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Health Reports

Spring 1999 Volume 10 No. 4

- Prescription drug insurance
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Statistics Canada
Health Statistics Division

Health Reports

Spring 1999 Volume 10 No. 4

Published by authority of the Minister responsible for Statistics Canada

April 1999

Catalogue no. 82-003-XPB, Vol. 10, No. 4
ISSN 0840-6529

Catalogue no. 82-003-XIE, Vol. 10, No. 4
ISSN 1209-1367

Frequency: Quarterly

Ottawa

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Research Articles

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Research Articles

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

Disparities in prescription drug insurance coverage

Wayne J. Millar

Abstract

Objectives

This article examines socioeconomic differences in supplementary insurance for prescription drugs among Canadians aged 15 or older and how the availability of such insurance affects prescription drug use.

Data source

The data on prescription drug insurance coverage and drug use are from the cross-sectional Health file of the 1996/97 National Population Health Survey (NPHS) conducted by Statistics Canada. The sample size of the population aged 15 or older was 70,884.

Analytical techniques

Rates of insurance coverage for prescription drug services were calculated. All summary estimates were age-adjusted using the 1996/97 population of Canada (both sexes).

Main results

Among people aged 15 or older, 61% were covered for prescription medications in 1996/97. Sixty-five percent of workers reported coverage, while those who were not working were less likely to have benefits (52%). Only 38% of lower income groups had insurance compared with 74% of the highest income group. Regardless of the number of chronic diseases individuals had, those with drug insurance were more likely to report taking medication.

Key words

health insurance, pharmaceutical services insurance, income, employment

Author

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All Canadians have access to universal medical care. The 1984 Canada Health Act, however, focuses mainly on hospital services. For example, drugs and other products and preparations that are administered in a hospital are provided to patients without charge. The Act makes no provision for prescription drugs used outside hospitals. And although the provinces cover all "medically necessary" services, the interpretation of what is medically necessary varies by province.[1] Thus, while provincial drug benefit programs have been implemented, publicly funded benefits for prescription drugs are not uniformly available across the country. As a result, when such products are used outside a hospital setting, the cost often becomes the patient's responsibility.

Compounding the problem is the recent shift away from in-patient hospital treatment and a reduction in hospital stays for a broad range of diagnoses.[2] Ambulatory care in hospital out-patient clinics and home care are becoming more common. Individuals who cannot obtain their medication

Methods

Data sources

This article is based on data from Statistics Canada's National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. 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.

This analysis of prescription drug insurance uses cross-sectional data from cycle 2 of the NPHS, which was conducted in 1996/97. The data analyzed here pertain to the household population in the 10 provinces.

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

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

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

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

The 1996/97 cross-sectional response rates for the Health file were 93.1% for the continuing longitudinal component and 75.8% for the RDD component, yielding an overall rate of 79.0%. Information in the Health file is available for 81,804 randomly selected respondents. This analysis is based on the sample of 70,884 Canadians who were aged 15 or older.

A more detailed description of the NPHS design, sample and interview procedures is found in published reports.[3,4] See also *The National Population Health Survey – its longitudinal nature* in this issue.

Information from Health Canada, the Canadian Institute for Health Information, and the Organisation for Economic Co-operation and Development (OECD) was used to supplement the NPHS data.

Analytical techniques

All estimates were weighted to represent the population at the date of the survey. The 1996/97 population of Canada aged 15 or older (both sexes) was used as the reference population for direct standardization of rates. The sample sizes for the 1996/97 cross-sectional component of the NPHS are large, so the variances associated with the estimates tend to be low. All questions about prescription drug insurance are based on non-proxy response. Weighted logistic regression was used to adjust for age and detect significant differences between groups. Coefficients of variation and standard errors were estimated using a weighted bootstrap procedure that fully accounts for the design effects of the NPHS.[5,6]

Limitations

The NPHS data do not indicate the scope or type of insurance coverage for prescription drugs. Consequently, there is no information about deductibles or the proportion of the cost that would be borne by individuals, although that could be expected to influence their prescription drug use. In addition, no information is available about the number of plans under which individuals may be covered.

The estimates of prescription drug insurance reflect the perception of the individual. It is possible that some respondents may have misinterpreted the question about prescription drug insurance coverage. For example, when asked if they currently had "insurance that covers all or part of the cost of prescription medications (including private, government or employer-paid)," respondents may have been uncertain how to answer the question if they did not directly pay a premium for coverage. In addition, some respondents may not have been aware that they had coverage under a spouse's or parent's plan, or under various provincial plans.

in a hospital must either pay for their prescriptions directly, or rely on insurance to help defray the expense.

This article uses data from the 1996/97 National Population Health Survey (NPHS) to look at the proportion of the population that has insurance coverage for prescription drugs. Comparisons of the insured and non-insured populations are also made (see *Methods* and *Definitions*).

Sources of coverage

Prescription drug insurance is available from either public or private sources. Public sources include the provincial plans, which may provide drug benefits to specific groups; for example, people older than 65, individuals with certain chronic diseases, and those receiving social assistance (Appendix Table A).

Private plans include those offered through employment or from private insurance companies. Employers may pay for workers' prescription medications through extended health care benefits. Some unions also provide extended health benefits to their members. Private insurance companies manage extended benefit packages and may cover services that do not fall under government plans.

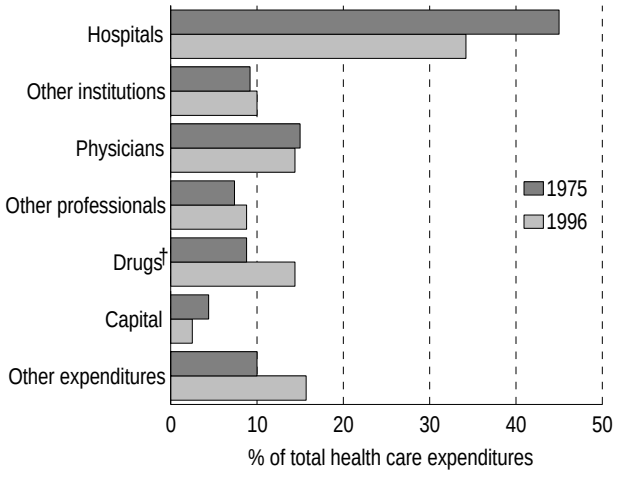
Shift in health care spending

The pattern of total health care expenditures changed between 1975 and 1996 (Chart 1, Appendix Table B).[7,8] The proportion going to hospitals, physicians, and capital expenditures declined. By contrast, the share allocated to other institutions, other professionals, and drugs (prescribed and non-prescribed) rose. In 1996, approximately $10.2 billion was spent on drugs (Appendix Table C), with most of it ($7.0 billion or 68.3%) borne by the private sector.

An international study showed that, in 1995, after co-payments and deductibles were taken into account, public programs covered 45% of drug costs in Canada. This compared with 90% in the United Kingdom and the Netherlands and 25% in the United States (Chart 2).[9]

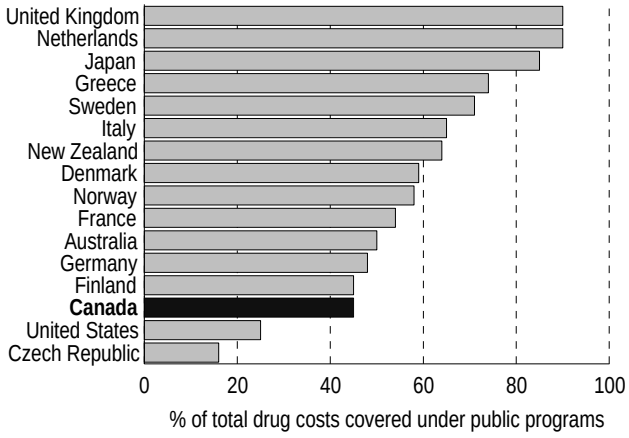
Prescription drugs make up a rising share of the health care budget. In 1996, prescription drugs represented 10.0% of total health care expenditures, up from 6.3% in 1975 (Appendix Table B). In 1975, the public sector (government and government agencies) covered one-third of the cost (33.2%) of prescription drugs. About two decades later, in 1996, this share had risen to almost one-half (48.3%). Although the private sector's share declined over

Chart 1
Health care expenditures, by category, Canada, 1975 and 1996



Data sources: *Health Canada and Canadian Institute for Health Information, references 7 and 8*
† Includes prescribed and non-prescribed (over-the-counter drugs and personal health supplies).

Chart 2
Share of costs† of pharmaceutical goods paid by public programs, Canada and selected countries, 1995



Data source: *Organisation for Economic Co-operation and Development, reference 9*
† Billing less average co-payment and deductible

the same period, by 1996, it was still absorbing just over half (51.7%) of the cost (data not shown).

Provincial governments account for the major share of public sector drug expenditures, spending about $3.0 billion in 1996. This represented close to one-third (29.6%) of total drug expenditures that year, up from 13.2% in 1975 (Appendix Table C).

Wide variations in provincial plans

Provincial prescription drug benefits vary considerably (Appendix Table A). The specific benefits and co-payments or deductibles differ from plan to plan. (Co-payment refers to payment of a proportion of the prescription cost by the consumer. Deductible refers to payment by the consumer of the full cost of a prescription up to a specified

Definitions

Prescribed drugs are those substances sold under the Food and Drug Act that require a prescription. *Non-prescribed drugs* are over-the-counter drugs and personal health supplies such as oral hygiene products and diagnostic test strips.

NPHS respondents were asked: "Do you have insurance that covers all or part of the cost of your prescription medications? (including private, government or employer-paid plans)."

The *number of drugs taken in the past month* by individuals who had been diagnosed with chronic disease was used as an indicator of the influence of drug insurance coverage on medication use. Respondents were asked: "In the past month, did you take any of the following medications?" The following drugs, which are usually available only with a prescription, were considered for this article: tranquilizers, anti-depressants, codeine, demerol or morphine, asthma medications such as inhalers or nebulizers, penicillin or other antibiotics, medicine for the heart, medicine for blood pressure, diuretics, steroids, insulin, pills to control diabetes, sleeping pills, birth control pills, hormones for menopause or aging, and thyroid medication.

Respondents were asked if they had "long-term conditions that have lasted or are expected to last 6 months or more and that have been diagnosed by a health professional." To assess the implications of not having prescription drug insurance, this analysis is based on people with specific medical conditions that are typically treated with prescription drugs: asthma, arthritis, high blood pressure, migraine, chronic bronchitis or emphysema, diabetes, epilepsy, heart disease, cancer, stomach or intestinal ulcers, stroke, thyroid, and glaucoma.

Drug use is influenced by the presence of *chronic conditions*.[10] Consequently, a derived variable that measures the number of chronic conditions a person had was used to place that person into one of the following categories: no chronic diseases, one, two, three, four, and five or more.

Household income levels were defined as lowest/lower-middle, middle, upper-middle and highest , based on total household income and the number of people living in the household.

Employment status was categorized as currently working or not currently working. Those who were working at the time of the survey were classed as full-time (30 or more hours per week) or part-time (less than 30 hours per week). Those who were not working either had a job but were not currently working, or they had not worked in the past 12 months. If respondents were not working, another question asked them why. The reasons used in this analysis are: own illness or disability; family responsibilities; student/educational leave; labour dispute/layoff; retired the entire year; looking for work; and other reasons.

Occupation was based on a derived variable, the Pineo scale, a prestige-based occupational ranking. Occupations were grouped into 16 categories: self-employed professionals; employed professionals; high-level management; semi-professionals; technicians; middle management; supervisors; foremen and forewomen; skilled clerical/sales/service; skilled crafts and trades; farmers; semi-skilled clerical/sales; semi-skilled manual; unskilled clerical/sales/service; unskilled manual; and farm labourers.

Respondents were asked to report their *main source of household income* in the past year. They could choose from: wages and salaries; self-employment; dividends and interest (on bonds, savings); Employment Insurance; Workers' Compensation; benefits from Canada or Quebec Pension Plans; retirement pensions, superannuation and annuities; Old Age Security and Guaranteed Income Supplement; Child Tax Benefit; provincial or municipal social assistance or welfare; child support/alimony; and other (e.g., rental income or scholarship).

amount.) Most provinces offer benefits to seniors (65 or older) and to people receiving Social Assistance, as well as to children and lower income groups. In addition, most provinces offer some kind of provision for special drugs needed for certain diseases; for example, diabetes, cystic fibrosis or HIV/AIDS.

Six in ten covered

The population covered by drug insurance benefits has been growing.[11] Among the lower income groups, the increase in coverage is partly attributable to provincial health care plans. Among the upper income groups, the growth is attributable to the purchase of private insurance or the provision of insured benefits through employment.

According to the 1996/97 NPHS, about 61% of both men and women aged 15 or older reported that they had insurance coverage for prescription medications. Drug insurance coverage tends to be relatively low among younger and older Canadians (Table 1). Just over half of the population in the 15-to-24 and 65-or-older age groups reported having some coverage for prescription drugs. By contrast, about two-thirds of those aged 25 to 64 reported that they were insured. The higher coverage among the middle age groups, who are more likely to be working, reflects the additional benefits that are often available through employment.

Rates of coverage rose along with educational level, from 52% for those with less than high school to 65% for those with a college diploma or a university degree.

The percentage of individuals reporting coverage varied by province as well, from less than half to over two-thirds. Given the extensive benefits offered by the various provincial plans, this may indicate that some respondents are unaware that they have some drug coverage and are entitled to some benefits.

Coverage also varied by family type, with couples being more likely to have drug insurance than single people or lone-parent families. About half of one-person households reported coverage, but individuals in households with two or more members had much higher rates.

Table 1
Household population aged 15 or older with prescription drug insurance, by selected socio-demographic characteristics, Canada excluding territories, 1996/97

	Number	Prescription drug insurance
	'000	Age-adjusted %
Sex		
Both sexes	23,444	61
Men	11,519	61
Women	11,925	61
Age group		
15-24	3,983	53
25-44	9,709	65
45-64	6,335	65
65+	3,416	51
Level of education		
Less than high school	6,376	52
High school	3,909	62
Some postsecondary	5,398	61
College diploma or university degree	7,595	65
Not stated	165	58
Province		
Newfoundland	449	56
Prince Edward Island	107	60
Nova Scotia	738	67
New Brunswick	607	63
Quebec	5,862	54
Ontario	8,879	66
Manitoba	857	48
Saskatchewan	752	40
Alberta	2,121	68
British Columbia	3,072	62
Economic family type		
Couple with children under age 25	9,237	63
Couple alone	5,384	62
Couple with children under age 25 and others	1,350	57
Couple with or without children aged 25 or older, with or without others	1,242	55
Lone parent with children under age 25	1,334	52
Single	3,171	51
Single with others	776	51
Other lone-parent household	765	50
Other	181	54
Not stated	3	- -
Number of persons in household		
One	3,171	51
Two	6,954	61
Three	4,627	62
Four	5,211	65
Five or more	3,480	58

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
- - Amount too small to provide reliable estimate

Table 2
Household population aged 15 to 74 with prescription drug insurance, by current employment status and occupation, Canada excluding territories, 1996/97

	Number	Prescription drug insurance
	'000	Age-adjusted %
Employment status		
Total	**22,124**	**62**
Currently working	13,814	65
Not currently working†	8,070	52
Worked in past 12 months, but current work status unknown	127	50
Not stated	113	58
Hours of work per week (main job)		
Total	**13,814**	**65**
30+ (full-time)	11,105	65
<30 (part-time)	2,551	57
Not stated	158	52
Reason for not currently working		
Total	**8,070**	**52**
Own illness or disability	961	59
Family responsibilities	1,337	57
Retired for the entire year	2,742	45
Looking for work	520	39
Student/Educational leave	1,537	37
Labour disputes/Layoff	586	37
Other reasons	173	48
Not applicable	131	55
Not stated	83	53
Occupation‡		
Total	**13,814**	**65**
Employed professionals	1,132	78
Technicians	310	76
High-level management	425	73
Skilled clerical/Sales/Service	1,045	70
Semi-professionals	1,151	68
Middle mangagement	1,259	68
Skilled crafts and trades	1,138	66
Unskilled clerical/Sales/Service	1,027	66
Semi-skilled manual	1,148	65
Foremen/Forewomen	305	64
Semi-skilled clerical/Sales	1,946	60
Supervisors	323	58
Unskilled manual	1,486	58
Self-employed professionals	191	49
Farm labourers	183	36
Farmers	165	28
Not stated	580	63

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Had a job but not currently working, or did not work in past 12 months.
‡ Categories are from the Pineo scale; however, its prestige-based ranking is not used here.

Full-time workers more likely to have coverage

As expected, the working population had a relatively high rate of prescription drug insurance coverage. Sixty-five percent of those who were working at the time of the survey stated that they were insured (Table 2), while individuals who were not working were considerably less likely to have benefits (52%). Full-time workers reported a higher rate of coverage than their part-time counterparts: 65% compared with 57%.

Among current workers, the percentage with drug insurance varied by occupation. Employed professionals showed the highest rates of coverage (78%). Self-employed professionals were much less likely to have drug insurance (49%), and farmers (28%) and farm labourers (36%) were least likely to be insured.

