medicine* 1999; 17(1): 24-30.

Appendix

Table A
Characteristics of household population aged 20 or older, by activity level, Canada excluding territories, 1994/95

	Sample size	Popu-lation	Total	In-active	Active
		'000		%	
Total	**11,026**	**19,270**	**100.0**	**62.1**	**37.9**
Sex					
Men	4,805	9,175	100.0	58.3	41.7
Women	6,221	10,095	100.0	65.7	34.4
Age group					
20-34	3,247	5,955	100.0	58.8	41.2
35-44	2,286	4,722	100.0	63.0	37.0
45-64	3,176	5,628	100.0	63.3	36.7
65+	2,317	2,964	100.0	65.3	34.7
Educational attainment					
Less than secondary graduation	3,182	4,677	100.0	69.2	30.8
Secondary graduation/Some postsecondary	4,374	8,014	100.0	61.8	38.3
Postsecondary graduation	3,454	6,537	100.0	57.6	42.4
Missing	16	42	--	--	--
Marital status					
Married/With partner	6,584	13,203	100.0	63.0	37.0
Not currently married	4,442	6,067	100.0	60.3	39.7
Household type					
Parent(s) with child(ren) < 18	3,546	11,606	100.0	65.2	34.8
Other	7,480	7,665	100.0	60.1	39.9
Self-perceived health					
Excellent/Very good/Good	9,546	17,140	100.0	60.7	39.3
Poor/Fair	1,480	2,131	100.0	74.0	26.0
Body mass index (BMI)					
Overweight (BMI > 27)	3,462	5,768	100.0	65.2	34.8
Not overweight (BMI ≤ 27)	7,316	13,050	100.0	60.3	39.7
Missing	248	452	--	--	--
Smoking status					
Current	3,242	5,488	100.0	65.3	34.8
Former	3,777	6,474	100.0	59.3	40.7
Never	4,003	7,288	100.0	62.2	37.8
Missing	4	19	--	--	--
Mastery					
Low	5,828	10,474	100.0	66.7	33.3
Moderate/High	5,090	8,554	100.0	58.2	41.9
Missing	108	241	--	--	--
Social involvement					
Low	4,191	7,752	100.0	64.0	36.0
Moderate/High	6,775	11,379	100.0	60.8	39.2
Missing	60	138	--	--	--
Chronic stress					
Low/Moderate	8,816	15,085	100.0	61.3	38.7
High	2,167	4,078	100.0	64.7	35.3
Missing	43	108	--	--	--

Data source: *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
Note: *Because of rounding, detail may not add to totals.*
-- Sample size too small to provide reliable estimate

Data Releases

Synopses of recent health
information produced by
Statistics Canada

Deaths, 1998

According to the latest vital statistics, a female born in 1998 could expect to live longer than a male. Life expectancy at birth reached record highs for both sexes in 1998. Men, on average, could expect to live 76.1 years, up 0.3 years from 1997. Women's life expectancy at birth reached 81.5 years, up only 0.1 years.

The gap in life expectancy between the sexes has narrowed over the last two decades, dropping from 7.1 in 1981 to 5.5 in 1998. In 1998, the gap was largest in New Brunswick (6.3 years), and smallest in Prince Edward Island (4.9 years).

The number of deaths continues to rise because the population is growing and aging. In 1998, a total of 218,091 individuals died, up 1.1% from 1997. Among men, there were 113,007 deaths, a 0.9% increase; among women, there were 105,084 deaths, up 1.4%. The crude mortality rate (number of deaths per 1,000 population) was 7.2 in 1998, unchanged from 1997, and only slightly higher than 7.1 in 1988.

The shelf tables for *Deaths, 1998* (84F0211XPB, $20) are now available. To order this product or custom tabulations, call Client Custom Services (613-951-1746; fax: 613-951-0792; hd-ds@statcan.ca), Health Statistics Division. Additional shelf tables, *Leading causes of death at different ages, 1998* (84F0503XPB, $20), are also available. *Mortality, summary list of causes, 1998* (84F0209XIB, free; 84F0209XPB, $20) and *Causes of death, 1998* (84F0208XPB, $20) will be available soon. For more information, or to enquire about the concepts, methods or data quality of this release, contact Leslie Geran (613-951-5243), Health Statistics Division.

Health care in Canada, 2001

Jointly released by the Canadian Institute for Health Information (CIHI) and Statistics Canada, *Health care in Canada 2001* examines Canada's health care system. The publication includes reports on health care providers, outcomes of care in hospitals, and the cost of health care.

A companion report, *The health divide—how the sexes differ*, second in the *How healthy are Canadians?* series, examines differences between men and women in attitudes and behaviours toward health.

Health care in Canada 2001 is available on CIHI's website (www.cihi.ca). *The health divide—how the sexes differ* (*Health reports*, Vol. 12, no. 3) is available on Statistics Canada's website (www.statcan.ca; 82-003-XIE, free) or in a paper version (82-003-XPE, $20/$58).

For more information, contact Sylvia Ralph-Thibodeau (613-241-7860; sthibodeau@cihi.ca), Canadian Institute for Health Information, or Kathryn Wilkins (613-951-1769; kathryn.wilkins@statcan.ca), Health Statistics Division, Statistics Canada.