For non-workers, the highest rates of coverage were reported by those who were not working because of an illness or disability (59%) or family responsibilities (57%). Students and people on educational leave, along with those who were not working because of a labour dispute or layoff, reported the lowest coverage (37%).

The strong link between work status and prescription drug insurance coverage has implications for the continuity of health care. Between 1981 and 1994, job tenure became more polarized between long- and short-term jobs.[12] Employers are increasingly using a small core of long-term employees and hiring supplementary short-term employees as needs dictate.[13] The latter may not have access to the benefits that are available to full-time workers. Benefit packages are often subject to minimum service requirements, such as 6 or 12 months of continuous employment.[14] Only about 20% of all organizations offer the same benefits to both regular and contingent workers.[15] When insured individuals are laid off or retire, there is no guarantee that they will retain their supplementary health benefits. In fact, according to the 1996/97 NPHS, fewer than half of retired individuals (45%) said they had prescription drug insurance.

Income a major factor

Prescription drug insurance benefits are strongly associated with household income (Table 3). Generally, the rates increase along with income. In fact, the insured rate for the highest income group was almost double that for the lowest (74% compared with 38%).

The main source of income, which reflects employment status, is also a factor in prescription drug insurance coverage. Persons whose household income was derived mainly from wages and salaries were most likely to report coverage (67%). In contrast, individuals who reported Employment Insurance as their main source of income were the least likely to have benefits (25%). People deriving their income mainly from self-employment or from dividends also reported a low rate of coverage (36%).

Although individuals whose main income source was Old Age Security and the Guaranteed Income Supplement are covered by most provincial drug plans, only 31% of this group reported prescription drug coverage. This apparent anomaly could be attributed to misinterpretation of the question, or lack of knowledge about drug benefits.

Individuals in the lowest and lower-middle income groups who reported their health as fair or poor were more likely than healthier people with similar incomes to have prescription drug insurance (Table 4). However, even among those who reported their health as fair or poor, the rate of coverage rose with income.

Table 3
Household population aged 15 or older with prescription drug insurance, by household income level and main source of income, Canada excluding territories, 1996/97

	Number	Prescription drug insurance
	'000	Age-adjusted %
Household income level		
Lowest/Lower-middle	3,051	38
Middle	5,865	53
Upper-middle	7,655	72
Highest	2,966	74
Missing	3,906	56
Main source of household income		
Wages and salaries	14,491	67
Child support/Alimony	50	58
Retirement pension, superannuation, annuities	1,653	57
Canada/Quebec Pension Plan	1,003	48
Child tax benefits	17	47
Provincial or municipal social assistance/Welfare	822	45
Workers' Compensation	108	39
Self-employment	2,218	36
Dividends and interest	227	36
Old Age Security/Guaranteed Income Supplement	1,124	31
Employment Insurance	172	25
Other	378	42
Don't know/Refused/Not stated	1,180	56

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

Table 4
Household population aged 15 or older with prescription drug insurance, by household income level and self-rated health status, Canada excluding territories, 1996/97

Household income level/ Self-rated health status	Number	Prescription drug insurance
	'000	Age-adjusted %
Lowest/Lower-middle		
Total	**3,051**	**38**
Fair/Poor	618	46
Good	985	38
Very good/Excellent	1,448	35
Middle		
Total	**5,865**	**53**
Fair/Poor	646	58
Good	1,715	49
Very good/Excellent	3,505	53
Upper-middle		
Total	**7,655**	**72**
Fair/Poor	504	74
Good	1,966	71
Very good/Excellent	5,184	73
Highest		
Total	**2,966**	**74**
Fair/Poor	133	71
Good	624	74
Very good/Excellent	2,209	74
Missing		
Total	**3,906**	**56**
Fair/Poor	425	54
Good	1,061	57
Very good/Excellent	2,421	56

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

Health status and prescription drug insurance

Surprisingly, the rates of coverage for prescription drug insurance did not vary between individuals with and without long-term disabilities: 62% and 61%, respectively.

Prescription drug insurance coverage was, however, directly associated with the number of chronic conditions a person had. With an increasing number of chronic illnesses, the need for drugs increases. This may heighten an individual's awareness of the degree of coverage he or she has, or it may lead to the purchase of supplementary coverage. About 59% of people with no chronic conditions had coverage, compared with 67% of those with three or more chronic diseases (Table 5). Because the estimates were age-adjusted, these differences are not attributable to age differences between the groups.

There was also a gradient in the prevalence of prescription drug insurance by the number of drugs used in the previous two days. Among those who had used no drugs, 61% had prescription drug insurance; the figure rose to 72% among those who had taken three or more drugs in the past two days.

Even among individuals who had not been diagnosed with a chronic condition, those with insurance were more likely to report using prescription drugs in the past month (Table 6). And among people with three or more chronic conditions, about 74% of the insured had used at least two drugs, compared with 58% of the non-insured. Differences in the nature of chronic conditions between the insured and non-insured populations could influence the number of drugs used. However, comparisons of the two groups in terms of the type of chronic diseases revealed few differences (data not shown). Consequently, the lower reported drug use among the non-insured population cannot be solely attributed to better health.

Table 5
Household population aged 15 or older with prescription drug insurance, by selected health characteristics, Canada excluding territories, 1996/97

	Population	Prescription drug insurance
	'000	Age-adjusted %
Long- term disability		
Yes	2,798	62
No	20,599	61
Missing	47	--
Number of chronic conditions		
None	14,447	59
One	5,551	63
Two	2,174	64
Three or more	1,272	67
Number of drugs taken in past two days		
None†	8,372	61
One	5,467	63
Two	2,490	65
Three or more	2,141	72
Not applicable‡	4,863	54
Missing	110	--

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Had taken drugs in past month, but not in past two days.
‡ Had not taken any drugs in past month.
-- Amount too small to provide reliable estimate

Table 6
Number of prescription drugs taken in past month, household population aged 15 or older, by number of chronic conditions and drug insurance status, Canada excluding territories, 1996/97

Number of chronic conditions/Drug insurance status	Population	Number of prescription drugs taken in past month			
		None	1	2	3+
	'000	%			
Total	**23,443**	**58**	**25**	**10**	**7**
Insured	14,300	55	26	11	8
Not insured	8,759	62	24	8	6
None					
Total	**14,446**	**73**	**20**	**5**	**2**
Insured	8,688	71	22	6	2
Not insured	5,469	76	18	4	2
One					
Total	**5,551**	**44**	**35**	**14**	**7**
Insured	3,459	42	35	16	8
Not insured	2,026	48	36	11	5
Two					
Total	**2,174**	**24**	**36**	**22**	**19**
Insured	1,339	22	36	21	21
Not insured	819	26	35	23	16
Three or more					
Total	**1,272**	**13**	**17**	**26**	**44**
Insured	814	11	15	28	46
Not insured	445	18	24	21	37

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Note: *Percentages may not add to 100 because of rounding. Excludes insurance status missing.*

The tendency for people without insurance to use fewer prescription drugs may reflect a decision to limit their use to essential medications.[16-20] People who do not have drug coverage may be deterred by the expense. A number of studies[17,18,21,22] have looked at patients who cannot afford prescriptions, and have found various behaviours. Some patients may not purchase a medication if it is too expensive. Others may hoard outdated prescriptions, use prescriptions intended for someone else, or take more drugs than prescribed in hopes of reducing the duration of illness. It has also been noted that elderly patients on fixed incomes make choices about which medications they can afford. It is not unusual for patients to forego expensive anti-depressants and take only what they feel are more necessary drugs (cardiovascular medication, for example).[18]

There is evidence that patients' health may be compromised if they do not have access to drug therapy.[20,23,24] Without proper drug treatment, a disease may progress to more acute levels. For example, not taking blood pressure medication may result in stroke, and failure to take prescribed antibiotics may lead to a relapse of an infection or to the development of resistant strains of bacteria. Unfortunately, such practices may increase the cost of health care in the long run. A conservative estimate of the costs of non-compliance in Canada is $7 billion to $9 billion per year.[21]

Concluding remarks

Over the past 20 years, prescription drugs have accounted for a rising share of Canadian health care costs. Hospital admissions and the length of hospital stays have declined, to some extent, because pharmaceuticals are now available to deal with medical problems that once would have required hospitalization. Thus, the increasingly prominent role of drugs has contributed to the shift from hospital to ambulatory and home care. But this change has meant that as the importance of drug treatment has grown, fewer people receive drugs in a hospital setting. Access to medications is now more and more the responsibility of the individual.

While the public sector has paid a growing share of drug costs over the past two decades, many individuals are not covered under provincial drug care plans and have no other coverage. They must often bear the full cost of their prescription drugs.

Even those eligible for provincial drug care benefits may find those benefits reduced. In an effort to control the cost of prescription drugs, some provinces have undertaken a number of cost control measures, including using lists of drugs eligible for reimbursement (prescription drug formularies) and reference-based pricing to limit the amount paid.[25] Others have removed some drugs from their drug formularies or have introduced co-payments or deductibles.[26]

However, concerns have been expressed that efforts to control costs through co-payments or by eliminating some drugs from formulary plans will reduce the use of medically necessary drugs.[27] Several studies have shown that patients may reduce or abruptly terminate their use of prescription drugs when deductibles or co-payments are required.[16,18,28,29]

Acknowledgements

The author thanks Geoff Ballinger, Canadian Institute for Health Information, for providing data on prescription drug expenditures.

References

1 Rachlis MM. Defining basic services and de-insuring the rest: The wrong diagnosis and the wrong prescription. *Canadian Medical Association Journal* 1995; 152(9): 1401-5.

2 Randhawa J, Riley R. Trends in hospital utilization, 1982-83 to 1992-93. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 41-9.

3 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.

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

5 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.

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

7 Health Canada. *National Health Expenditures in Canada, 1975-1994*. Ottawa: Minister of Supply and Services, 1996.

8 Canadian Institute for Health Information. *National Health Expenditure Trends, 1975-1998*. Ottawa: Canadian Institute for Health Information, 1998.

9 Organisation for Economic Co-operation and Development. *Health Data '98 CD-ROM*. Paris: Organisation for Economic Co-operation and Development, 1997.

10 Millar WJ. Multiple medication use among seniors. *Health Reports* (Statistics Canada, Catalogue 82-003) 1998; 9(4): 11-17.

11 Lexchin J. Income class and pharmaceutical expenditure in Canada: 1964-1990. *Canadian Journal of Public Health* 1996; 87(1): 46-51.

12 Grenon L, Chun B. Non-permanent paid work. *Perspectives on Labour and Income* (Statistics Canada, Catalogue 75-001-XPE) 1997; 9(3): 21-31.

13 Heisz A. Changes in job tenure. *Perspectives on Labour and Income* (Statistics Canada, Catalogue 75-001-XPE) 1996; 8(4): 31-5.

14 Schellenberger G, Clark C. Temporary employment in Canada: Profiles, patterns, and policy considerations. *Social Research*, Paper no. 1. Ottawa: Canadian Council on Social Development, 1996.

15 Booth P. *Contingent Work: Trends, Issues and Challenges for Employers,* Report 192-97. Ottawa: The Conference Board of Canada, 1997.

16 Leibowitz A, Manning WG, Newhouse JP. The demand for prescription drugs as a function of cost-sharing. *Social Science and Medicine* 1985; 21(10): 1063-9.

17 Salzman C. Medication compliance in the elderly. *Journal of Clinical Psychiatry* 1995; 56(Suppl 1): 18-22.

18 Soumerai SB, Avorn J, Ross-Degnan D, et al. Payment restrictions for prescription drugs under Medicaid. Effects on therapy, cost and equity. *New England Journal of Medicine* 1987; 317(9): 550-6.

19 Foxman B, Valdez RB, Lohr KN, et al. The effect of cost sharing on the use of antibiotics in ambulatory care: Results from a population-based randomized controlled trial. *Journal of Chronic Diseases* 1987; 40(5): 429-37.

20 Soumerai SB, Ross-Degnan D, Avorn J, et al. Effects of Medicaid drug-payment limits on admission to hospitals and nursing homes. *New England Journal of Medicine* 1991; 325(15): 1072-7.

21 Coombs RB, Jensen P, Her MH, et al. *Review of the Scientific Literature on the Prevalence, Consequences, and Health Costs of Non-compliance and Inappropriate Use of Prescription Medication in Canada*. Ottawa: Pharmaceutical Manufacturers Association of Canada, 1995.

22 Roemer MI, Hopkins CE, Carr L, et al. Copayments for ambulatory care: Penny-wise and pound-foolish. *Medical Care* 1975; 13(6): 457-66.

23 Johnson RF, Goodman MJ, Hornbrook MC, et al. The impact of increasing patient prescription drug cost sharing on therapeutic classes of drugs received and on the health status of elderly HMO members. *Health Services Research* 1997; 32(1): 103-22.

24 Soumerai SB, McLaughlin TJ, Ross-Degnan D, et al. Effects of a limit on Medicaid drug-reimbursement benefits on the use of psychotropic agents and acute mental health services by patients with schizophrenia. *New England Journal of Medicine* 1994; 331(10): 650-65.

25 Dingwall D. *Drug Costs in Canada*. Ottawa: Health and Welfare Canada, 1997.

26 Brooke J. High cost of Ontario drug benefit plan sees more medication cut from list. *Medical Post* 1993; 2(36).

27 Lexchin J. Prescribing and drug costs in the province of Ontario. *International Journal of Health Services* 1992; 22(3): 471-7.

28 Martin BC, McMillan JA. The impact of implementing a more restrictive prescription limit on Medicaid recipients. Effects on cost, therapy and out-of-pocket expenditures. *Medical Care* 1996; 34(7): 686-701.

29 O'Brien B. The effect of patient charges on the utilization of prescription medicines. *Journal of Health Economics* 1989; 8: 109-32.

30 Bacovsky RA. *Federal, Provincial and Territorial Government-sponsored Drug Plans and Drug Databases*. Background information prepared for the Conference on National Approaches to Pharmacare. Integra Consulting Ltd., December 2, 1997.

31 Government of Newfoundland and Labrador, Department of Health and Community Services. Available at: http://www.gov.nf.ca/health. Accessed January 27, 1999.

32 The Official Website of the Government of Prince Edward Island, Health and Social Services. Available at: http://www.gov.pe.ca/hss. Accessed January 27, 1999.

33 Nova Scotia, Prescription Drug Plan Regulations. Available at: http://www.gov.ns.ca/just/regulations/regs/hsidrugs.html. Accessed January 27, 1999.

34 Nova Scotia, Seniors' Pharmacare Program Regulations. Available at: http://www.gov.ns.ca/just/regulations/regs/hsisenor.html. Accessed January 27, 1999.

35 Nova Scotia, Family Benefits Schedule "B" Regulations. Available at: http://www.gov.ns.ca/just/regulations/regs/fbschedb.html. Accessed January 27, 1999.

36 New Brunswick Prescription Drug Program. Available at: http://www.gov.nb.ca.hcs. Accessed January 27, 1999.

37 Communication-Québec. Available at: http://www.com-qc.ca/55health.html. Accessed January 27, 1999.

38 Ontario Ministry of Health, Drug Programs. Available at: http://www.gov.on.ca/health/english/pub/pub_links/pub_link4.html. Accessed February 16, 1999.

39 Pharmacare, Manitoba Health. Available at: http://www.gov.mb.ca/health/pharmaca.html. Accessed January 27, 1999.

40 Saskatchewan Health Programs and Services. Available at: http://www.gov.sk.ca/health/progserv.html. Accessed January 27, 1999.

41 Alberta Ministry of Health, Alberta Health Care Insurance Plan, Statistical Supplement, 1997-98. Available at: http://www.health.gov.ab.ca/public/document/ssup97-98/sec5.html. Accessed January 27, 1999.

42 Alberta Blue Cross, Non-group Coverage, Hospital and Health Coverage for Albertans. Available at: http://www.health.gov.ab.ca/ahcip/bluecros/index.html. Accessed February 3, 1999.

43 British Columbia Ministry of Health and Ministry Responsible for Seniors, Pharmacare. Available at: http://www.hlth.gov.bc.ca/pharme/index.html. Accessed February 3, 1999.

Appendix A

Table A
Overview of provincial drug insurance programs in Canada

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
Newfoundland and Labrador	Newfoundland and Labrador Prescription Drug Program:				
	Senior Citizens' Drug Subsidy Plan	All residents aged 65 or older who receive the Guaranteed Income Supplement.	None, except as indicated in description of eligible beneficiaries.	Recipient pays dispensing fee directly to pharmacist. Prescription fees vary according to competitive practices.	Pharmacy bills plan directly for service. Patient is responsible for dispensing fee and professional services.
	Social Services Drug Plan	Recipients of long-term care or those who qualify for social service benefits.		None.	Retailers bill Department of Health and Community Services for reimbursement.
	Newfoundland and Labrador Interchangeable Drug Products Formulary	Lists commonly used drugs that have chemical and therapeutic equivalence; established to help general population obtain prescription drugs at reasonable price.			
Prince Edward Island	Drug Cost Assistance Plan (for seniors) Welfare Assistance Program Special Drug Programs Drug benefits are listed in the Drug Cost Assistance Plan Formulary. There is a least-cost-alternative pricing policy.	Any person requiring drugs for tuberculosis, rheumatic fever, diabetes, multiple sclerosis, phenylketonuria, transplant therapy, AIDS, renal failure, children with cystic fibrosis if family in need, all Welfare Assistance clients, any persons aged 65 or older, residents of government manors and government-subsidized beds in private nursing homes.	None, except as indicated in description of eligible beneficiaries.	Various co-payment charges including those for vaccines, pharmacist dispensing fees, insulin vials, and Welfare Assistance emergency prescriptions. Co-payments apply only to certain plan components. Seniors pay first $7 of ingredient cost for prescription and pharmacy dispensing fee.	Retailers bill Department of Health and Community Services for reimbursement.