Health indicators, 2001

Health indicators, a Web-based data publication produced by Statistics Canada and the Canadian Institute for Health Information, measures the health of the Canadian population and the health care system. The indicators are based on standard definitions and methods, and were designed to provide comparable information at the national, provincial/territorial and health region levels.

Four types of indicators are presented: health status (including health conditions, mortality rates and measures of well being); non-medical determinants (socio-economic characteristics and health behaviours); health system performance (measures of accessibility, appropriateness and effectiveness of health care services); and community and health system characteristics (contextual information). Highlights and data tables are organized by sex, age and geography. The data were obtained from the National Population Health Survey, the National Longitudinal Survey of Children and Youth, the Vital Statistics Database and the 1996 Census of Population.

Health indicators, Volume 2001, Number 1 (82-221-XIE) is available free on Statistics Canada's Web site (www.statcan.ca). For more information, contact Jason Gilmore (613-951-7118; jason.gilmore@statcan.ca), Health Statistics Division, Statistics Canada, or Sylvia Ralph-Thibodeau (613-241-7860; sthibodeau@cihi.ca), Canadian Institute for Health Information.

Stillbirths, 1998

In 1998, Canada recorded its lowest-ever number of stillbirths with a gestational age of 28 weeks or more. Medical officials reported 1,079 such deaths, down 8.1% from 1997. Since 1990, the number of late fetal deaths has fallen 30.8%.

There were 3.1 stillbirths at 28 weeks or more for every 1,000 total births (live births plus stillbirths) in 1998, compared with 3.4 in 1997 and 3.8 in 1990. This continues a long-term downturn from the 1920s, when stillbirth data were first collected. The 1998 rate was about one-tenth of that recorded in 1928, when the nation had 30.5 stillbirths for every 1,000 total births.

In 1998, there were 1,987 stillbirths at 20 or more weeks (5.8 for every 1,000 births). This includes a few stillbirths with either an unknown gestation period, or a gestation period of less than 20 weeks but a weight of 500 grams or more. The number was down 7.3% from 1997 and 18.1% from 1990.

Stillbirth rates are substantially higher among older women: 11.2 for every 1,000 births of 20 or more weeks among women aged 40 to 44 and 15.9 per 1,000 among women 45 or older. Women aged 20 to 34 had the lowest stillbirth rate, at 5.3. The rate among teenage girls was slightly higher: 7.6 per 1,000 births.

Stillbirths are more likely to occur during multiple births. In 1998, only 0.5% of singleton births were stillborn at 20 or more weeks. In contrast, 1.7% of babies in twin events and 2.4% of those in triplet events were stillborn.

Births—Shelf tables, 1998 (84F0210XPB, $20) contains data on both births and stillbirths. To order the shelf table or to request custom tabulations, contact Client Custom Services (613-951-1746; fax: 613-951-0792; hd-ds@statcan.ca), Health Statistics Division. For more information, or to enquire about concepts, methods or data quality, contact Leslie Geran (613-951-5243; gerales@statcan.ca), Health Statistics Division, Statistics Canada.

Canadian Tobacco Use Monitoring Survey, 2000

According to data from the Canadian Tobacco Use Monitoring Survey (CTUMS), Canada has more ex-smokers than smokers. The survey, conducted between February and June 2000 by Statistics Canada on behalf of Health Canada, found that about 5.9 million people aged 15 or older, or about 24% of the population, smoked daily or occasionally. However, another 26%—about 6 million—reported that they had quit.

Young adults (20 to 24) had the highest smoking rates of any age group. An estimated 35% of men and 30% of women in this age group reported that they smoked. Teenagers aged 15 to 19 had the second-highest smoking rates (about 26%).

Cigarette consumption is comparatively low in British Columbia, Alberta, Saskatchewan, Manitoba and Newfoundland, each of which has fairly high taxes and prices. Smokers in these provinces consumed an average of 14.0 to 15.5 cigarettes a day. By contrast, consumption varied between 17.5 and 18.0 cigarettes in the other provinces.

For more information on the Canadian Tobacco Use Monitoring Survey, contact Anne Zaborski (613-954-0152; anne_zaborski@hc-sc.gc.ca), Health Canada, or visit the program's website (www.hc-sc.gc.ca/hppb/tobacco/ctums_splash.html).

Canadian Perinatal Health Report, 2000

The *Canadian Perinatal Health Report 2000* and *Perinatal Health Indicators for Canada: A Resource Manual,* both published by the Bureau of Reproductive Health at Health Canada in collaboration with the Canadian Perinatal Surveillance System, contain indicators based on data from Statistics Canada. They include vital statistics on live births, stillbirths and infant deaths, hospitalization data, and data from the National Population Health Survey and the National Longitudinal Survey of Children and Youth.

The *Canadian Perinatal Health Report 2000* and *Perinatal Health Indicators for Canada: A Resource Manual* are available free on the Internet at www.hc_sc.gc.ca/hpb/lcdc/publicat/cphr_rspc00/index.html and www.hc_sc.gc.ca/hpb/lcdc/brch/reprod/phic_ispc/index.html, respectively. For more information, contact Ernesto Delgado (613-941-2395; fax: 613-941-9927; Ernesto_Delgado@hc-sc.gc.ca), or the Canadian Perinatal Surveillance System (cpss@hc-sc.gc.ca).