Overview of provincial drug insurance programs in Canada – continued

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
Nova Scotia	Seniors Pharmacare Program	Residents of province aged 65 or older. Each senior contributes annual premium of $215. When a senior meets low income criteria, there are provisions to reduce the premium payable.	Persons with coverage under other drug plans.	Payment to pharmacy of 20% of the charge to Pharmacare for dispensing the drug up to a maximum of $200 per year per senior.	Insured benefits may be obtained from a non-participating pharmacy, physician or institution. Bills are submitted by providers to the plan.
	Special Drug Program	Provincial residents who qualify for income assistance. Residents who qualify under Family Benefits Program. Children in foster care. Residents diagnosed with cystic fibrosis, diabetes insipidus, growth hormone deficiency, HIV/AIDS, or who have had organ transplants.		$3 per prescription; no yearly limit. 20% co-payment (maximum of $150 per person per year).	
	Canadian Cancer Society Funded Drug Program	Cancer patients who meet income requirements. Patients whose gross family income is under $12,000 per year. Patients whose gross family income is between $12,001 and $15,720 and who have no other drug coverage.	Cancer patients with gross family income of more than $12,000 per year.	Cancer patients may be required to share costs. Although there is no co-payment, some drugs cost more than maximum allowable cost, and patients are responsible for difference in price.	Payments normally made directly to provider except for cancer drugs for which payment is made to the Cancer Society.

Overview of provincial drug insurance programs in Canada – continued

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
New Brunswick	Prescription Drug Program consists of: Seniors Drug Plan, Nursing Home Beneficiary Group; Human Growth Hormone; Children in Care; Organ Transplant Beneficiary Group; Cystic Fibrosis Beneficiary Group; HIV Beneficiary Group; and Human Resources Development.	Seniors aged 65 or older who receive the Guaranteed Income Supplement or qualify for benefits by a declaration of income. Eligibility is based on income.	None, except as indicated in description of eligible beneficiaries.	Beneficiaries of Seniors Plan required to pay co-payment of $9.05 per prescription. Annual co-payment for Guaranteed Income Supplement recipients. Yearly co-payment ceiling applies only to seniors who receive Guaranteed Income Supplement. Cystic fibrosis, HIV, organ transplant, human growth hormone programs: registration fee of $50 and co-payment of $20 for each prescription up to annual ceiling of $500 per family. Persons on social assistance are exempt from yearly registration fee.	Services provided are billed directly to the plan.

Overview of provincial drug insurance programs in Canada – continued

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
Quebec	Prescription Drugs and Pharmaceutical Services Program	Provides basic coverage for all Quebec residents– persons are insured under a group plan (Group Insurance or Employee Benefit Plan) or by the Régie de l'assurance-malade du Québec (RAMQ). Prescription drug insurance is obligatory and financial contributions are required; Income Security Recipients; persons aged 65 or older (RAMQ); and persons without access to prescription drug insurance (covered by RAMQ).	Classes of persons entitled to coverage under another act of Quebec, Act of Parliament, or laws of another province. Alternative coverage must be at least equivalent to basic Quebec plan.	In group plans, must not exceed 25% of cost of prescription drugs purchased. Maximum contribution must not exceed $750 per adult per year, including any deductible amount applicable to children. Persons insured by board must pay premium of $175 per year whether or not any medications purchased. Maximum contribution based on combination of premium charges, deductibles and co-insurance charges. Maximum contribution varies by beneficiary class and income. For persons aged 65 or older receiving the Guaranteed Income Supplement, a maximum of $16.67 to $62.50 per month per adult, depending on level of Guaranteed Income Supplement. Persons on Income Security pay $16.67 per month per adult. Persons without access to RAMQ pay maximum of $62.50 per month per adult; no contributions payable for children.	Services provided by pharmacists who are members of l'Association québécoise des pharmaciens.

Overview of provincial drug insurance programs in Canada – continued

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
Ontario	Three programs: Ontario Drug Benefit Program; Trillium Drug Program; Special Drugs Program. Each eligible drug product is listed in Drug Benefit/Formulary/ Comparative Drug Index.	People aged 65 or older; residents of long-term care facilities or homes for special care; people receiving professional services under the Home Care Program; social assistance recipients (general welfare or family benefits assistance); and Trillium Drug Program recipients. The Special Drugs Program provides selected drugs for Ontario residents with end-stage renal disease, cystic fibrosis, Gaucher's Disease, growth hormone deficiency, HIV/AIDS, organ transplants, schizophrenia, and thalassemia.	Ontario residents not specifically identified as eligible.	Single people aged 65 or older with annual income of $16,018 or more and seniors in couples with a combined income of $24,175 or more pay $100 deductible per senior, then pay up to $6.11 toward dispensing fee. Up to $2 per prescription, at discretion of pharmacist. Income-based deductible per person per family per year, then up to $2 per prescription, at discretion of pharmacist.	Services provided online through network of pharmacies, dispensing physicians, hospital outpatient pharmacies. Providers submit claim to plan. Persons not eligible for coverage under Ontario Drug Benefit Program pay between $1.99 and $16.95 dispensing fee per prescription. Maximum dispensing fee for drugs listed in formulary is $6.11. Pharmacy mark-up is 10% over Drug Index price.
Manitoba	Three programs: Pharmacare; Social Allowance Health Services; Personal Care Home Drug Program. The Manitoba Drug Benefits and Interchangeability Formulary lists benefits under the Pharmacare Program and inter-changeable drugs.	Persons eligible for Manitoba Health coverage whose prescriptions not paid by other provincial or federal programs or by private drug insurance program; persons whose eligible prescription drug costs exceed their Pharma-care deductible; residents who receive social assistance or who are residents of personal care homes.		Deductible of 3% of adjusted family income over $15,000 or 2% of adjusted family income under $15,000. No co-payment after deductible is exceeded. None for recipients of social assistance, or for residents of personal care homes.	Service provided by pharmacists, and in some regions, physicians. Registrants to Pharmacare program are assessed for deductible portion of drug charges. Online pharmacy database determines deductible charge. After deductible exceeded, program pays 100% of eligible prescription drug charges.

Overview of provincial drug insurance programs in Canada – continued

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
Saskatchewan	Saskatchewan Prescription Drug Plan Saskatchewan Formulary lists drugs approved for coverage under the Drug Plan.	All residents holding valid Saskatchewan Health Services card, except those whose prescription costs are paid by another government agency.	Those whose prescription costs are paid by another government agency: Status Indians, Department of Veterans Affairs beneficiaries, Workers' Compensation Board claimants, RCMP, Armed Forces personnel, federal penitentiary inmates.	Deductibles depend on type of beneficiary. For families on Family Income Supplement: $100 deductible semi-annually; co-payment of 35%. For seniors who receive Guaranteed Income Supplement: $200 deductible semi-annually; co-payment of 35%. For residents on Saskatchewan Assistance Plan: $2 per prescription, waived for certain adults and children under age 18, or for people on long-term medications. Co-payment waived for Saskatchewan Aids to Independent Living, persons with cystic fibrosis or chronic end-stage renal disease, registered palliative care patients, residents using certain high cost drugs. Deductible and co-payment adjusted for families, including families with seniors if annual drug costs exceed 3.4% of adjusted income. All other residents: $850 deductible semi-annually per person or family, then 35% co-payment.	Claims submitted by means of electronic data and adjudicated online. Pharmacies collect payment.

Overview of provincial drug insurance programs in Canada – continued

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
Alberta	Alberta Health Alberta Health Drug Benefit List identifies drug benefits and whether they have full or restricted listings. All plans are administered by Alberta Blue Cross.	Prescription drugs available without charge to registered Alberta residents aged 65 or older, their spouses and dependants, persons who qualify for Alberta Widows Pension (ages 55 to 64) and their dependants. Voluntary plan available to other registered Alberta residents subject to payment of a premium. Alberta Health also funds drugs for residents of long-term care facilities and designated drugs under Special Drug Programs for Alberta residents with cancer, cystic fibrosis, growth hormone deficiency, HIV/AIDS, organ transplants, tuberculosis, sexually transmitted diseases, and rheumatic fever. These programs are funded under global budget provided to regional health authorities and the Alberta Cancer Board.	None.	Annual $50 deductible on non-drug benefits (except for senior citizens and eligible widows) and 30% co-payment charge for prescriptions up to maximum of $25 per eligible drug per prescription. Alberta government maintains Alberta Health Drug Benefit List. Program will only pay for lowest-priced drug product where interchangeable products can be used. $25 maximum does not apply in cases where more expensive drug is selected; these patients are responsible for additional cost. No charge for designated drugs through special programs; beneficiaries must be registered with individual programs and obtain drugs through designated hospital pharmacies in Edmonton and Calgary.	Depending on benefit covered, Alberta Blue Cross will pay provider of service, pharmacy, or patient.

Overview of provincial drug insurance programs in Canada – concluded

Province	Plan	Eligible beneficiaries	Exclusions	Co-payment/ Deductible	Mode of payment
British Columbia	Pharmacre	Pharmacare is divided into plans that cover: seniors; permanent residents of adult licensed long-term care facilities; residents not receiving benefits under any Pharmacare program and who are registered with Medical Services Plan; social services recipients; cystic fibrosis patients; children under At Home Program or Associate Family Program; clients of mental health centres who require psychiatric medications; and Home Oxygen Subsidy Program.	None.	First $200 of dispensing fee paid by senior user each year. Pharmacare covers ingredient cost and dispensing fees over $200. Residents receiving premium assistance under Medical Services Plan pay yearly deductible of $600. Once a family has paid a total of $2,000 per year in costs recognized by Pharmacare, Pharmacare pays 100% of further costs. No co-payment or deductibles are associated with cystic fibrosis, or child-at-home programs, residents of long-term care facilities. Persons on premium assistance pay a $600 deductible; Pharmacare pays 100% of further costs.	Provincial government pays suppliers directly for groups who receive benefits at no cost. For all other residents, deductible and co-payments are calculated at point of sale through pharmacy's online database.

Sources: *References 30-43.*

Table B
Total health care expenditures, by category, Canada, 1975 to 1996

						Drugs				
	Total†	Hospitals‡	Other institutions	Physicians‡	Other professionals	Total	Prescribed§	Non-prescribed††	Capital	Other expenditures
	$ millions (current dollars)									
1975	12,260.1	5,514.3	1,124.3	1,839.9	1,094.6	1,076.2	770.6	305.6	536.1	1,074.6
1976	14,102.5	6,408.7	1,367.7	2,071.0	1,273.0	1,197.9	881.9	316.0	544.1	1,240.1
1977	15,500.9	6,841.6	1,575.9	2,284.4	1,491.4	1,309.5	985.0	324.5	563.7	1,434.4
1978	17,172.1	7,444.3	1,850.3	2,566.7	1,711.7	1,442.0	1,049.2	392.8	672.2	1,484.9
1979	19,230.8	8,176.2	2,169.5	2,857.0	1,957.2	1,655.3	1,159.8	495.5	725.1	1,690.5
1980	22,353.4	9,399.2	2,544.9	3,287.5	2,260.0	1,881.5	1,295.2	586.3	990.7	1,989.4
1981	26,363.9	11,134.5	2,892.3	3,824.8	2,626.9	2,328.9	1,673.9	655.0	1,111.2	2,445.3
1982	30,851.0	13,238.2	3,346.3	4,420.8	3,037.5	2,635.9	1,920.9	715.0	1,394.8	2,777.5
1983	34,107.7	14,560.6	3,707.7	5,052.7	3,350.2	2,949.6	2,103.8	845.8	1,436.6	3,050.3
1984	36,775.2	15,452.1	3,898.4	5,525.8	3,681.7	3,310.8	2,252.2	1,058.6	1,504.1	3,402.2
1985	39,889.5	16,386.3	4,089.1	6,046.7	4,131.9	3,793.4	2,557.6	1,235.8	1,657.7	3,784.4
1986	43,441.9	17,800.1	4,074.4	6,675.1	4,522.3	4,405.6	3,006.6	1,399.0	1,816.5	4,147.8
1987	46,939.8	19,142.1	4,335.7	7,342.2	4,915.2	4,900.5	3,278.8	1,621.7	1,884.4	4,419.8
1988	51,092.3	20,561.3	4,748.9	7,947.8	5,353.4	5,506.4	3,721.5	1,784.9	1,910.9	5,063.4
1989	56,303.2	22,461.4	5,150.8	8,516.3	5,893.8	6,218.0	4,242.3	1,975.7	2,113.9	5,949.1
1990	61,229.5	24,058.4	5,757.5	9,258.1	6,415.4	6,906.3	4,847.7	2,058.6	2,162.5	6,671.2
1991	66,492.1	25,928.3	6,350.9	10,219.3	6,945.3	7,674.6	5,438.0	2,236.6	2,018.3	7,355.5
1992	70,003.5	26,879.3	6,869.5	10,464.2	7,282.8	8,461.3	6,059.6	2,401.7	2,058.0	7,988.4
1993	71,927.0	27,066.3	6,090.9	10,513.3	7,611.2	9,091.2	6,531.3	2,559.9	1,986.5	8,748.7
1994	73,367.9	26,530.1	7,047.5	10,747.2	8,043.8	9,295.0	6,678.2	2,616.9	2,371.5	9,332.7
1995	74,223.3	25,917.0	7,355.4	10,597.6	8,454.5	9,925.1	7,283.5	2,641.5	2,295.6	9,678.3
1996	75,304.1	25,861.3	7,529.2	10,744.5	8,827.0	10,207.0	7,527.6	2,679.4	2,221.0	9,914.2
					%					
1975	100.0	45.0	9.2	15.0	8.9	8.8	6.3	2.5	4.4	8.8
1976	100.0	45.4	9.7	14.7	9.0	8.5	6.3	2.2	3.9	8.8
1977	100.0	44.1	10.2	14.7	9.6	8.4	6.4	2.1	3.6	9.3
1978	100.0	43.4	10.8	14.9	10.0	8.4	6.1	2.3	3.9	8.6
1979	100.0	42.5	11.3	14.9	10.2	8.6	6.0	2.6	3.8	8.8
1980	100.0	42.0	11.4	14.7	10.1	8.4	5.8	2.6	4.4	8.9
1981	100.0	42.2	11.0	14.5	10.0	8.8	6.3	2.5	4.2	9.3
1982	100.0	42.9	10.8	14.3	9.8	8.5	6.2	2.3	4.5	9.0
1983	100.0	42.7	10.9	14.8	9.8	8.6	6.2	2.5	4.2	8.9
1984	100.0	42.0	10.6	15.0	10.0	9.0	6.1	2.9	4.1	9.3
1985	100.0	41.1	10.3	15.2	10.4	9.5	6.4	3.1	4.2	9.5
1986	100.0	41.0	9.4	15.4	10.4	10.1	6.9	3.2	4.2	9.5
1987	100.0	40.8	9.2	15.6	10.5	10.4	7.0	3.5	4.0	9.4
1988	100.0	40.2	9.3	15.6	10.5	10.8	7.3	3.5	3.7	9.9
1989	100.0	39.9	9.1	15.1	10.5	11.0	7.5	3.5	3.8	10.6
1990	100.0	39.3	9.4	15.1	10.5	11.3	7.9	3.4	3.5	10.9
1991	100.0	39.0	9.6	15.4	10.4	11.5	8.2	3.4	3.0	11.1
1992	100.0	38.4	9.8	14.9	10.4	12.1	8.7	3.4	2.9	11.4
1993	100.0	37.6	9.6	14.6	10.6	12.6	9.1	3.6	2.8	12.2
1994	100.0	36.2	9.6	14.6	11.0	12.7	9.1	3.6	3.2	12.7
1995	100.0	34.9	9.9	14.3	11.4	13.4	9.8	3.6	3.1	13.0
1996	100.0	34.3	10.0	14.3	11.7	13.6	10.0	3.6	2.9	13.2

Data source: *Canadian Institute for Health Information, reference 8*
† Detail may not add to totals because of rounding.
‡ Includes drugs dispensed in hospitals and by physicians.
§ Substances sold under the Food and Drug Act that require a prescription
†† Includes over-the-counter drugs and personal health supplies.

Table C
Total drug expenditures (prescribed† and non-prescribed‡), Canada, 1975 to 1996

			Public sector				
	Total	Private sector	Total, public sector	Provincial governments	Federal direct	Workers' Compensation	Percentage of total drug expenditures
			$ millions (current dollars)				%
1975	1,076.2	918.7	157.5	142.0	13.5	2.0	14.6
1976	1,197.9	983.6	214.3	196.2	15.7	2.3	17.9
1977	1,309.5	1,045.9	263.6	243.4	17.8	2.5	20.1
1978	1,442.0	1,117.6	324.5	301.4	20.3	2.8	22.5
1979	1,655.3	1,272.0	383.3	359.2	21.1	3.1	23.2
1980	1,881.5	1,419.6	461.9	431.1	26.7	4.2	24.5
1981	2,328.9	1,765.2	563.7	527.2	30.4	6.1	24.2
1982	2,635.9	1,955.5	680.4	636.1	36.8	7.5	25.8
1983	2,949.6	2,135.6	814.0	761.2	43.8	9.0	27.6
1984	3,310.8	2,371.3	939.5	879.2	49.6	10.8	28.4
1985	3,793.4	2,683.6	1,109.8	1,039.2	58.0	12.6	29.3
1986	4,405.6	3,097.9	1,307.8	1,229.2	63.3	15.2	29.7
1987	4,900.5	3,422.2	1,478.3	1,392.3	68.2	17.8	30.2
1988	5,506.4	3,816.8	1,689.7	1,580.3	88.6	20.8	30.7
1989	6,218.0	4,265.8	1,952.2	1,825.9	103.4	22.9	31.4
1990	6,906.3	4,649.8	2,256.5	2,107.8	121.2	27.5	32.7
1991	7,674.6	5,095.0	2,579.6	2,413.5	133.0	33.2	33.6
1992	8,461.3	5,589.1	2,872.2	2,691.3	142.8	38.1	33.9
1993	9,091.2	6,115.4	2,975.8	2,784.8	150.8	40.2	32.7
1994	9,295.1	6,285.5	3,009.7	2,811.8	158.0	39.9	32.4
1995	9,925.0	6,667.8	3,257.2	3,049.1	166.0	42.1	32.8
1996	10,207.0	6,967.2	3,239.7	3,024.6	172.7	42.4	31.7

Data source: *Canadian Institute for Health Information, reference 8*
† Substances sold under the Food and Drug Act that require a prescription
‡ Includes over-the-counter drugs and personal health supplies.

Living with heart disease – the working-age population

Abstract

Objectives

This article compares the socioeconomic and health characteristics of the household population aged 35 to 64 with and without self-reported heart disease.

Data sources

Information on the prevalence of heart disease is from the household component of Statistics Canada's 1996/97 National Population Health Survey.

Analytical techniques

Weighted estimates of the health, health care utilization and socioeconomic characteristics of people aged 35 to 64 were calculated by sex and self-reported heart disease. Logistic regression was used to adjust for age and test for statistical significance.

Main results

In 1996/97, about 3% of Canadians aged 35 to 64, or approximately 345,000 individuals, reported that they had been diagnosed with heart disease. Compared with their contemporaries without heart disease, they reported more pain, chronic conditions, and activity restrictions. They were much less likely than people without heart disease to be employed. A relatively large percentage of them lived in low-income households. The consequences of heart disease were particularly severe for women.

Key words

cardiovascular disease, comorbidity, pain, disabled, income, employment, drugs, women

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Heart disease is the second leading cause of death in Canada and a major cause of hospitalization (see *Deaths and hospitalizations*). However, a diagnosis of heart disease does not necessarily result in death or institutionalization. In fact, many people with heart conditions continue to live in the community.

Information about people who die or are hospitalized because of heart disease is limited to what is contained in death certificates and hospital records. Even less is known about those who have been diagnosed with heart disease and are living in the community. The impact of this diagnosis on their lives is only infrequently assessed.[1-4]

Although heart disease is most prevalent among seniors, a substantial number of people aged 35 to 64 have been diagnosed with heart conditions. Because people in this age range may face the multiple responsibilities arising from work and family, the effects of such a diagnosis, not only on their health, but also on their employment, income and daily living, can be devastating.

This article uses data from the 1996/97 National Population Health Survey (NPHS) to examine the characteristics of the household population aged 35 to 64 who reported that a health professional had diagnosed them as having heart disease (see *Methods* and *Limitations*). Their health status, use of health care services and socioeconomic characteristics are compared with those of people in the same age group who were free of heart conditions. As well, the circumstances of women with heart disease are contrasted with those of their male counterparts.

Majority are men

In 1996/97, 3% of the household population aged 35 to 64—an estimated 345,000 individuals—reported that they had been diagnosed with heart disease (see *Definitions*). The prevalence of heart disease rose sharply with age. At ages 35 to 44, just

Methods

Data sources

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. A more detailed description of the NPHS design, sample and interview procedures can be found in published reports.[5] See also *The National Population Health Survey – its longitudinal nature* in this issue.

This analysis of the circumstances of people with heart disease uses cross-sectional data from the second cycle of the NPHS, which was conducted in 1996/97. The data analyzed here pertain to the household population in the provinces.

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

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

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

Among individuals in the longitudinal component, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for that household in cycle 1 (1995/94) and was usually the person who provided information on all household members for the General file in cycle 2 (1996/97).

The 1996/97 cross-sectional response rates for the Health file were 93.1% for the longitudinal component and 75.8% for the RDD component, yielding an overall response rate of 79.0%. Information in the Health file is available for 81,804 randomly selected respondents. This analysis is based on 33,686 respondents aged 35 to 64, 1,182 of whom reported that they had been diagnosed by a health professional as having heart disease.

Mortality data, compiled from the vital statistics registries in each province, are from the Canadian Vital Statistics Data Base at Statistics Canada. Data on hospitalizations are from the the Hospital Morbidity File at Statistics Canada.

Analytical techniques

All analyses are based on weighted data. Men and women aged 35 to 64 were analyzed separately. Estimates of health, health care utilization and socioeconomic characteristics by sex and self-reported heart disease were calculated. Because the population reporting heart disease has an older age distribution than the population not affected, weighted logistic regression was used to adjust for age. Coefficients of variation and standard errors were estimated using a weighted bootstrap procedure that fully accounts for the design effect of the NPHS.[6,7]

The percentages shown in the charts and Appendix tables were not age-adjusted. The odds ratios, however, were age-adjusted and were used to test statistically significant differences.

1% reported a diagnosis, but by ages 55 to 64, the proportion was 7% (Table 1).

At ages 35 to 54, the percentages of men and women who had been diagnosed were not significantly different, but at ages 55 to 64, the prevalence was higher among men. As a result, men accounted for more than half (58%) of all 35- to 64-year-olds with heart disease.

Poor health

For a large share of 35- to 64-year-olds with heart disease, it was only one of several health problems. More than a third (36%) reported having at least two other major illnesses (asthma, arthritis, chronic obstructive lung disease, stroke, high blood pressure or diabetes), whereas this was true for just 6% of people without heart disease (Appendix Table A). To some degree, this discrepancy in disease prevalence might result from the older age distribution of the group with heart disease. But even when age was taken into account, the odds that people with heart disease would have at least two other serious chronic conditions were about six times those for people who were not afflicted (Table 2).

Table 1
Prevalence of heart disease,† household population aged 35 to 64, by age group and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
	'000	%	'000	%	'000	%
Total 35-64	**344.9**	**3**	**200.4**	**3**	**144.5**	**3**
35-44	56.4	1‡	26.9	1‡	29.6	1‡
45-54	112.9	3	69.8	4	43.1	2‡
55-64	175.6	7	103.7	8*	71.9	5

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Note: *Because of rounding, detail may not add to totals.*
† Diagnosed by a health professional.
‡ Coefficient of variation between 16.6% and 25.0%
** Significantly higher for men than for women (p < 0.05)*

Comorbid conditions were more common among women than men (Chart 1). Close to half (48%) of women with heart disease reported that they had at least two other chronic conditions, compared with 28% of the men.

As might be expected from the high prevalence of health problems, people with heart disease were much more likely than those without heart disease to report chronic pain, activity restriction and disability days. Even after allowing for their older

Table 2
Age-adjusted odds ratios for selected health characteristics, household population aged 35 to 64, by heart disease† status and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Health						
Two or more comorbidities‡	5.6*	4.3, 7.4	4.8*	3.2, 7.0	8.1*	5.3, 12.4
Chronic pain/discomfort	2.8*	2.2, 3.7	2.3*	1.5, 3.4	4.1*	2.8, 5.9
Activity restriction	6.5*	4.9, 8.6	5.9*	4.0, 8.6	7.7*	5.2, 11.3
One or more disability days in past 2 weeks	3.3*	2.5, 4.5	3.5*	2.3, 5.2	3.7*	2.4, 5.7
Describes health as poor/fair	5.6*	4.3, 7.4	6.3*	4.4, 9.0	5.0*	3.3, 7.6
Major depressive episode in past year	3.1*	1.9, 5.2	2.8*	1.2, 6.5	3.8*	1.8, 8.3
Health care utilization						
Took more than 3 medications in last 2 days	8.4*	6.3, 11.1	15.3*	10.6, 22.0	5.1*	3.4, 7.8
Need help with housework or personal care	5.3*	4.0, 7.0	6.0*	4.0, 8.8	5.7*	3.8, 8.5
Use home care§	2.4*	1.3, 4.6	1.4	0.7, 2.8	3.7*	1.6, 8.7
Overnight patient in past year††	5.4*	3.9, 7.4	6.1*	4.0, 9.4	4.7*	2.8, 7.9

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Note: *Reference group is household population aged 35 to 64 not diagnosed with heart disease.*
† Diagnosed by a health professional.
‡ Asthma, arthritis, chronic obstructive lung disease, stroke, high blood pressure, diabetes
§ Completely or partially government-funded; includes nursing, personal care and housework.
†† In hospital, nursing home or convalescent home
** p < 0.05*

Definitions

Respondents to the National Population Health Survey were asked whether they had "long-term conditions that have lasted or are expected to last 6 months or more and that have been diagnosed by a health professional." The interviewer read a list of conditions. Those relevant to this analysis are heart disease, asthma, arthritis, chronic obstructive lung disease, stroke, high blood pressure and diabetes. If respondents asked what was meant by "heart disease," they were told that it includes angina, heart failure and rheumatic heart disease.

Respondents were asked, "Are you usually free of pain or discomfort?" Those who replied "no" were considered to have *chronic pain.*

A positive response to the question, "Because of a long-term physical or mental condition or a health problem, are you limited in the kind or amount of activity that you can do?" indicated an *activity restriction.*

Disability days were determined with two questions: "During that period (past 14 days), did you stay in bed at all for all or most of the day because of illness or injury, including any nights spent as a patient in a hospital?" and "During those 14 days, were there any days that you cut down on things you normally do because of illness or injury?" Respondents who answered "yes" to one or both of these questions were asked how many days they had had to spend in bed or had to cut down on their activities.

General health was assessed with the question: "In general, would you say your health is: excellent, very good, good, fair, poor?"

The use of *medications* (both prescription and over-the-counter) was assessed with the question, "In the past month, did you take any of the following medications: ...?" Among the options was "medicine for the heart."

Those who responded "yes" to the question, "Have you received any home care services in the past 12 months?", were considered to have been *home care* recipients. Home care services are health care or homemaker services received at home, with the cost being entirely or partially covered by government. Examples are nursing care, help with bathing or housework, respite care and meal delivery.

To determine whether respondents *needed help with housework or personal care,* they were asked if they required assistance in preparing meals, shopping for groceries or other necessities, doing normal everyday housework, doing heavy household chores such as washing walls, yard work, etc., or for personal care such as washing, dressing or eating.

A respondent who answered "yes" to the question, "In the past 12 months, have you been a patient over night in a hospital, nursing home or convalescent home?" was considered to have been an *overnight patient.*

Respondents who reported that they were currently working were considered to be *employed*. If they were not employed, they were asked the main reason they were not working. The reasons used in this analysis are: caring for family, recovering from illness/on disability, and retired.

Respondents who were employed were asked the number of hours they worked at each job in a week. These hours were totalled to classify employed respondents into those who *worked less than 30 hours a week* and those who *worked 30 or more hours a week*.

To determine respondents' *main source of household income*, they were asked: "What was the main source of income?" For this analysis, several categories were combined: 1) wages, salaries, income from self-employment; 2) Employment Insurance, Worker's Compensation, provincial or municipal social assistance or welfare; and 3) pensions (benefits from Canada or Quebec Pension Plans, retirement pensions, superannuation and annuities, Old Age Security and Guaranteed Income Supplement).

Income adequacy was calculated by taking into account both household income and the number of people in the household. *Low income* was defined as less than $30,000 per year for 5 or more people, less than $20,000 for 3 or 4 people, and less than $15,000 for 1 or 2 people.

Respondents who answered "yes" to the question, "Thinking about the past 12 months, did your household ever run out of money to buy food?" were considered to be in *financial distress.*

Using the methodology of Kessler et al.,[8] 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, which are listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM III-R).[9] Responses to these questions were scored on a scale and transformed into a probability estimate of a diagnosis of MDE. If this estimate was 0.9, that is, 90% certainty of a positive diagnosis, then the respondent was considered to have experienced *depression* in the previous 12 months.

Low education was defined as less than high school graduation.

age profile, the odds that 35- to 64-year-olds with heart disease would report these problems were significantly high, compared with people who were not afflicted. Chronic pain and disability days were more prevalent among women than men. For instance, 46% of women with heart disease reported chronic pain, compared with 29% of the men (Chart 2).

Given the prevalence of other health conditions, chronic pain and activity limitations, to say nothing of the diagnosis of heart disease itself, it is hardly surprising that a large percentage of 35- to 64-year-olds with heart disease assessed their health negatively. Overall, 41% of them described their health as fair or poor, while this was the case for only 9% of their contemporaries who did not have heart disease. After adjusting for age, the odds that people with heart disease would judge themselves to be in fair or poor health were about six times those of people who were not afflicted.

Multiple-medication use

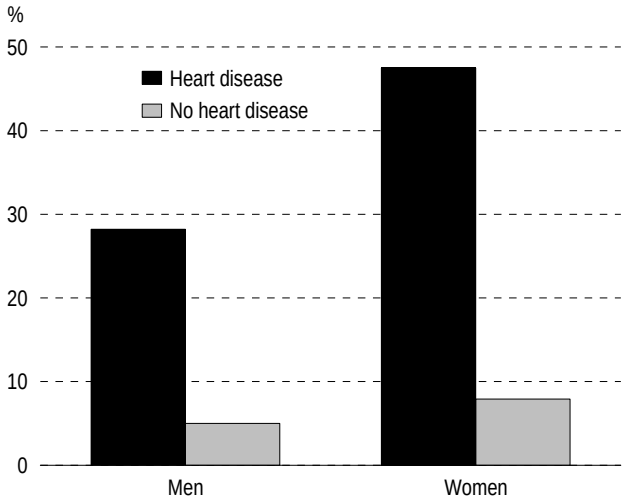
Perhaps in an attempt to cope with poor health and chronic pain, many people with heart disease used several medications. In 1996/97, more than half (52%) of 35- to 64-year-olds with heart disease reported to the NPHS that they had taken three or more medications (prescription and over-the-counter) in the last two days. For people in this age range who did not have heart disease, the corresponding figure was 9%. The age-adjusted

Deaths and hospitalizations

Although the death rate for heart disease has declined steadily since 1960, the toll remains high.[10] In 1995, 6.6% of all deaths of men aged 35 to 39 were due to ischemic heart disease (IHD), which was the fourth most common cause of death of men in this age range.[11] By ages 60 to 64, IHD accounted for 24.1% of all male deaths, and ranked first among causes. For women, IHD was the fifth most common cause of death at ages 35 to 39, accounting for 3.9%. By ages 60 to 64, IHD was in first place and represented 14% of female deaths.

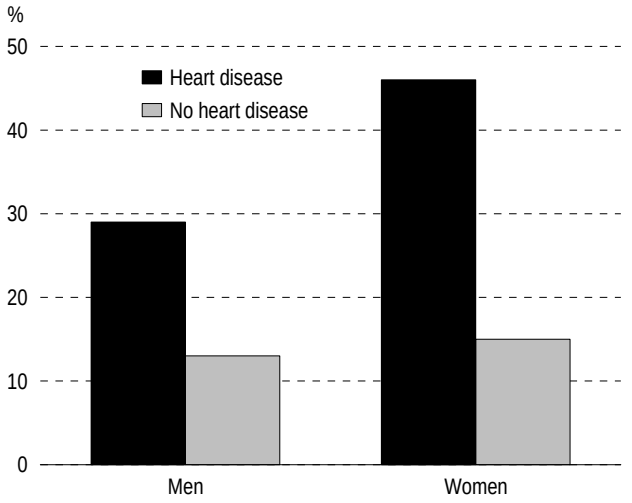
In 1996/97 IHD accounted for 57,420 hospital stays of men and 19,453 stays of women aged 35 to 64. This represented 12% and 4%, respectively, of all hospitalizations for this age group.

Chart 1
Percentage of household population aged 35 to 64 with at least two other chronic conditions,†‡ by heart disease‡ status and sex, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Asthma, arthritis, chronic obstructive lung disease, stroke, high blood pressure, diabetes
‡ Diagnosed by a health professional.