Mental health statistics, 1996/97 and 1998/99

In 1997/98, the discharge rate of patients with mental disorders was 680 per 100,000 population, down 1% from the previous year. A total of 204,425 discharges were reported from general and psychiatric hospitals, with general hospitals accounting for 86%.

The total number of days that patients with mental disorders stayed in hospital declined to 11.2 million in 1997/98, representing a 9% drop from the 12.3 million days reported the previous year. A reduction in the number of days spent in general hospitals was responsible for the entire decline.

In 1997/98, the average length of stay for a mental disorder fell to 55.0 days, down from 59.5 in 1996/97. Stays in psychiatric hospitals averaged 254.5 days, compared with 22.9 days for general hospitals. The average stay for a mental disorder is considerably longer than the 8.9-day average for all hospitalizations (for example, cancer, respiratory and circulatory disorders).

The Canadian Institute for Health Information (CIHI) has been responsible for collecting data on mental health since 1994/95. For more information, or to enquire about the concepts, methods, or data quality of this release, contact Karen McCarthy (613-241-7860; fax: 613-241-8120) at CIHI. For historical information, contact the Client Custom Services Unit (613-951-1746; fax: 613-951-0792; hd-ds@statcan.ca), Health Statistics Division, Statistics Canada. ●

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Health status of children. Statistics Canada. 2000; 11(3): 25-34.

Chronic conditions
See also Arthritis
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      Cancer
      Cardiovascular disease
      Depression
      Diabetes
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      Stroke

Are recent cohorts healthier than their predecessors? Chen J, Millar WJ. 2000; 11(4): 9-23.

Body mass index and health. Gilmore J. 1999; 11(1): 31-43.

Chronic back problems among workers. Pérez CE. 2000; 12(1): 41-55.

Chronic conditions, physical limitations and dependency among seniors living in the community. Wilkins K, Park E. 1996; 8(3): 7-15.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Health in mid-life. Statistics Canada. 2000; 11(3): 35-46.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Migraine. Gilmour H, Wilkins K. 2001; 12(2): 23-40.

Older drivers—a complex public health issue. Millar WJ. 1999; 11(2): 59-71.

Stress and well-being in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 21-32.

Contraception

Multiple-risk behaviour in adolescents and young adults. Galambos NL, Tilton-Weaver LC. 1998; 10(2): 9-20.

Oral contraceptive use. Wilkins K, Johansen H, Beaudet MP, et al. 2000; 11(4): 25-37.

D · · · · · · · · · · · · · · · · · · ·

Data collection
See also Health surveys

Multiple causes of death. Wilkins K, Wysocki M, Morin C, et al. 1997; 9(2): 19-29.

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

Proxy reporting in the National Population Health Survey. Shields M. 2000; 12(1): 21-39.

Deaths
See also Cause of death

Cancer incidence and mortality across Canada. Gaudette LA, Altmayer CA, Wysocki M, et al. 1998; 10(1): 51-66.

Changing trends in melanoma incidence and mortality. Gaudette LA, Gao R-N. 1998; 10(2): 29-41.

Deaths —Shifting trends in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 41-6.

Health status of children. Statistics Canada. 2000; 11(3): 25-34.

Income inequality and mortality among working-age people in Canada and the US. Statistics Canada. 2000; 11(3): 77-82.

Infant mortality and low birthweight, 1975 to 1995. Nault F. 1998; 9(3): 39-46.

Life expectancy. Statistics Canada. 2000; 11(3): 9-24.

Maternal education and fetal and infant mortality in Quebec. Chen J, Fair M, Wilkins R, et al. 1998; 10(2): 53-64.

Monthly and daily patterns of death. Trudeau R. 1997; 9(1): 43-50.

Mortality in metropolitan areas. Gilmour H, Gentleman JF. 1999; 11(1): 9-19.

Narrowing mortality gaps, 1978 to 1995. Nault F. 1997; 9(1): 35-41.

Trends in breast cancer incidence and mortality. Gaudette LA, Silberberger C, Altmayer CA, et al. 1996; 8(2): 29-37.

Dementia

Dementia among seniors. Hill G, Forbes W, Berthelot J-M, et al. 1996; 8(2): 7-10.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C. et al. 2000; 11(4): 49-61.

Dental care

Dental insurance and use of dental services. Millar WJ, Locker D. 1999; 11(1): 55-67.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Household spending on health care. Chaplin R, Earl L. 2000; 12(1): 57-65.

Dependency
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Changes in social support in relation to seniors' use of home care. Wilkins K, Beaudet MP. 2000; 11(4): 39-47.

Chronic conditions, physical limitations and dependency among seniors living in the community. Wilkins K, Park E. 1996; 8(3): 7-15.

Death—Shifting trends in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 41-6.

Disability among Canada's Aboriginal Peoples in 1991. Ng E. 1996; 8(1): 25-32.

Health expectancy by immigrant status, 1986 and 1991. Chen J, Wilkins R, Ng E. 1996; 8(3): 17-38.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Seniors' needs for health-related personal assistance. Chen J, Wilkins R. 1998; 10(1): 39-50.

Stress and well-being in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 21-32.

Depression
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Chronic back problems among workers. Pérez CE. 2000; 12(1): 41-55.

Depression: An undertreated disorder? Diverty B, Beaudet MP. 1997; 8(4): 9-18.

Health effects of physical activity. Chen J, Millar WJ. 1999; 11(1): 21-30.

The health of lone mothers. Pérez C, Beaudet MP. 1991; 11(2): 21-32.

Long working hours and health. Shields M. 1999; 11(2): 33-48.

Psychological health—depression. Statistics Canada. 2000; 11(3): 63-75.

Stress and well-being in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 21-32.

Diabetes

Are recent cohorts healthier than their predecessors? Chen J, Millar WJ. 2000; 11(4): 9-23.

The health of Canadians with diabetes. James R, Young TK, Mustard CA, et al. 1998; 9(3): 47-52.

Disability

Are recent cohorts healthier than their predecessors? Chen J, Millar WJ. 2000; 11(4): 9-23.

Chronic back problems among workers. Pérez CE. 2000; 12(1): 41-55.

Chronic conditions, physical limitations and dependency among seniors living in the community. Wilkins K, Park E. 1996; 8(3): 7-15.

Disability among Canada's Aboriginal Peoples in 1991. Ng E. 1996; 8(1): 25-32.

Health among older adults. Statistics Canada. 2000; 11(3): 47-61.

Health expectancy by immigrant status, 1986 and 1991. Chen J, Wilkins R, Ng E. 1996; 8(3): 17-38.

Health in mid-life. Statistics Canada. 2000; 11(3): 35-46.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Older drivers—a complex public health issue. Millar WJ. 1999; 11(2): 59-71.

Divorce

Divorce in the 1990s. Gentleman JF, Park E. 1997; 9(2): 53-8.

E ·

Exercise

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Health effects of physical activity. Chen J, Millar WJ. 1999; 11(1): 21-30.

Heart disease, family history and physical activity. Chen J, Millar WJ, 2001; 12(4): 23-32.

Long working hours and health. Shields M. 1999; 11(2): 33-48.

Oral contraceptive use. Wilkins K, Johansen H, Beaudet MP, et al. 2000; 11(4): 25-37.

Personal health practices: Smoking, drinking, physical activity and weight. Statistics Canada. 2000; 11(3): 83-90.

Starting and sustaining physical activity. Chen J, Millar WJ. 2001; 12(4): 33-43.

Taking risks/Taking care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 11-20.

F ·

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Changes in children's hospital use. Connors C, Millar WJ. 1999; 11(2): 9-19.

Medications and fall-related fractures in the elderly. Wilkins K. 1999; 11(1): 45-53.

H ·

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Changes in children's hospital use. Connors C, Millar WJ. 1999; 11(2): 9-19.

Depression: An undertreated disorder? Diverty B, Beaudet MP. 1997; 8(4): 9-18.

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

Health care/Self-care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 33-9.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

The health of lone mothers. Pérez C, Beaudet MP. 1991; 11(2): 21-32.

Household spending on health care. Chaplin R, Earl L. 2000; 12(1): 57-65.

Health insurance

Dental insurance and use of dental services. Millar WJ, Locker D. 1999; 11(1): 55-67.

Disparities in prescription drug insurance coverage. Millar WJ. 1999; 10(4): 11-31.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Health promotion

Reaching smokers with lower educational attainment. Millar WJ. 1996; 8(2): 11-9.

Health services accessibility

Dental insurance and use of dental services. Millar WJ, Locker D. 1999; 11(1): 55-67.

Disparities in prescription drug insurance coverage. Millar WJ. 1999; 10(4): 11-31.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

How far to the nearest physician? Ng E, Wilkins R, Pole J, et al. 1997; 8(4): 19-31.

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Are recent cohorts healthier than their predecessors? Chen J, Millar WJ. 2000; 11(4): 9-23.

Health-adjusted life expectancy. Wolfson MC. 1996; 8(1): 41-6.

Health among older adults. Statistics Canada. 2000; 11(3): 47-61.

Health expectancy by immigrant status, 1986 and 1991. Chen J, Wilkins R, Ng E. 1996; 8(3): 17-38.

Health in mid-life. Statistics Canada. 2000; 11(3): 35-46.

Health status of children. Statistics Canada. 2000; 11(3): 25-34.

Life expectancy. Statistics Canada. 2000; 11(3): 9-24.

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

Proxy reporting in the National Population Health Survey. Shields M. 2000; 12(1): 21-39.

Health Utilities Index

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Home care

Changes in social support in relation to senior's use of home care. Wilkins K, Beaudet MP. 2000; 11(4): 39-47.

Health care/Self-care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 33-39.

Home care in Canada. Wilkins K, Park E. 1998; 10(1): 29-37.

Seniors' needs for health-related personal assistance. Chen J, Wilkins R. 1998; 10(1): 39-50.

Hormone replacement therapy

Characteristics of women on hormone replacement therapy. Beaudet MP, Walop W, Le Petit C. 1997; 9(2): 9-18.

Hormone replacement therapy and incident arthritis. Wilkins K. 1999; 11(2): 49-57.

Hospitalization

Changes in children's hospital use. Connors C, Millar WJ. 1999; 11(2): 9-19.