Chart 2
Percentage of household population aged 35 to 64 with chronic pain, by heart disease† status and sex, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Diagnosed by a health professional.

odds that men who had heart disease would be multiple-medication users were 15 times the odds for men who did not have heart problems. The odds of multiple-medication use among women with heart disease were 5 times higher than the odds for women who were not afflicted.

A range of medications is recommended for heart conditions. Possible long-term drug treatment includes aspirin, beta-blockers, lipid-lowering agents, angiotensin converting enzyme (ACE) inhibitors and perhaps anticoagulants.[12] Yet surprisingly, 34% of people with heart disease reported not taking a heart medication within the last month. This could reflect misclassification of disease or misclassification of medication, but it might also indicate missed opportunities for secondary health promotion.

Home care

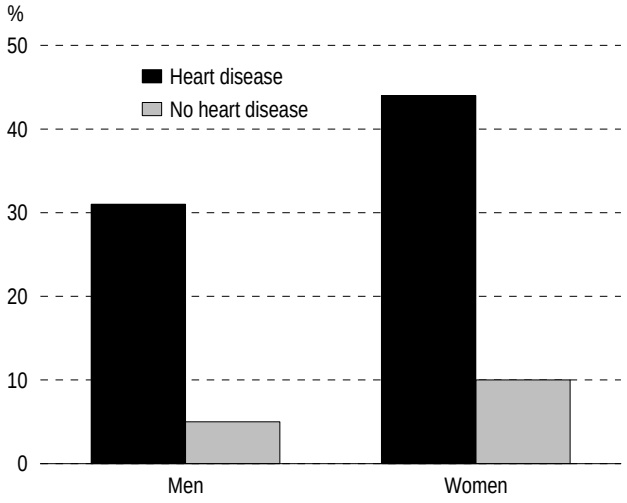
More than a third (36%) of people with heart disease reported needing help with one or more household tasks or personal care, compared with only 8% of those without heart disease. In fact, the odds that 35- to 64-year-olds with heart disease would need help were five times those of their contemporaries without heart disease.

The number of people who actually received formal home care services (funded wholly or in part by the government) fell far short of the number who reported needing help. Thus, many who needed assistance did not get publicly funded help.[13] Their options would be to rely on family or friends, pay for assistance themselves, or do without.

Allowing for the older age distribution of those with heart disease, the odds were significantly higher that women who had been diagnosed with a heart condition would be home care recipients, compared with women who did not have heart disease. By contrast, men with heart disease did not have significantly higher odds of receiving home care than did men who were not afflicted.

The preponderance of women among home care recipients may be attributable to the fact that men are more likely to receive help from their spouse (Chart 3). It has been suggested that because male spouses may not be accustomed to care-giving roles, women with heart disease are disadvantaged compared with their male counterparts.[1] As well, a higher percentage of women (24%) than men (13%) with heart disease lived alone, and so they may have had less access to informal care (data not shown).

Chart 3
Percentage of household population aged 35 to 64 who needed help with housework or personal care, by heart disease† status and sex, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Diagnosed by a health professional.

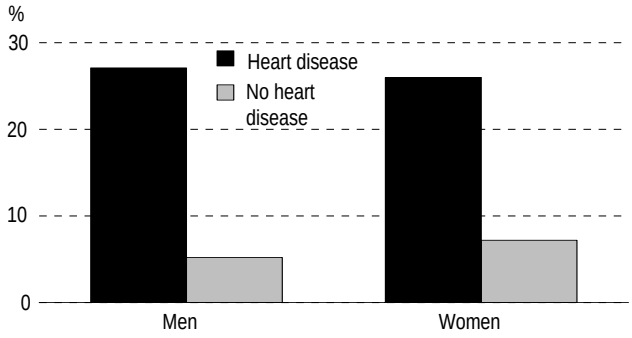
Health care use

People with heart disease were heavy users of health care resources. However, the large percentage of them with other serious chronic conditions suggests that the care they received was not exclusively for heart disease.

Over a quarter (27%) of 35- to 64-year-olds with heart disease had been admitted over night to a hospital, nursing home or convalescent home in the previous year, compared with 6% of their contemporaries without heart disease (Appendix Table A, Chart 4). Even when the older age profile of people with heart disease is taken into account, they had five times the odds of admission as did those who were not afflicted.

Individuals aged 35 to 64 with heart disease accounted for more than 1 million hospital days in 1996/97, which was 16% of the total for this age

Chart 4
Percentage of household population aged 35 to 64 admitted to hospital† over night during last year, by heart disease‡ status and sex, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Includes nursing homes and convalescent homes.
‡ Diagnosed by a health professional.

group. They also reported over 3 million physician consultations, or 7% of all consultations by 35- to 64-year-olds (data not shown).

Lower employment rate

Causality cannot be inferred from cross-sectional data, but it seems likely that the employment and income situation of people with heart disease may be influenced by their poor health.

Although 35 to 64 is a prime age range for labour force participation, just 48% of men with heart disease reported that they were working for pay or profit when they were interviewed for the NPHS (Appendix Table B). The figure for men without heart disease was much higher at 83%. The corresponding rates among women were 36% and 64%. For both sexes, the age-adjusted odds that those with heart disease would be employed were less than half those for people without heart disease (Table 3).

Table 3
Age-adjusted odds ratios for selected employment and income characteristics, household population aged 35 to 64, by heart disease† status and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Employment status						
Employed	0.4*	0.3, 0.5	0.3*	0.2, 0.4	0.4*	0.3, 0.7
Not employed because:‡						
Caring for family	0.5	0.2, 1.5	- -	- -	0.6	0.2, 1.9
Illness/On disability	5.5*	4.1, 7.3	5.4*	3.6, 8.3	5.9*	3.8, 9.2
Retired	0.8	0.6, 1.1	1.3	0.9, 2.0	0.5*	0.3, 0.9
Employed or caring for family	0.3*	0.3, 0.5	0.3*	0.2, 0.4	0.3*	0.2, 0.6
Household income						
Main source§						
Wages/Salary	0.5*	0.3, 0.6	0.4*	0.3, 0.6	0.4*	0.2, 0.7
Employment Insurance/ Workers' Compensation/Welfare	3.1*	1.9, 4.9	3.1*	1.8, 5.3	3.1*	1.5, 6.5
Pensions	1.4*	1.0, 2.0	1.4	0.9, 2.2	1.5	1.0, 2.3
Low income	1.9*	1.4, 2.6	1.5*	1.1, 2.2	2.5*	1.5, 4.2
Financial distress††	3.2*	2.1, 4.9	3.1*	1.8, 5.3	3.3*	1.7, 6.4

Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
Note: *Reference group is household population aged 35 to 64 not diagnosed with heart disease. Because of rounding, a confidence interval with 1.0 as the lower limit may be significant.*
† Diagnosed by a health professional.
‡ Excludes other reasons.
§ Excludes other sources.
†† Ran out of money for food in past year.
** $p < 0.05$*
- - Amount too small to provide reliable estimate

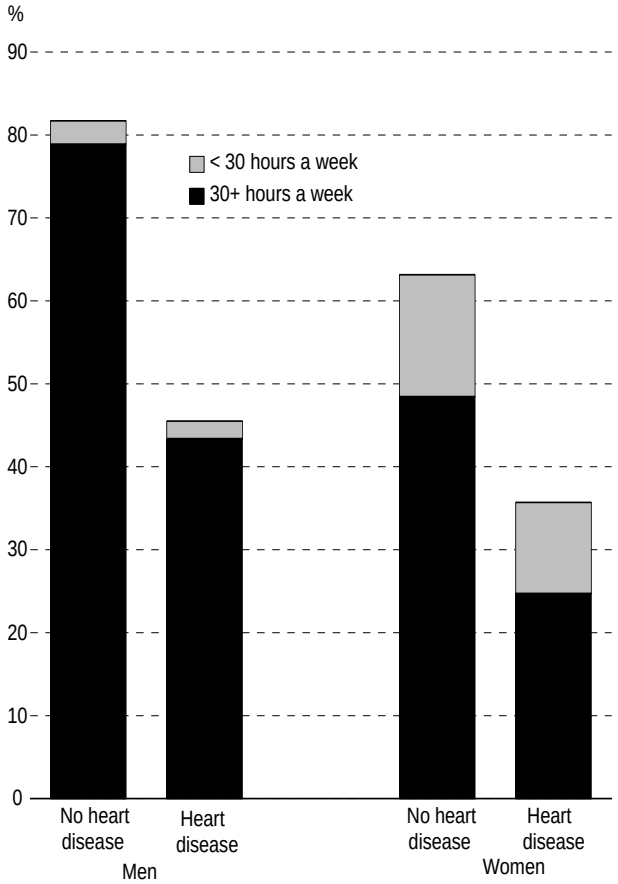
In addition, 43% of the men with heart disease worked 30 or more hours a week, well below the figure for men who had not been diagnosed with a heart condition (79%) (Chart 5). Only 25% of women with heart disease worked at least 30 hours a week, compared with 48% of those who were not afflicted.

Regardless of whether they had heart disease, women were less likely than men to be employed. However, if family care and working for pay or profit are considered together, 43% of women with heart disease were "active," compared with 48% of men, a difference that is not statistically significant. Other studies, too, have found that when homemaking tasks are counted, male and female activity rates are close.[14]

The main reason that 35- to 64-year-olds with heart disease gave for not working was that they were recovering from an illness or were on disability (30%). By contrast, only 6% of people who did not have heart disease cited illness or disability (Chart 6). Allowing for the age structure of the two groups, the odds that people with heart disease would not be working because of illness or disability were 5.5 times higher than those of people without heart disease.

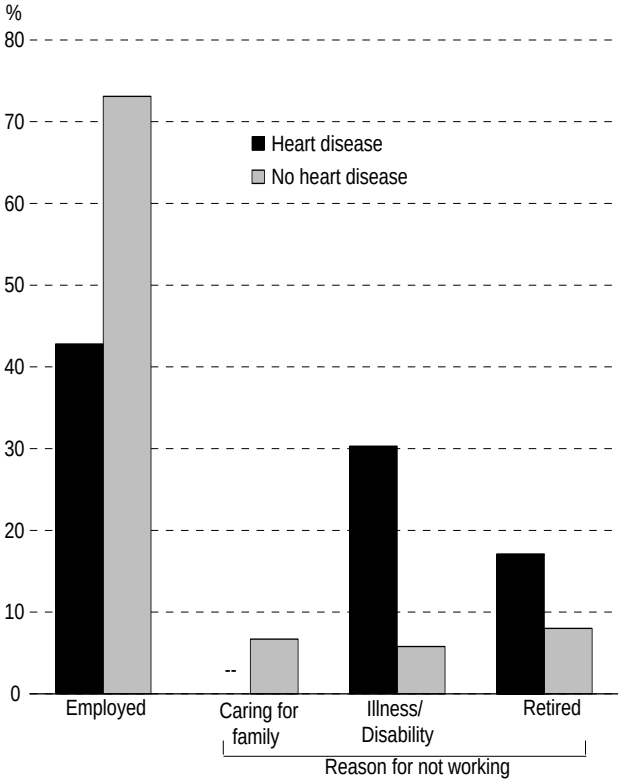
As well, 17% of people aged 35 to 64 with heart disease reported that they had retired, more than double the figure (8%) for those without heart disease. But when adjusted for age, this difference was not statistically significant.

Chart 5
Hours of work of employed household population aged 35 to 64, by heart disease† status and sex, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Diagnosed by a health professional.

Chart 6
Employment status of household population aged 35 to 64, by heart disease† status, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
† Diagnosed by a health professional.
- - Amount too small to provide reliable estimate

Less reliance on employment income

The income sources of people aged 35 to 64 with heart disease reflect their employment status. Employment was the main source of household income for just 62% of men and 52% of women with heart disease, compared with 87% of men and 80% of women without heart disease. The age-adjusted odds that people with heart disease would rely on employment income were half those of people without heart disease.

On the other hand, close to a quarter (24%) of 35- to 64-year-olds with heart disease cited pensions as their main source of household income, and another 13%, Employment Insurance/Workers' Compensation/welfare. Their odds of reporting these sources were three times higher than those for people without heart disease.

Low income

The heavy reliance on pensions and government transfer payments means that a relatively large percentage of people with heart disease had low incomes. In 1996/97, 22% of 35- to 64-year-olds with heart disease were living in low income households versus 12% of those who did not have heart disease (Appendix Table B).

Low income was particularly common among women with heart disease. Close to a third (30%) of them lived in low-income households, double the proportion for women without a heart condition (14%). Adjusting for the age distribution of the two groups, the odds that women with heart disease would live in a low-income household were 2.5 times higher than those for women did not have heart disease (Table 3).

Just 16% of men with heart disease lived in low-income households, well below the figure for women. Nonetheless, compared with men who were not afflicted, those with heart disease still had significantly high odds of low income.

To some extent, the relationship between heart disease and income might be attributable to educational attainment. Low income tends to be associated with low education, which, in turn, is associated with risk factors for heart disease such as smoking, obesity and high blood pressure.[15-17] However, even after adjusting for age, sex, living arrangements and education, the odds that 35- to 64-year-olds with heart disease would be in low-income households were almost two times higher than those for people without heart disease (OR=1.8; CI=1.3, 2.5) (data not shown). This

Limitations

National Population Health Survey data on heart disease are subject to the problems inherent in self-reporting. Specifically, there was no independent source to verify whether people who reported having been diagnosed with heart disease actually did have it. The same is true of the other chronic conditions used in this article: asthma, arthritis, high blood pressure, stroke, diabetes and chronic obstructive lung disease.

The time elapsed since respondents were diagnosed with heart disease is not known. Respondents were not asked if more than one episode had occurred, nor was information about the severity of the problem collected.

Heart disease is a broad term, covered by ICD-9[18] codes 391 to 398, 402, 404, and 410 to 429. Respondents' heart problems could range from less serious ones such as acute pericarditis (420) to something much more serious such as acute myocardial infarction (410). In addition, some respondents may have been misclassified because they misunderstood what was asked, or because they did not remember receiving the diagnosis.

Hospital data show 76,873 hospital stays in 1996/97 attributable to ischemic heart disease (IHD) among men and women aged 35 to 64, which is 84% of the number of NPHS respondents with heart disease who reported having been admitted to hospital (about 91,800). This is consistent with the fact that IHD is a subcategory of the general term "heart disease," which was used in the NPHS.

The data in this article pertain only to the household population. This means that the analysis does not contain an estimate of the overall prevalence of heart disease among 35- to 64-year-olds. Although relatively few people in this age range live in institutions, their health characteristics may differ from those of household residents in ways that would affect the prevalence estimates if the former were included. And even among the household population, there may be a selection effect. That is, those who participated in the survey may have been healthier and more likely to engage in health-promoting behaviour than those who did not participate.

Finally, this is a descriptive study. The data are cross-sectional and cannot be used to determine causality. For instance, it is not possible to say whether an individual's employment status and income are the result of having heart disease.

suggests that the link between heart disease and low income is not entirely attributable to education.

The proportions of people with heart disease reporting financial distress (specifically, running out of money to buy food in the past year) were relatively high: 15% of women and 11% of men, more than double the figures for their contemporaries without heart disease. The odds that people with heart disease would report such difficulties were over three times those for people without a heart condition.

High rate of depression

Possibly as a result of their poor health and comparatively unfavourable socioeconomic circumstances, people with heart disease reported a high prevalence of depression. Close to 16% of women aged 35 to 64 with heart disease had suffered a major depressive episode in the previous year, compared with 5% who did not have heart disease. The odds that women with heart disease would have experienced depression were about four times the odds for women without heart disease. Men with heart disease were also significantly more likely than their counterparts without heart disease to have suffered depression, although the difference was less pronounced. In other studies, too, researchers have observed a high incidence of depression among people with heart problems.[19,20]

Women face more difficulties

In many respects, the consequences of heart disease appear to be particularly severe for women.

Compared with men who had been diagnosed, women with heart disease had about twice the odds of having at least two other chronic conditions, of suffering chronic pain, and of having had one or more disability days in the previous two weeks (Table 4). They also had much higher odds than men of living alone. To some extent, poorer health and living alone may have contributed to the high odds that women with heart disease would need help with housework or personal care and would use home care.

The odds that women with heart disease would be employed were only about half those of their male counterparts, and the odds of working fewer than 30 hours a week were much greater for women. Women with heart disease also had significantly elevated odds of living in a low-income household.

These results support other studies that found poorer health and a lower quality of life among

Table 4
Age-adjusted odds ratios for selected characteristics among women aged 35 to 64 with heart disease,† household population, Canada excluding territories, 1996/97

	Odds ratio	95% confidence interval
Health		
Two or more comorbidities‡	2.6*	1.4, 4.6
Chronic pain/discomfort	2.1*	1.2, 3.6
Activity restriction	1.6	1.0, 2.8
One or more disability days in past 2 weeks	1.9*	1.1, 3.4
Describes health as poor/fair	1.0	0.6, 1.6
Major depressive episode in past year	2.7	0.8, 8.6
Health care utilization		
Took more than 3 medications in last 2 days	0.7	0.4, 1.1
Need help with housework or personal care	2.0*	1.1, 3.4
Use home care§	4.0*	1.5, 10.8
Overnight patient in past year††	1.0	0.5, 1.8
Employment status		
Employed	0.5*	0.3, 0.9
Work less than 30 hours per week	3.1*	1.2, 8.5
Not employed because:‡‡		
Illness/On disability	1.4	0.8, 2.4
Retired	0.8	0.4, 1.5
Employed or caring for family	0.7	0.4, 1.3
Household income		
Main source§§		
Wages/Salary	0.6*	0.3, 1.0
Employment Insurance/Workers' Compensation/Welfare	1.1	0.5, 2.2
Pensions	2.3*	1.3, 4.1
Low income	2.2*	1.2, 3.9
Financial distress†††	1.2	0.6, 2.7
Live alone	2.4*	1.2, 4.6

***Data source**: 1996/97 National Population Health Survey, cross-sectional sample, Health file*
***Note**: Reference group is men aged 35 to 64 diagnosed with heart disease. Because of rounding, some confidence intervals with 1.0 as the upper limit were significant.*
† Diagnosed by a health professional.
‡ Asthma, arthritis, chronic obstructive lung disease, stroke, high blood pressure, diabetes
§ Completely or partially government-funded; includes nursing, personal care and housework.
†† In hospital, nursing home or convalescent home
‡‡ Excludes other reasons.
§§ Excludes other sources.
††† Ran out of money for food in past year.
** $p < 0.05$*

women than among men after a heart attack.[1-3] The literature suggests a number of reasons for this difference.

Diagnosis of heart disease is more complicated in women than in men.[21] Women's symptoms are different, and they have more heart failure. During the first year after a heart attack, women have been shown to have a greater risk of death, cardiac distress and re-infarction.[22] This analysis of NPHS data complements such results, in that women reported more pain and disability.

Women may undergo different treatment than men. In fact, lower rates of heart surgery among women[23-26] have raised questions about sex bias in selection for surgery.[27,28] An earlier study reported that during one year of observation, women were treated less aggressively for coronary artery disease and were less likely to use aspirin.[29] Other research showed that women were referred significantly less often to coronary care units than were men, even when the women had more angina pectoris and heart failure.[3]

Women appear to have relatively low participation rates in cardiac rehabilitation programs. Studies of rehabilitation outcomes report lower enrolment in such programs, poorer adherence and significantly higher dropout rates for women than men, even though women who completed cardiac rehabilitation experienced the same or even greater functional improvements.[30]

Like the NPHS, analyses in the Cardiac Arrhythmia Suppression Trials indicate that the socioeconomic circumstances of women with heart disease were less favourable than those of their male counterparts.[4] In general, women had lower incomes to begin with, and they returned to work less frequently, and after a longer absence.[30] This makes it harder for women to pay for the help they need. As well, the costs of transportation to a rehabilitation centre, of a healthier diet, and of medications could be a greater burden.

The double loads of work and family have emerged as documented risk factors for heart disease.[31] Women may continue to perform domestic chores even when they are sick, and return to such tasks before they have completely recovered. As well, care-giving responsibilities may make it difficult to find time for rehabilitation programs. In fact, the NPHS data show that women with heart disease were just as likely to be caring for their family as were women without heart disease (data not shown).

Concluding remarks

According to the 1996/97 National Population Health Survey, about 345,000 Canadians aged 35 to 64 have been diagnosed with heart disease. This condition is associated with compromised quality of life, in terms of physical and mental health and financial well-being. For many people, heart disease and its attendant health problems limit their ability to work and thereby earn enough to maintain a relatively comfortable standard of living. Women are particularly vulnerable.

Knowledge of the social, financial and health circumstances of people with heart disease helps direct secondary health promotion efforts most effectively. This knowledge aids in anticipating the indirect costs associated with heart disease, such as a lower employment rate, lower income, more pain and disability, and greater need for help with household tasks and personal care. ●

Acknowledgements

The author thanks Claudio Pérez, Marie P. Beaudet and Mike Gagnon for their technical assistance.

References

1 Loose MS, Fernhall B. Differences in quality of life among male and female cardiac rehabilitation participants. *Journal of Cardiopulmonary Rehabilitation* 1995; 15(3): 225-31.

2 Conn VS, Taylor SG, Abele PB. Myocardial infarction survivors: age and gender differences in physical health, psychosocial state and regimen adherence. *Journal of Advanced Nursing* 1991; 16(9): 1026-34.

3 Wiklund I, Herlitz J, Johansson S, et al. Subjective symptoms and well-being differ in women and men after myocardial infarction. *European Heart Journal* 1993; 14(10): 1315-9.

4 Shumaker SA, Brooks MM, Schron EB, et al. Gender differences in health-related quality of life among postmyocardial infarction patients: brief report. CAST Investigators. Cardiac Arrhythmia Suppression Trials. *Womens Health* 1997; 3(1): 53-60.

5 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.

6 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.

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

8 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: 8-19.

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

10 Heart and Stroke Foundation of Canada. *Heart Disease and Stroke in Canada*. Ottawa: Heart and Stroke Foundation of Canada, 1997.

11 Statistics Canada. *The leading causes of death at different ages, Canada, 1995* (Statistics Canada, Catalogue 84-503-XPB) Ottawa: Minister of Industry, 1997.

12 Yusuf S, Lessem J, Jha P, et al. Primary and secondary prevention of myocardial infarction and strokes: an update of randomly allocated, controlled trials. *Journal of Hypertension* 1993; Suppl 11(4): S61-73.

13 Wilkins K, Park E. Home care in Canada. *Health Reports* (Statistics Canada, Catalogue 82-003) 1998; 10(1): 29-37.

14 Angus J. Women and recovery from myocardial infarction and coronary artery bypass surgery, Part II: A review of the cardiovascular literature. *Canadian Journal of Cardiovascular Nursing* 1996; 7(4): 15-22.

15 Irbarren C, Luepker RV, McGovern PG, et al. Twelve-year trends in cardiovascular disease risk factors in the Minnesota Heart Survey. Are socioeconomic differences widening? *Archives of Internal Medicine* 1997; 157(8): 873-81.

16 Johansen H, Nargundkar M, Nair C, et al. At risk of first or recurring heart disease. *Health Reports* (Statistics Canada, Catalogue 82-003-XPB) 1998; 9(4): 19-29.

17 Luepker RV, Rosamond WD, Murphy R, et al. Socioeconomic status and coronary heart disease risk factor trends. The Minnesota Heart Survey. *Circulation* 1993; 88(5 Pt 1): 2172-9.

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

19 Mickus D. Activities of daily living in women after myocardial infarction. *Heart Lung* 1986; 15(4): 376-81.

20 Riegel B, Gocka I. Gender differences in adjustment to acute myocardial infarction. *Heart Lung* 1995; 24(6): 457-66.

21 Cole PL. Coronary artery disease in women: differences in diagnosis, therapy, and prognosis. *Coronary Artery Disease* 1993; 4: 595-604.

22 Young RF, Kahana E. Gender, recovery from late life heart attack, and medical care. *Women and Health* 1993; 20(1): 11-31.

23 Kostis JB, Wilson AC, O'Dowd K, et al. Sex differences in the management and long-term outcome of acute myocardial infarction. A statewide study. MIDAS Study Group. Myocardial Infarction Data Acquisition System. *Circulation* 1994; 90(4): 1715-30.

24 Majeed FA, Cook DG. Age and sex differences in the management of ischaemic heart disease. *Public Health* 1996; 110(1): 7-12.

25 Giles WH, Anda RF, Casper ML, et al. Race and sex differences in rates of invasive cardiac procedures in US hospitals. Data from the National Hospital Discharge Survey. *Archives of Internal Medicine* 1995; 155(3): 318-24.

26 Jaglal SB, Goel V, Naylor CD. Sex differences in the use of invasive coronary procedures in Ontario. *Canadian Journal of Cardiology* 1994; 10(2): 239-44.

27 Tobin JN, Wassertheil-Smoller S, Wexler JP, et al. Sex bias in considering coronary bypass surgery. *Annals of Internal Medicine* 1987; 107: 19.

28 Bergelson BA, Tommaso CL. Gender differences in clinical evaluation and triage in coronary artery disease. *Chest* 1995; 108(6): 1510-3.

29 Schwartz LM, Fisher ES, Tosteson NA, et al. Treatment and health outcomes of women and men in a cohort with coronary artery disease. *Archives of Internal Medicine* 1997; 157(14): 1545-51.

30 Hamilton GA. Recovery from acute myocardial infarction in women. *Cardiology* 1990; 77(Suppl 2): 58-70.

31 Brezinka V, Kittel F. Psychosocial factors of coronary heart disease in women: a review. *Social Science and Medicine* 1996; 42(10): 1351-65.

Appendix

Table A

Percentage of household population aged 35 to 64 with selected health characteristics, by heart disease† status and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
	Heart disease		Heart disease		Heart disease	
	Yes	No	Yes	No	Yes	No
			%			
Health						
Two or more comorbities‡	36	6	28	5	48	8
Chronic pain/discomfort	36	14	29	13	46	15
Activity restriction	59	16	56	14	64	17
One or more disability days in past 2 weeks	29	11	23	9	37	13
Describes health as poor/fair	41	9	42	8	40	10
Major depressive episode in past year	10§	4	- -	3	16††	5
Health care utilization						
Took more than 3 medications in last 2 days	52	9	57	6	45	11
Need help with housework or personal care	36	8	31	5	44	10
Use home care‡‡	3††	1	2††	1§	- -	2
Overnight patient in past year§§	27	6	27	5	26§	7

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

† Diagnosed by a health professional.

‡ Asthma, arthritis, chronic obstructive lung disease, stroke, high blood pressure, diabetes

§ Coefficient of variation between 16.6% and 25.0%

†† Coefficient of variation between 25.1% and 33.3%

‡‡ Completely or partially government-funded; includes nursing, personal care and housework.

§§ In hospital, nursing home or convalescent home

- - Amount too small to provide reliable estimate

Table B

Percentage of household population aged 35 to 64 with selected employment and income characteristics, by heart disease† status and sex, Canada excluding territories, 1996/97

	Total		Men		Women	
	Heart disease		Heart disease		Heart disease	
	Yes	No	Yes	No	Yes	No
			%			
Employment status						
Employed	43	73	48	83	36	64
Not employed because:‡						
Caring for family	- -	7	- -	- -	- -	13
Illness/On disability	30	6	28	5	34	7
Retired	17	8	19	6	15§	10
Employed or caring for family	46	80	48	83	43	77
Household income						
Main source††						
Wages/Salary	58	84	62	87	52	80
Employment Insurance/ Workers' Compensation/ Welfare	13§	5	12§	4	14‡‡	6
Pensions	24	9	20	7	29	11
Low income	22	12	16	11	30§	14
Financial distress§§	12§	5	11	5	14‡‡	6

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

† Diagnosed by a health professional.

‡ Excludes other reasons.

§ Coefficient of variation between 16.6% and 25.0%

†† Excludes other sources.

‡‡ Coefficient of variation between 25.1% and 33.3%

§§ Ran out of money for food in past year.

- - Amount too small to provide reliable estimate

Health care consequences of falls for seniors

Kathryn Wilkins

Abstract

Objectives

This article examines falls that caused a serious injury among people aged 65 or older living in private households. Based on an analysis of people followed over a two-year period, it focuses on the association of a fall in 1994/95 with subsequent health care.

Data source

The data are from the household component of the 1994/95 and 1996/97 cycles of the National Population Health Survey conducted by Statistics Canada. Longitudinal and cross-sectional data are from a sample of 2,081 people aged 65 or older in 1994/95 for whom data were available and who were still alive in 1996/97. An additional 11,282 elderly people in this age group provided cross-sectional data in 1996/97, yielding a total sample of 13,363.

Analytical techniques

In addition to descriptive statistics, multivariate analyses were used to study the associations between injurious falls and subsequent entry into care, controlling for selected factors.

Main results

After controlling for age, decline in ability to perform activities of daily living, and other factors, the odds of entry into care were three times as high for seniors who reported an injurious fall in 1994/95 as for those who did not.

Key words

elderly, accidents, institutionalization, home care

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For Canada's elderly population, injurious falls constitute an important health problem. Between 1983 and 1992, for example, falls were the second leading cause of hospitalization among women aged 65 or older, and the fifth leading cause among men in this age group.[1] In some western provinces, accidental falls ranked first as a cause of hospitalization of elderly women, even surpassing the rate for coronary heart disease.

Hip fractures—at least 90% of which are estimated to be caused by falls[2]—were the second leading cause of hospital admission for women aged 65 or older in 1995/96.[3] Recent Ontario data indicate that falls account for 86% of injury admissions to hospital among elderly people.[4]

In 1995, over 2,100 deaths (1%) among people aged 65 or older were attributed to falls (that is, the death certificate listed an accidental fall as the underlying cause of death).[5] As well, falls contribute to considerably more deaths than conventional mortality data indicate. Analysis of all causes of death listed for a sample of 179,175 death records for Canadians aged 65 or older shows that "accidental fall" was entered on the death certificate more than twice as often as

Methods

Data source

This article is based on Statistics Canada's National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both a cross-sectional and longitudinal 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 cross-sectional data from the household component of the second (1996/97) cycle of the NPHS for the 10 provinces and longitudinal data from the first (1994/95) and second cycles.

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

Individual data are organized into two files: General and Health. Socio-demographic and some health information was obtained for each member of participating households. These data are found in the General file. Additional, in-depth health information was collected for one randomly selected household member. The in-depth health information, as well as the information in the General file pertaining to that individual, is found in the Health file. In households belonging to the cross-sectional buy-in component, one knowledgeable person provided the socio-demographic and health information about all household members for the General file. As well, one household member, not necessarily the same person, was randomly selected to provide in-depth health information about himself or herself for the Health file. Among individuals in the longitudinal component, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for the household in cycle 1 (1994/95) and was usually the person who provided information on all household members for the General file in cycle 2.

The 1994/95 provincial, non-institutional sample consisted of 27,263 households, of which 88.7% agreed to participate in the survey. After the application of a screening rule to keep the sample representative,[6] 20,725 households remained. In 18,342 of these households, the randomly selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents. Of these 17,626 randomly selected respondents, 14,786 were eligible members of the NPHS longitudinal panel, along with 468 persons for whom only general information was collected. And 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible. Thus, 17,276 respondents were eligible for re-interview in 1996/97. The remaining respondents were sponsored by provincial governments that elected to enlarge the sample size in their province for cycle 1 only. These respondents were not followed up.

For the longitudinal panel, a response rate of 93.6% was achieved in 1996/97. Of these 16,168 respondents, 15,670 provided full information; that is, general and in-depth health information for both cycles of the survey. Of the 15,670 people providing full information, 2,546 were aged 65 or older.

The one-time participation of additional respondents in cycle 2 for cross-sectional purposes (not as part of the longitudinal panel) resulted in a total of 210,377 respondents to the general health questions (173,216 aged 12 or older) and 81,804 respondents to the in-depth health questions (73,402 aged 12 or older). The overall response rate was 79.0%.

The data used in this analysis were weighted to reflect the sample design, adjustments for non-response, and post-stratification. The longitudinal data were provided by people aged 65 or older in 1994/95 who were still alive in 1996/97, for whom complete data were provided in both interviews, and who did not receive formal home care in 1994/95. This sample numbered 2,081 (822 men and 1,259 women); these data were weighted to represent 2.7 million Canadians aged 65 or older. The sample excludes 201 respondents, or 8%, who had died between 1994/95 and 1996/97 (see *Deaths*). In addition, cross-sectional data from 13,363 people aged 65 or older in 1996/97, which were weighted to represent 3.4 million people, were used for this article.

A more detailed description of the NPHS design, sample, and interview procedures can be found in published reports.[6,7] See also *The National Population Health Survey—its longitudinal nature* in this issue.

Analytical techniques

All analyses were based on weighted data. Descriptive statistics for household residents aged 65 or older were based on data from the Health file for 1996/97. With data from the longitudinal file, multiple logistic regression was used to model the relationship between at least one injurious fall reported by residents of households in 1994/95 (independent variable) and subsequent entry into care (dependent variable). Entry into care was defined as having been hospitalized for a total of at least 14 nights, receiving formal home care in the 12 months before the NPHS interview in 1996/97, or living in an institution at the time of the interviewer's follow-up in 1996/97 (see *Limitations*).

The behavioural model of health services utilization was used as the basis for selecting factors to be controlled for in multiple logistic regression.[8] The behavioural model describes three categories of variables related to health services use: predisposing, enabling and need. From the NPHS data, sex, age and marital status were specified as predisposing factors; level of household income as an enabling factor; and decline in ability to perform personal activities of daily living (ADL) and the presence of selected chronic conditions as indicators of need (see *Definitions)*.

Multiple logistic regression controlled for factors other than falls present in 1994/95 that could have influenced the use of health care services. Standard errors used in the calculation of the confidence intervals for the odds ratios were estimated with the bootstrap technique,[9,10] which fully accounts for the design effects of the survey.