Characteristics of hospital users. Wilkins K, Park E. 1998; 9(3): 27-36.

Current and future hospitalization after heart attack. Johansen H, Nair C, Taylor G. 1998; 10(2): 21-8.

Health care/Self-care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 33-9.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Hysterectomy, 1981/82 to 1996/97. Millar WJ. 2001; 12(2): 9-22.

Pregnancy-related hospital use. Werschler T. 1998; 10(1): 21-7.

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Body mass index and health. Gilmore J. 1999; 11(1): 31-43.

Chronic conditions, physical limitations and dependency among seniors living in the community. Wilkins K, Park E. 1996; 8(3): 7-15.

Health among older adults. Statistics Canada. 2000; 11(3): 47-61.

Health in mid-life. Statistics Canada. 2000; 11(3): 35-46.

Living with heart disease—the working-age population. Johansen H. 1999; 10(4): 33-46.

Oral contraceptive use. Wilkins K, Johansen H, Beaudet MP, et al. 2000; 11(4): 25-37.

Hysterectomy

Hysterectomy, 1981/82 to 1996/97. Millar WJ. 2001; 12(2): 9-22.

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Immigrants

Health expectancy by immigrant status, 1986 and 1991. Chen J, Wilkins R, Ng E. 1997; 8(3): 17-38.

Tuberculosis, 1994. Wilkins K. 1996; 8(1): 33-9.

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Income inequallity and mortality among working-age people in Canada and the US. Statistics Canada. 2000; 11(3): 77-82.

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Death—Shifting trends in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 41-6.

Dementia among seniors. Hill G, Forbes W, Berthelot J-M, et al. 1996; 8(2): 7-10.

Health-adjusted life expectancy. Wolfson MC. 1996; 8(1): 41-6.

Income inequallity and mortality among working-age people in Canada and the US. Statistics Canada. 2000; 11(3): 77-82.

Life expectancy. Statistics Canada. 2000; 11(3): 9-24.

Narrowing mortality gaps, 1978 to 1995. Nault F. 1997; 9(1): 35-41.

Lone parents

The health of lone mothers. Pérez C, Beaudet MP. 1991; 11(2): 21-32.

Low birth weight

Birth outcome, the social environment and child health. Chen J, Millar WJ. 1999; 10(4): 57-67.

Changing fertility patterns, 1974 to 1994. Ford D, Nault F. 1996; 8(3): 39-46.

Health status of children. Statistics Canada. 2000; 11(3): 25-34.

Infant mortality and low birthweight, 1975 to 1995. Nault F. 1998; 9(3): 39-46.

Maternal education and fetal and infant mortality in Quebec. Chen J, Fair M, Wilkins R, et al. 1998; 10(2): 53-64.

Maternal education and risk factors for small-for-gestational age births. Millar WJ, Chen J. 1998; 10(2): 43-51.

The risks of childbearing at older ages. MacNab YC, Macdonald J, Tuk TA. 1997; 9(2): 41-50.

M

Mammography

Trends in mammography utilization, 1981 to 1994. Gaudette LA, Altmayer CA, Nobrega KMP, et al. 1996; 8(3): 17-27.

Who doesn't get a mammogram? Gentleman JF, Lee J. 1997; 9(1): 19-28.

Marriage

Twenty years of marriages. Nault F. 1996; 8(2): 39-47.

Mass screening

Falling short of Pap test guidelines. Lee J, Parsons GF, Gentleman JF. 1998; 10(1): 9-19.

Who doesn't get a mammogram? Gentleman JF, Lee J. 1997; 9(1): 19-28.

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Medication use

Characteristics of women on hormone replacement therapy. Beaudet MP, Walop W, Le Petit C. 1997; 9(2): 9-18.

Disparities in prescription drug insurance coverage. Millar WJ. 1999; 10(4): 11-31.

Health care/Self-care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 33-9.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Hormone replacement therapy and incident arthritis. Wilkins K. 1999; 11(2): 49-57.

Medications and fall-related fractures in the elderly. Wilkins K. 1999; 11(1): 45-53.

Multiple medication use among seniors. Millar WJ. 1998; 9(4): 11-7.

Older drivers—a complex public health issue. Millar WJ. 1999; 11(2): 59-71.

Oral contraceptive use. Wilkins K, Johansen H, Beaudet MP, et al. 2000; 11(4): 25-37.

Menopause

Characteristics of women on hormone replacement therapy. Beaudet MP, Walop W, Le Petit C. 1997; 9(2): 9-18.

Hormone replacement therapy and incident arthritis. Wilkins K. 1999; 11(2): 49-57.

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The health of lone mothers. Pérez C, Beaudet MP. 1991; 11(2): 21-32.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Psychological health—depression. Statistics Canada. 2000; 11(3): 63-75.

Work stress and health. Wilkins K, Beaudet MP. 1999; 10(3): 47-62.

Migraine

Migraine. Gilmour H, Wilkins K. 2001; 12(2): 23-40.

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See also Abortion

Pregnancy outcomes. Wadhera S, Millar WJ. 1996; 8(1): 7-15.

Teenage pregnancies, 1974 to 1994. Wadhera S, Millar WJ. 1998; 9(3): 9-17.