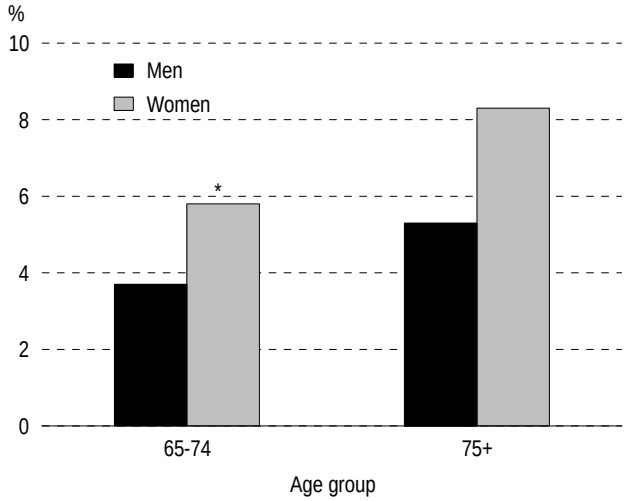
it was selected as the underlying cause.[11] The problem of undercounting deaths caused by falls has also been noted in the United States.[2]

Hospitalization and death records show that falls are a major health problem for elderly people. These sources, however, reveal an incomplete picture of the consequences of falls, in part because the data relate mostly to care or outcomes immediately after the fall. American research indicates that for elderly people, falls are strongly predictive of future needs for health care or institutionalization, even several years after the fall.[12-14] These findings are derived from analyses of population-based longitudinal data.

To date in Canada, research on falls among seniors has been based on analyses of administrative data,[15] and studies of community-based[16] or clinical samples. Recently, though, nationally representative longitudinal data have become available. The first two cycles of the National Population Health Survey (NPHS) present an opportunity to study injurious falls among a large sample of seniors representative of non-institutionalized elderly people in Canada.

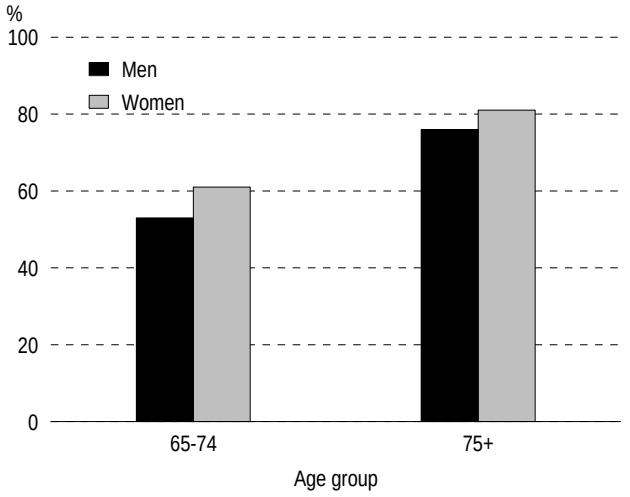
Based on the most recent cross-sectional data from the NPHS, this article describes characteristics of seniors who reported sustaining a serious injury due to falling (see *Methods, Definitions* and *Limitations*). As well, using NPHS data from a panel of people who were surveyed in 1994/95 and again in 1996/97, the article examines the extent to which a fall that occurred in 1994/95 was associated with subsequent use of health care services. These services include a high number of days in hospital or receipt of formal home care during the year before the 1996/97 interview, or institutionalization at some point after the 1994/95 interview.

Chart 1
Percentage of household population aged 65 or older who sustained an activity-limiting injury in past year, by sex and age group, Canada excluding territories, 1996/97



Data source: *1996/97 National Population Health Survey, cross-sectional sample, Health file*
** Percentage is significantly higher for women than for men ($p < 0.05$).*

Chart 2
Percentage of household population aged 65 or older sustaining an activity-limiting injury in past year whose most serious injury was caused by a fall, by sex and age group, Canada excluding territories, 1996/97



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

Falls cause most injuries in seniors

Nearly 200,000 (6%) people who were aged 65 or older in 1996/97 were estimated to have experienced at least one activity-limiting injury in the year before the survey. For about two-thirds of them (131,500), a fall was responsible for the most serious injury sustained, which amounts to 4% of the total household population of seniors. In the 65 to 74 age group, a higher percentage of women than men reported an activity-limiting injury (Chart 1). However, the percentage of the most serious injuries attributed to falls was nearly the same for both sexes (Chart 2). At age 75 or older, falls caused roughly 80% of the most serious injuries reported.

Deaths

To compare the characteristics of individuals in the sample who died with those of people who did not, and either remained in the household population or became institutionalized at some time between the two NPHS interview cycles, odds ratios were estimated using multiple logistic regression. Characteristics based on data reported in 1994/95 were used as independent variables, with dying as the dependent variable. The odds of an injurious fall were not elevated among those who died. As expected, old age (75 or older, compared with 65 to 74) was predictive of death, as was being in fair or poor health, compared with good, very good or excellent health. Compared with people who could perform personal activities of daily living (ADL) independently, the odds that those reporting ADL dependency would have died were elevated. Finally, a diagnosis of cancer in 1994/95 was predictive of death by 1996/97.

Adjusted odds ratios for dying by 1996/97, household population aged 65 or older in 1994/95, Canada excluding territories

Characteristics in 1994/95	Adjusted odds ratio	95% confidence interval†
Injurious fall in past year		
No‡	1.0	...
Yes	0.9	0.4, 2.3
Sex		
Men‡	1.0	...
Women	0.6	0.3, 1.0
Age		
65-74‡	1.0	...
75+	2.3*	1.4, 3.8
Marital status		
Married‡	1.0	...
Single	1.6	1.0, 2.7
Household income		
Higher‡	1.0	...
Lower	1.3	0.8, 2.2
Activities of daily living (ADL)		
Not dependent‡	1.0	...
Dependent	3.5*	1.5, 8.2
General health		
Good, very good, excellent‡	1.0	...
Fair, poor	1.7*	1.0, 2.7
Smoking		
Never‡	1.0	...
Ever	1.2	0.7, 2.2
Chronic conditions§		
Cancer	3.1*	1.6, 6.1
Diabetes	1.3	0.7, 2.4
Effects of stroke	1.4	0.6, 3.6
Heart disease	1.5	0.9, 2.6
High blood pressure	0.9	0.6, 1.4

Data source: *1994/95 and 1996/97 National Population Health Survey, longitudinal sample*
† Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.
‡ Reference category, for which odds ratio is always 1.0
§ Reference category is absence of condition.
** $p < 0.05$*
... Not applicable

These figures, however, do not represent the incidence of injurious falls in the population. NPHS respondents were asked only for information about the single most serious injury they sustained during the year. Because a fall—or several falls—may have occurred that did not cause the most serious injury, the falls reported clearly underrepresent the total number experienced. In a study of 409 community-dwelling seniors in Montréal,[16] 29% reported falling over a 48-week period.

Women, very old more likely to fall

A comparison of the characteristics of seniors who reported injurious falls in 1996/97 with those of all community-dwelling seniors indicates that disproportionate numbers of women and people aged 75 or older were affected (Table 1). As well, the percentage of elderly single people reporting falls (55%) was notably higher than the percentage of elderly single people in the household population (41%). As expected, falls also occurred with higher frequency among people who were ADL-dependent (that is, they needed help with activities of daily living) in 1994/95. Similarly, people with arthritis or rheumatism were overrepresented among those who reported falls.

Fracture most common injury

The physical consequences of the falls reported were relatively serious. However, because the NPHS collected information on only those falls that caused the most serious injury, the data overrepresent the more severe injuries; for example, fractures. Research in the United States indicates that about 5% of all falls among the elderly result in a fracture.[17]

Among seniors who reported that their most serious injury in 1996/97 was caused by a fall, 49% sustained fractures; sprains or strains occurred in another 22%. The body parts most frequently injured were the legs or feet (30%) and the arms or hands (25%). A hip injury (distinct from a leg injury) was reported by 12% (Table 2). Two-thirds of the reported injurious falls occurred in the home or surrounding area (data not shown).

Among the 65,000 seniors who reported fractures, the arms or hands were injured most often, followed by the legs or feet. The hip was the third most frequently fractured bone, affecting 12,000 people, or 19% of those whose fractures were caused by falling (data not shown).

Long-term consequences

Of those seniors who were living in households and not receiving formal home care in 1994/95, an estimated 290,000, or 11%, had "entered care" by 1996/97. That is, they had either been hospitalized for a total of 14 or more nights or had entered formal home care in the year prior to their interview in 1996/97, or they had been placed in an institutional care facility some time following their 1994/95 interview and were still there at the time of the interviewer's subsequent contact with the household. The unadjusted odds of entry into care for people who reported having sustained an injurious fall in 1994/95 were nearly triple (2.7) the odds for people who did not report a fall (data not shown).

It was expected that adding factors such as age, income and illness to the model would lower the magnitude of the odds ratio for falls somewhat, assuming that some of the increased risk of entering care would be accounted for by these other factors. Previous prospective studies linking falls to subsequent nursing home placement or health care services have reported that including control variables, such as age and functional ability, slightly lowered the estimated risk related to falls.[12-14] However, in this analysis of NPHS data, the odds ratio for falls as a predictor of eventual entry into care remained in the same range, even after adjusting for variables reflecting chronic disease, ADL decline,

Table 1
Characteristics of total household population aged 65 or older and of those reporting an injurious fall, Canada excluding territories, 1996/97

	Household population 65+			Household population 65+ reporting a fall that caused most serious injury		
	Total	Men	Women	Total	Men	Women
			'000			
Number	3,416	1,479	1,937	131	39	92
			%			
Age						
65-74	61	63	60	44	45	44
75+	39	37	40	56	55	56
Marital status						
Married	59	76	46	45	66	36
Single	41	24	54	55	34	64
Income						
Lower	19	14	23	--	--	24
Higher	61	68	56	54	69	47
Not available	20	18	21	24	12†	29
Activities of daily living (ADL)-dependent	7	7	7	20	26†	17
Chronic conditions						
Arthritis/ Rheumatism	42	34	49	56	45	62
Effects of stroke	4	5	3	--	--	2†
Heart disease	16	18	14	18	24†	15
High blood pressure	33	27	36	36	28	40
Urinary incontinence	6	4	7	16	--	15†

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

Table 2
Type of injury and body part injured, household population aged 65 or older who reported most serious injury caused by a fall, Canada excluding territories, 1996/97

	Number	%
Type of injury		
Total	**131,500**	**100**
Fracture	64,800	49
Sprain/Strain	28,400	22
Other	38,100	29
Unknown	--	--
Body part injured		
Total	**131,500**	**100**
Legs/Feet	39,700	30
Arms/Hands	33,400	25
Hip	15,400	12
Other	42,500	32
Unknown	--	--

***Data source**: 1996/97 National Population Health Survey, cross-sectional sample, Health file*
-- Amount too small to provide reliable estimate

and social and demographic characteristics (Table 3). This provides strong evidence that neither health problems present at the time of the fall nor subsequent decline in function solely account for the increase in the odds of entry into care for elderly people who are hurt in a fall. Because the analysis controlled for a decline in ADL after the fall, the observed association of falls with subsequent care is even more compelling than that reported in studies that have controlled for ADL function only at the time of the fall.[14,18]

Table 3
Adjusted odds ratios for entry into care,† household population aged 65 or older, by selected characteristics in 1994/95, Canada excluding territories

Characteristics in 1994/95	Adjusted odds ratio	95% confidence interval‡
Injurious fall in past year		
No§	1.0	...
Yes	3.2*	1.1, 9.0
Sex		
Men§	1.0	...
Women	0.9	0.5, 1.5
Age		
65-74§	1.0	...
75+	3.3*	2.2, 5.1
Marital status		
Married§	1.0	...
Single	0.8	0.5, 1.3
Household income††		
Higher§	1.0	...
Lower	1.6	0.9, 2.7
Activities of daily living (ADL)		
No decline between 1994/95 and 1996/97§	1.0	...
Decline between 1994/95 and1996/97	16.7*	9.3, 29.9
Chronic conditions‡‡		
Effects of stroke	2.7*	1.0, 7.2
Heart disease	1.1	0.6, 1.9
High blood pressure	1.2	0.7, 2.1
Urinary incontinence	1.3	0.3, 5.3

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample*
† Spent a total of 14 or more nights in hospital, received home care, or entered a long-term care facility before 1996/97 interview.
‡ Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.
§ Reference category, for which odds ratio is always 1.0
†† A variable for unavailable data on income was also entered into the model, but the odds ratio is not shown.
‡‡ Reference category is absence of condition.
** $p < 0.05$*
··· Not applicable

Effects of other factors

The odds ratios for entry into care associated with several other control variables were also significantly elevated. Not unexpectedly, age 75 or older was associated with entry into care, reflecting the greater frailty of old age. Compared with people aged 65 to 74, the odds of entry into care among people aged 75 or older were over three times as high.

Although women were more likely than men to suffer an injurious fall, the odds ratio for women was not significantly elevated in the multivariate analysis. This indicates that other factors in the model were more strongly associated with entry into care than being female.

Two control variables included as indicators of need for health care, the presence of the effects of stroke in 1994/95 and decline in ADL function from 1994/95 to 1996/97, were significantly associated with entry into care in 1996/97. The association with stroke was not surprising. Stroke victims afflicted by mobility problems are more likely to experience multiple falls, which have been reported to be even more strongly linked to use of health care services than single falls.[14,19] The strong association between decline in ADL function and entry into care was also expected. There is substantial variance in the estimated odds ratio because of the relatively small number of people affected. Nonetheless, the level of elevation of the odds ratio for ADL decline reflects its close association with entry into care. In view of this, it is even more remarkable that the independent contribution of falls remains unaffected by adjustment for this variable.

Concluding remarks

The analysis in this article is the first attempt to evaluate injurious falls longitudinally using nationally representative data for Canada. The association of falls with subsequent entry into care, independent of co-existing physical need or predisposing or enabling factors, suggests that falls play a critical role in the deteriorating health of older people and in their ensuing need for assistance. It has been suggested that, for an older person with certain pre-existing problems, an injurious fall may be the "last

straw" or precipitating event that causes family members to arrange for formal home care or institutionalization.[13]

The question of whether an injurious fall initiates, or merely exacerbates, a decline in health is beyond the scope of this analysis. However, these findings do show that seniors who fall can suffer serious consequences, both physically and in their need for health care services—even a considerable time after the fall. Measures effective in preventing falls, such as balance or strengthening exercises, adjustments to medication, and alterations in the home (installing railings or grab-bars, for example), might also avert or delay the need for home care or institutional placement.[20] Further research to identify the characteristics of seniors who are at greatest risk of sustaining injurious falls would benefit such preventive efforts. ●

Definitions

Use of selected health care services in the survey year 1996/97, referred to as "entry into care," was defined as the dependent variable for the regression analyses. People aged 65 or older who were living in households and who had not received government-supported home care services in the year before 1994/95, but who then reported spending a total of at least 14 nights in hospital in 1996/97, receiving formal home care (except respite care) or becoming institutionalized before their 1996/97 interview, were defined as entering care. (On average, people aged 65 or older living in households spent 2.3 nights in hospital in the 12-month period in 1996/97.) In view of reductions in hospital stays and increasing restrictions on admissions to hospital in recent years, the hospitalization element of entry into care was also defined as at least 7 nights in hospital for preliminary analysis. Because this reduction did not substantially alter the results of the regression analysis, the more conservative definition of at least 14 nights in total was retained.

To determine *hospitalization*, the NPHS asked: "In the past 12 months, have/has . . . been a patient over night in a hospital, nursing home or convalescent home?" If respondents answered "yes," they were asked, "For how many nights in the past 12 months?"

The question about *home care* was: "Home care services are health care or homemaker services received at home, with the cost being entirely or partially covered by government. Examples are nursing care, help with bathing or housework, respite care, and meal delivery. Have/Has . . . received any home care services in the past 12 months?"

Information on *institutionalization* of respondents at some time between their 1994/95 NPHS interview and the data collection period two years later was ascertained by interviewers in 1996/97.

NPHS respondents were asked if, in the year before the 1994/95 survey, they had experienced *any injury serious enough to limit their normal activities*. Those who reported at least one such injury were asked about their most serious injury: the type (for example, a burn or broken bone), the body part injured, where the injury happened, and what caused it. Respondents were dichotomized as those who reported that a fall had caused their most serious injury, and those who either sustained no injury or attributed their injury to a cause other than a fall.

Two *age groups* were examined: 65 to 74 and 75 or older. *Marital status* was defined as "married" for those who stated that they were married or living with a partner; "single" for respondents who reported that they were single, widowed, divorced or separated.

Household income levels were defined as "lower" and "higher," based on total household income and the number of people living in the household:

	Income level	
People in household	**Lower**	**Higher**
1 or 2	Less than $15,000	$15,000 or more
3 or 4	Less than $20,000	$20,000 or more
5 or more	Less than $30,000	$30,000 or more

Data on income were unavailable for 20% of respondents aged 65 or older. So that other information on these people could be included in the regression analysis, a variable for unknown income was included in the model.

A number of factors reflecting need for care were included as control variables in the regression analysis. Among these was decline in ability to perform activities of daily living (ADL) between 1994/95 and 1996/97. A respondent who answered "no" in 1994/95, but then "yes" in 1996/97 to the question, "Because of any condition or health problem, do you need the help of another person in: personal care such as washing, dressing or eating, or moving about inside the house?" was defined as having experienced a decline in ADL functioning.