Teenage pregnancy. Dryburgh H. 2000; 12(1): 9-19.

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Neoplasms
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Northern residents

Life expectancy. Statistics Canada. 2000; 11(3): 9-24.

The health of Northern residents. Diverty B, Pérez C. 1998; 9(4): 49-58.

Nursing

Male registered nurses, 1995. Trudeau R. 1996; 8(2): 21-7.

Nursing homes
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Nutrition

Body mass index and health. Gilmore J. 1999; 11(1): 31-43.

Food insecurity in Canadian households. Che J, Chen J. 2001; 12(4): 11-22.

Taking risks/Taking care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 11-20.

O

Occupational health

Chronic back problems among workers. Pérez CE. 2000; 12(1): 41-55.

Long working hours and health. Shields M. 1999; 11(2): 33-48.

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Work stress and health. Wilkins K, Beaudet MP. 1999; 10(3): 47-62.

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P

Pain

Chronic back problems among workers. Pérez CE. 2000; 12(1): 41-55.

Migraine. Gilmour H, Wilkins K. 2001; 12(2): 23-40.

Stress and well-being in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 21-32.

Physicians

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

How far to the nearest physician? Ng E, Wilkins R, Pole J, et al. 1997; 8(4): 19-31.

Pregnancy
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Birth outcome, the social environment and child health. Chen J, Millar WJ. 1999; 10(4): 57-67.

Health status of children. Statistics Canada. 2000; 11(3): 25-34.

Maternal education and fetal and infant mortality in Quebec. Chen J, Fair M, Wilkins R, et al. 1998; 10(2): 53-64.

Maternal education and risk factors for small-for-gestational-age births. Millar WJ, Chen J. 1998; 10(2): 43-51.

Pregnancy outcomes. Wadhera S, Millar WJ. 1996; 8(1): 7-15.

Pregnancy-related hospital use. Werschler T. 1998; 10(1): 21-7.

Teenage pregnancies, 1974 to 1994. Wadhera S, Millar WJ. 1998; 9(3): 9-17.

Teenage pregnancy. Dryburgh H. 2000; 12(1): 9-19.

Preventive health

Factors associated with bicycle helmet use. Millar WJ, Pless IB. 1997; 9(2): 31-9.

Heart disease, family history and physical activity. Chen J, Millar WJ, 2001; 12(4): 23-32.

Starting and sustaining physical activity. Chen J, Millar WJ. 2001; 12(4): 33-43.

Taking risks/Taking care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 11-20.

R

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Mortality in metropolitan areas. Gilmour H, Gentleman JF. 1999; 11(1): 9-19.

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Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

S

Safety equipment

Factors associated with bicycle helmet use. Millar WJ, Pless IB. 1997; 9(2): 31-9.

Seasonality

Monthly and daily patterns of death. Trudeau R. 1997; 9(1): 43-50.

Seniors
See also Aging

Changes in social support in relation to seniors' use of home care. Wilkins K, Beaudet MP. 2000; 11(4): 39-47.

Health among older adults. Statistics Canada. 2000; 11(3): 47-61.

Health care consequences of falls for seniors. Wilkins K, 1999; 10(4): 47-55.

Home care in Canada. Wilkins K, Park E. 1998; 10(1): 29-37.

Hormone replacement therapy and incident arthritis. Wilkins K. 1999; 11(2): 49-57.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Medications and fall-related fractures in the elderly. Wilkins K. 1999; 11(1): 45-54.

Multiple medication use among seniors. Millar WJ. 1998; 9(4): 11-7.

Older drivers—a complex public health issue. Millar WJ. 1999; 11(2): 59-71.

Seniors' needs for health-related personal assistance. Chen J, Wilkins R. 1998; 10(1): 39-50.

Smoking

The age of smoking initiation: Implications for quitting. Chen J, Millar WJ. 1998; 9(4): 39-46.

Are recent cohorts healthier than their predecessors? Chen J, Millar WJ. 2000; 11(4): 9-23.

Attitudes toward smoking. Ross N, Pérez C. 1999; 10(3): 23-33.

Body mass index and health. Gilmore J. 1999; 11(1): 31-43.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Long working hours and health. Shields M. 1999; 11(2): 33-48.

Maternal education and risk factors for small-for-gestational age births. Millar WJ, Chen J. 1998; 10(2): 43-51.

Multiple-risk behaviour in adolescents and young adults. Galambos NL, Tilton-Weaver LC. 1998; 10(2): 9-20.

Oral contraceptive use. Wilkins K, Johansen H, Beaudet MP, et al. 2000; 11(4): 25-37.

Personal health practices: Smoking, drinking, physical activity and weight. Statistics Canada. 2000; 11(3): 83-90.

Reaching smokers with lower educational attainment. Millar WJ. 1996; 8(2): 11-9.

Smoking prevalence, quit attempts and successes. Stephens M, Siroonian J. 1998; 9(4): 31-7.

Taking risks/Taking care in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 11-20.

Which workers smoke? Gaudette LA, Richardson A, Huang S. 1999; 10(3): 35-45.

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See also Dependency

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Home care in Canada. Wilkins K, Park E. 1998; 10(1): 29-37.

Living at home or in an institution: What makes the difference for seniors? Trottier H, Martel L, Houle C, et al. 2000; 11(4): 49-61.

Seniors' needs for health-related personal assistance. Chen J, Wilkins R. 1998; 10(1): 39-50.

Stress and well-being in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 21-32.

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Long working hours and health. Shields M. 1999; 11(2): 33-48.

Psychological health—depression. Statistics Canada. 2000; 11(3): 63-75.

Stress and well-being in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 21-32.

Work stress and health. Wilkins K, Beaudet MP. 1999; 10(3): 47-62.

Stroke

Oral contraceptive use. Wilkins K, Johansen H, Beaudet MP, et al. 2000; 11(4): 25-37.

Surgery

Changes in children's hospital use. Connors C, Millar WJ. 1999; 11(2): 9-19.

Gender differences in abdominal aortic aneurysm surgery. Parsons GF, Gentleman JF, Johnston KW. 1997; 9(1): 9-18.

Hysterectomy, 1981/82 to 1996/97. Millar WJ. 2001; 12(2): 9-22.

Survival rates

Death—Shifting trends in *The Health Divide—How the Sexes Differ.* Statistics Canada. 2001; 12(3): 41-6.

Trends in colorectal cancer incidence and mortality. Gibbons L, Waters C, Mao Y, et al. 2001; 12(2): 41-55.

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Therapeutic abortion
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Tuberculosis

Tuberculosis, 1994. Wilkins K. 1996; 8(1): 33-9.

U

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Income inequality and mortality among working-age people in Canada and the US. Statistics Canada. 2000; 11(3): 77-82.

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Health status of children. Statistics Canada. 2000; 11(3): 25-34.

Life expectancy. Statistics Canada. 2000; 11(3): 9-24.

W

Weight

Are recent cohorts healthier than their predecessors? Chen J, Millar WJ. 2000; 11(4): 9-23.

Body mass index and health. Gilmore J. 1999; 11(1): 31-43.

Food insecurity in Canadian households. Che J, Chen J. 2001; 12(4): 11-22.

Health care services—recent trends. Statistics Canada. 2000; 11(3): 91-109.

Heart disease, family history and physical activity. Chen J, Millar WJ, 2001; 12(4): 23-32.

Long working hours and health. Shields M. 1999; 11(2): 33-48.

Personal health practices: Smoking, drinking, physical activity and weight. Statistics Canada. 2000; 11(3): 83-90.

Starting and sustaining physical activity. Chen J, Millar WJ. 2001; 12(4): 33-43.

Taking risks/Taking care in The Health Divide—How the Sexes Differ. Statistics Canada. 2001; 12(3): 11-20.

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Personal health practices: Smoking, drinking, physical activity and weight. Statistics Canada. 2000; 11(3): 83-90.

Teenage pregnancies, 1974 to 1994. Wadhera S, Millar WJ. 1998; 9(3): 9-17.

Teenage pregnancy. Dryburgh H. 2000; 12(1): 9-19.

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Report on Smoking Prevalence in Canada, 1985 to 1999		82F0077XIE	Internet	Free
Health Care in Canada 2000 – A First Annual Report		82-222-XIE (and http://www.cihi.ca)	Internet	Free
Health Statistics: Catalogue of Products and Services		82F0058XIE	Internet	Free
Canadian Community Health Survey				
Canadian Community Health Survey Check-up*		82-004-XIE	Internet	Free
Cancer				
Cancer Incidence in Canada, 1969-1993 *(For 1994 to 1996, available as shelf table or custom tabulations through the Client Custom Services Unit)*		82-566-XPB	Paper	$ 42
Cancer Record, Newsletter for Cancer Registries in Canada		82F0081XIB	Internet	Free
Heart Disease				
The Changing Face of Heart Disease and Stroke in Canada		82F0076XIE	Internet	Free
Hospitalization				
Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures and Treatments		82-562-XPB	Paper	$ 40
Life Expectancy				
Life Tables, Canada, Provinces and Territories, 1995-1997		84-537-XIE	Internet	$ 15
Life Tables, Canada and Provinces, 1990-1992		84-537-XPB	Paper	$ 40
		84-537-XDB	Diskette	$ 40

† All prices exclude sales tax.
‡ See inside cover for shipping charges.
* Forthcoming

Title	Catalogue number	Format	Price (CAN$)†‡
National Population Health Survey			
National Population Health Survey Overview 1994-95	82-567-XPB	Paper	$ 10
	82-567-XIB	Internet	$ 8
National Population Health Survey Overview 1996-97	82-567-XPB	Paper	$35
	82-567-XIB	Internet	$26
User's guide for the public use microdata file National Population Health Survey 1998-99 - Household component	82M0009GPE	Paper	$50
User's guide for the public use microdata file National Population Health Survey 1996-97 - Household Component	82M0009GPE	Paper	$50
User's guide for the public use microdata file National Population Health Survey 1996-97 - Health Care Institutions	82M0010GPE	Paper	$50
Information about the National Population Health Survey *(See also section on Microdata files)*	82F0068XIE	Internet	Free
Nursing			
Registered Nurses Management Data 1998, Shelf Table *(This shelf table can be ordered through the Client Custom Services Unit.)*	83F0005XPB	Paper	$25
Occupational Surveillance			
Occupational Surveillance in Canada: Cause-specific mortality among workers, 1965-1991	84-546-XCB	CD-ROM	$500
Residential Care			
Residential Care Facilities, 1997-98 *(These data are available as custom tabulations through the Client Custom Services Unit.)*			
Vital Statistics			

Shelf tables

Health Statistics Division produces shelf tables for the following, from 1996 and 1997 data years.

Title	Catalogue number	Format	Price (CAN$)
General Summary of Vital Statistics	84F0001XPB	Paper	$20
Causes of Death	84F0208XPB	Paper	$20
Mortality - Summary List of Causes	84F0209XPB	Paper	$20
Mortality - Summary List of Causes, 1997	84F0209XIB	Internet	Free
Births, 1998	84F0210XPB	Paper	$20
Deaths, 1998	84F0211XPB	Paper	$20
Marriages	84F0212XPB	Paper	$20
Divorces, 1998	84F0213XPB	Paper	$20
Leading Causes of Death	84F0503XPB	Paper	$20

(These shelf tables can be ordered through the Client Custom Services Unit.)

Other

Title	Catalogue number	Format	Price (CAN$)
Validation study for a record linkage of births and deaths in Canada	84F0013XIE	Internet	Free

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† All prices exclude sales tax.
‡ See inside cover for shipping charges.

Title	Catalogue number	Format	Price (CAN$)†‡
Historical Information			
Vital Statistics Compendium, 1996	84-214-XPE	Paper	$45
	84-214-XIE	Internet	$33
Reproductive Health: Pregnancies and Rates, Canada, 1974-1993	82-568-XPB	Paper	$32
Selected Mortality Statistics, Canada, 1921-1990	82-548-XPB	Paper	$40
The Decline of Marriage in Canada, 1981 to 1991	84-536XPB	Paper	$36

Custom Tabulations

Health Statistics Division provides a custom tabulation service to meet special resource needs and supplement published data on a fee-for-service basis. Custom tables can be created using a variety of health and vital statistics data sources maintained by the Division.

To order custom tabulations, contact:

Client Custom Services Unit
Health Statistics Division
Statistics Canada
Ottawa, Ontario
K1A 0T6
Telephone: (613) 951-1746
Fax: (613) 951-0792
Email: HD-DS@statcan.ca

Microdata Files

To order the products listed below, contact:

Client Custom Services Unit
Health Statistics Division
Statistics Canada
Ottawa, Ontario
K1A 0T6
Telephone: (613) 951-1746
Fax: (613) 951-0792
Email: HD-DS@statcan.ca

National Population Health Survey public-use microdata files		Product number	Format	Price (CAN$)[†‡]
Cycle 3, 1998-99				
Household	Cross-sectional data in Flat ASCII files, User's Guide, data dictionary, indexes, layout, Beyond 20/20 Browser for the Health File	82M0009XCB	CD-ROM	$2,000
Custom tables	Household	82C0013	Price varies with information requirements	
	Institutions	82C0015	Price varies with information requirements	
Cycle 2, 1996-97				
Household	Cross-sectional Flat ASCII Files, Beyond 20/20 Browser for the Health File	82M0009XCB	CD-ROM	$500
Health care institutions	Cross-sectional Flat ASCII File	82M0010XCB	CD-ROM Clients who purchase the 1996/97 Household file will receive the Institutions file free of charge	$250
Custom tables	Household	82C0013	Price varies with information requirements	
	Institutions	82C0015	Price varies with information requirements	
Cycle 1, 1994-95				
Household	Data, Beyond 20/20 Browser Flat ASCII Files, User's Guide	82F0001XCB	CD-ROM	$300
Health care institutions	Flat ASCII Files	82M0010XDB	Diskette	$75
Custom tables	Household	82C0013	Price varies with information requirements	
	Institutions	82C0015	Price varies with information requirements	

† All prices exclude sales tax.
‡ See inside cover for shipping charges.

Other Information
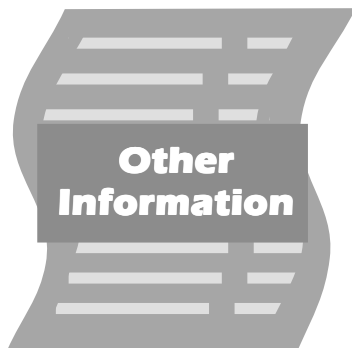
Canadian Community Health Survey (CCHS)

A new survey, the Canadian Community Health Survey (CCHS), is being conducted by Statistics Canada to provide regular and timely cross-sectional estimates of health determinants, health status and health system utilization for 132 health regions across the country.

For more information about this survey, visit our web site at http://www. statcan.ca, under "Statistical Methods," followed by "Discussion papers and new surveys."

National Population Health Survey (NPHS) Questionnaires

• Household
• Institutions
• North

The NPHS questionnaires are downloadable from Statistic Canada's website at http://www.statcan.ca, under "Statistical methods," followed by "Questionnaires and data dictionaries" and "National Population Health Survey" (NPHS).

Canadian Statistics

Obtain free tabular data on aspects of Canada's economy, land, people and government.

For more information, visit our web site at http://www.statcan.ca: under "Canadian Statistics," and then click on "Health."