Chronic conditions reported to be present in 1994/95 were also included as factors reflecting need for care, based on previously reported associations with institutionalization.[17] These included high blood pressure, heart disease, effects of a stroke, and urinary incontinence. The presence of these conditions was ascertained by asking, "Does . . . have any of the following long-term conditions that have lasted or are expected to last six months or more and that have been diagnosed by a health professional?"

Limitations

The analysis was restricted to the NPHS household sample. Therefore, the results cannot be generalized to the total population of seniors, 5% of whom reside in long-term care facilities.[21] The unavailability of data on people who experienced falls that resulted in institutionalization or death before they could be interviewed may render the observed associations between falls and other factors weaker than they actually are.

The data preclude estimates of the number and frequency of injurious falls and of the frequency of falls among individuals. The NPHS collected data only on the single "most serious" of any activity-limiting injuries sustained over the previous 12 months. Thus, a person who was injured in a fall but who also sustained a more serious injury from another cause would not report his or her fall(s).

The inability to distinguish people who fell only once from those who fell recurrently also limits the use of the data in prospective analysis. Previous research has found an association between health status and use of health care services by elderly people who had fallen repeatedly, but not for those who had fallen only once.[14,19] Because these groups cannot be identified in the present analysis, this factor could not be considered.

No information was available on the exact duration of the elements that were combined to make up the dependent variable, entry into care. Although this variable was defined so that it would reflect a relatively serious health disturbance, it is likely that there were inconsistencies in the severity of the disorders that resulted in entry into care. That is, entry into formal home care, or a total of 14 or more days in hospital, or institutionalization would usually imply a permanent disturbance of significant severity, but each could also occur in the case of a temporary problem that could be remedied.

The purpose of the analysis was to examine the extent to which falls in the elderly were associated with eventual, rather than immediate, entry into care. However, the reference periods pertaining to the elements of entry into care were somewhat inconsistently defined. The reference period for the receipt of formal home care and for hospital stays was specified as the 12-month period before the 1996/97 interview. For institutionalization, however, no information was available on the date of admission. Therefore, people classified as institutionalized (and thus as having entered care) in 1996/97 might have entered an institution at any point after their interview in 1994/95.

It is also possible that some people may have been temporarily institutionalized (for example, in a convalescent home) sometime between the 1994/95 and 1996/97 interviews, and then have returned home before the interview in 1996/97. Information on these institutionalizations has not been collected, so such people may have been misclassified as not having entered care. However, information about temporary institutionalizations of at least 14 days' duration that occurred sometime in the year before the 1996/97 interview would presumably have been elicited by the question on hospitalization (see *Definitions*).

Collection methods impose certain limitations on how the NPHS data can be interpreted. The data were self-reported, and their degree of validity is not known. As well, causality cannot be inferred. However, the use of longitudinal data does establish the temporal relationships between injurious falls and subsequent health care outcomes.

References

1 Stokes J, Lindsay J. Major causes of death and hospitalization in Canadian seniors. *Chronic Diseases in Canada* 1996; 17(2): 63-73.

2 Sattin RW. Falls among older persons: A public health perspective. *Annual Review of Public Health* 1992; 13: 489-508.

3 Statistics Canada. Hospital morbidity data, unpublished tabulations, Health Statistics Division, 1999.

4 Canadian Institute for Health Information (CIHI). *Fact Sheet: Ontario Trauma Registry, Hospital Injury Admissions, 1996/97*. Available at http://www.cihi.ca. Released January 26, 1999.

5 Statistics Canada. *Causes of death, 1995* (Catalogue 84-208-XPB) Ottawa: Minister of Industry, 1997.

6 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.

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

8 Andersen R, Newman J. Societal and individual determinants of medical care utilization in the United States. *Milbank Memorial Fund Quarterly* 1973; 41: 95-124.

9 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.

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

11 Maillet S. *La chute accidentelle comme une cause de décès chez les aînés*. Internal report. Ottawa: Statistics Canada, 1998.

12 Tinetti ME, Williams CS. Falls, injuries due to falls, and the risk of admission to a nursing home. *New England Journal of Medicine* 1997; 337(18): 1279-84.

13 Kiel DP, O'Sullivan P, Teno JM, et al. Health care utilization and functional status in the aged following a fall. *Medical Care* 1991; 29(3): 221-8.

14 Dunn JE, Furner SE, Miles TP. Do falls predict institutionalization in older persons? An analysis of data from the Longitudinal Study of Aging. *Journal of Aging and Health* 1993; 5(2): 194-207.

15 Riley R. Accidental falls and injuries among seniors. *Health Reports* (Statistics Canada, Catalogue 82-003) 1994; 4(4): 341-54.

16 O'Loughlin JL, Robitaille Y, Boivin J-F, et al. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. *American Journal of Epidemiology* 1993; 137(3): 342-54.

17 Tinetti ME, Speechly M. Prevention of falls among the elderly. *New England Journal of Medicine* 1989; 320(16): 1055-9.

18 Dunn JE, Rudberg MA, Furner SE, et al. Mortality, disability, and falls in older persons: The role of underlying disease and disability. *American Journal of Public Health* 1992; 82(3): 395-400.

19 Wolinsky FD, Johnson RJ, Fitzgerald JF. Falling, health status, and the use of health services by older adults: A prospective study. *Medical Care* 1992; 30(7): 587-97.

20 Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine* 1994; 331(13): 821-7.

21 Tully P, Mohl C. Older residents of health care institutions. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(3): 27-30.

Birth outcome, the social environment and child health

Jiajian Chen and Wayne J. Millar

Abstract

Objectives

This article examines the effects of birth outcome and selected social environmental factors on the health of young children.

Data source

The data are from the 1994/95 National Longitudinal Survey of Children and Youth. Information provided by the biological mothers of 5,888 children younger than age 3 is analyzed.

Analytical techniques

The analysis focuses on two measures of child health: the mother's perception of the child's general health and a diagnosis of asthma. Logistic regression was used to estimate the effects of birth outcome and selected social environmental factors on these measures. Birth outcome refers to gestational age and birthweight. Social environmental factors include maternal education, maternal smoking, maternal age at birth of child, family status and household income.

Main results

Preterm low birthweight was associated with a higher risk of poor health and asthma among children when all the other selected risk factors were controlled. Poor maternal health and maternal smoking were important risk factors for poor child health. Maternal asthma and low maternal education were significantly associated with childhood asthma.

Key words

preterm, low birthweight, smoking, childhood asthma, maternal education

Authors

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Advancements in neonatal care and medical technology have improved the survival of low birthweight infants. Yet this very success has resulted in growing concerns about the subsequent health of these babies.[1-9] Children born too small have higher mortality than babies of normal birthweight and tend to have more developmental and physical health problems.[1-5,7,10,11] Moreover, the effects of low birthweight may persist into adulthood,[6,12-14] and thus, have important long-term public health implications.[15-18]

But low birthweight children are not a homogeneous group. They may be preterm (before 37 weeks' gestation) or full-term but "subnormal in weight because of various abnormal maternal or fetal conditions."[2] Therefore, studies of the subsequent health of low birthweight children "must include consideration of whether the children were born preterm or at term gestation and the conditions associated with the low birthweight."[2]

While the biological outcomes of the fetal environment may exert independent effects on subsequent health, the social environment also has a profound influence. The social

environment consists of socioeconomic and behavioural elements such as maternal education, maternal smoking, the mother's age at the birth of the child, family status, and household income.[19-22] There is increasing concern about the relative importance of birth outcome and social environmental factors to child health.[3,12,23-30]

This article uses data from the 1994/95 National Longitudinal Survey of Children and Youth (NLSCY) to examine the effects of birth outcome and social environmental factors on the health of children younger than age 3 (see *Methods, Definitions* and *Limitations*). It focuses on two health outcomes—general health status and asthma—as reported by the child's mother.

General health

In 1994/95, the overwhelming majority of Canadian children younger than age 3 were judged by their mothers to be healthy; only 2% were considered to

Methods

Data sources

The data are from the 1994/95 (first) cycle of the National Longitudinal Survey of Children and Youth (NLSCY). The target population was children from newborn to age 11.[31] In each NLSCY household, up to four children were selected at random, and a question was asked to determine who in the household was the person most knowledgeable (PMK) about them. For 91.3% of the selected children, the PMK was the mother (89.9% biological; 1.4% step, adoptive or foster).

The NLSCY had a responding sample of 13,439 households. In these households, 22,831 children were selected to participate in the survey. Data on these children will be collected every two years as they grow to adulthood. The overall response rate at the household level was 86%. Response rates for the health outcomes of children and the characteristics of the PMK for the sampled children were over 91%. A more detailed description of the survey is available in published reports.[31,32]

Information on birthweight and gestational age was collected only for children younger than age 3. This analysis, therefore, is restricted to a subsample of 5,888 children younger than 3 who were born in Canada and whose biological mothers were interviewed as the PMK (Appendix Table A).

Analytical techniques

Prevalence and unadjusted and adjusted odds ratios were estimated to examine the effects of birth outcome and selected social environmental factors on the health of children. This analysis focuses on two measures of health: overall health as assessed by the child's mother and diagnosed asthma. Maternal assessment of overall child health is recognized as being important for primary care clinicians.[33,34] Asthma has been identified as the most common chronic illness and one of the leading causes of hospitalization among children in industrialized countries.[23,24,35-38]

Logistic regression was used to estimate the odds ratios for health outcomes by the child's birthweight in combination with gestational age, sex and age, by the mother's educational attainment, smoking behaviour and age at the birth of the child, and by family type and household income. The model for the child's general health incorporated the mother's general health status; the model for childhood asthma incorporated the mother's asthma status. Several other health outcomes and measures of health care utilization were also examined in relation to birth outcome (see *Definitions*).

The selection of the variables included in the model was guided by the results of earlier research. Lone parenthood and teenage motherhood are highly associated with poor child health and childhood asthma.[25,39,40] Maternal education and household income have been related to the health of children.[41-43] Maternal health status and maternal asthma were included in the general health and asthma models, respectively, as controls for potential biological links to the child's health.[5,44]

The multiple logistic regression analyses were based on 5,810 children younger than age 3 whose mothers reported information on all the variables included in the models. Records with missing data were excluded. The analysis was based on a weighted sample using survey weights, which were normalized to average 1. Although this procedure produces less biased estimates of the standard errors, the adjustment does not take into account the complex design of the NLSCY and may underestimate the standard errors. Therefore, only tests with p-values of less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design. Even so, caution is warranted when interpreting the results.

be in poor health. However, the child's health varied depending on a number of biological and social factors.

Both gestational age and birthweight were associated with subsequent child health (Table 1, Appendix Table B). Six percent of children who had been preterm low birthweight babies were reported to be in poor health, as were 4% who had been full-term low birthweight babies. The figure was 2% for normal birthweight children regardless of gestational age.

Among the characteristics examined, the only one other than preterm low birthweight that was related to a higher prevalence of poor child health was

Definitions

The National Longitudinal Survey of Children and Youth asked the person most knowledgeable about the child a series of questions about the child's health and health behaviour. The analysis in this study was confined to the responses of the biological mother.

In this analysis, *birth outcome* was measured in terms of birthweight and gestational age.

For *gestational age*, the mother was asked: "Was ... born before or after the due date?" Those who answered that the child had not been born on the due date were asked the number of days before or after the due date. Gestational age was grouped into two categories: preterm (less than 37 weeks) and full-term (37 or more weeks).

For *birthweight*, the mother was asked: "What was …'s birthweight in kilograms and grams or pounds and ounces?" Birthweight in grams was divided into two categories: low (less than 2,500) and normal (2,500 or more).

Children were grouped into four categories based on gestational age and birthweight: preterm low birthweight; full-term low birthweight; preterm normal birthweight; and full-term normal birthweight.

To determine the overall health of the child, the mother was asked: "In general, how would you describe …'s health?" Response options were: excellent, very good, good, fair, poor. For this analysis, if a mother replied "poor" or "fair," the child's health was classified as poor. The asthmatic status of children was based on the question: "Has ... ever had asthma that was diagnosed by a health professional?" The validity of these two measurements of the health of children appears high, since both overall health and asthma status are highly associated with prescription drug use, hospitalization and long-term activity limitation among young children.[45]

Chronic conditions were assessed with the question: "Does … have any of the following long-term conditions that have been diagnosed by a health professional?" This analysis examines the prevalence of bronchitis.

Frequent nose or throat infections was determined by asking whether infections had occurred "almost all the time" or "often."

Any injury in the past year refers to injuries that occurred in the past 12 months and were serious enough to require medical attention by a doctor, nurse or dentist.

The presence of long-term *activity limitations* was determined by asking: "Does this condition or health problem prevent or limit …'s participation in school, at play or any other activity normal for a child …'s age?"

To measure *physician contact*, the mother was asked: "In the past year, how many times have you seen or talked on the telephone about …'s physical or mental health with: a general practitioner, family physician or pediatrician?" Frequent contact was defined as at least six times (the average was five).

The regular use of *prescription drugs* was based on the question "Does … take any of the following prescribed medications on a regular basis." Response options were: Ventolin or other inhalants, Ritalin, tranquilizers or nerve pills, anti-convulsants or anti-epileptic pills, and other.

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

The child's *age* was grouped into three categories: younger than 1, 1, and 2.

Mother's health status was defined as poor if she reported herself as being in poor or fair health; otherwise, her health was considered to be good.

Maternal asthma status was determined by asking: "Do you have any of the following long-term conditions that have been diagnosed by a health professional?" Asthma was included among the response options.

Maternal education was collapsed into three categories: less than high school, high school graduation or some postsecondary, and postsecondary graduation.

Maternal smoking was determined by asking: "At the present time do you smoke cigarettes daily, occasionally or not at all?"

Maternal age at birth of child was defined as younger than 20, 20 to 24, 25 to 34, and 35 or older.

Family type was dichotomized as lone-mother or two-parent family (including stepfather).

Based on household size, *household income* quintiles were derived and further grouped as low (quintiles 1 and 2), middle (quintiles 3 and 4) and high (quintile 5).

maternal health status: 11% of mothers whose health was poor reported that their children, too, experienced poor health. The prevalence of poor health was also somewhat elevated—around 4%—among children whose mother was not a high school graduate, smoked daily, had been a teenager when she gave birth, was a lone parent, or had low household income. Many of these characteristics co-exist, however. For instance, low birthweight is associated with poor maternal health, low educational attainment and smoking. Teenage motherhood often results in lone parenthood and low income.

Table 1
Prevalence and adjusted odds ratios for poor health among children younger than age 3, by selected characteristics, Canada excluding territories, 1994/95

	Prevalence	Adjusted odds ratio	99% confidence interval
	%		
Characteristics of child			
Birth outcome			
Preterm low birthweight	6.3	3.1**	1.5, 6.6
Full-term low birthweight	4.2	1.8	0.5, 7.0
Preterm normal birthweight	2.1	0.8	0.3, 2.3
Full-term normal birthweight†	1.9	1.0	...
Age			
Younger than 1†	1.4	1.0	...
1	2.1	1.5	0.8, 2.8
2	2.9	1.8	1.0, 3.4
Sex			
Male	2.4	1.3	0.8, 2.2
Female†	1.9	1.0	...
Characteristics of mother			
Health status			
Poor/Fair	11.1	4.8**	2.4, 9.7
Good/Very good/Excellent†	1.9	1.0	...
Educational attainment			
Less than high school	3.5	1.9	0.9, 4.1
High school graduation/Some postsecondary	2.6	1.8	1.0, 3.4
Postsecondary graduation†	1.2	1.0	...
Smoking status			
Daily	4.0	2.0**	1.2, 3.3
Occasional	1.8	1.1	0.3, 3.8
Non-smoker†	1.5	1.0	...
Age at birth of child			
Younger than 20	4.1	0.9	0.3, 2.5
20-24	2.2	0.8	0.4, 1.5
25-34†	2.0	1.0	...
35+	2.2	1.2	0.6, 2.5
Household characteristics			
Family type			
Lone mother	4.5	1.6	0.8, 3.0
Two-parent family†	1.8	1.0	...
Income			
Low	3.8	0.9	0.4, 2.3
Middle	1.7	0.7	0.3, 1.6
High†	1.8	1.0	...

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *The multivariate analysis is based on 5,810 children younger than age 3 whose mothers reported information on all variables in the model. Tests with p-values of less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design.*
† Reference category, for which odds ratio is 1.0
*** $p < 0.01$*
... Not applicable

After birth outcome, child age and sex, maternal education, smoking and age at the birth of the child, and family type and household income were controlled, maternal health emerged as being independently associated with poor child health. Children whose mother was in poor health had almost five times the odds of being in poor health themselves, compared with children of mothers in good, very good or excellent health.

After adjustment for the other factors including maternal health, preterm low birthweight remained significantly associated with poor child health. The odds that such children would experience poor health were three times the odds for full-term normal birthweight children. Full-term low birthweight children had moderately higher odds of poor health, but the difference was not statistically significant and is partly attributable to small sample size.

It also appears that daily maternal smoking had a detrimental effect on child health, after birth outcome and other social environmental conditions were controlled. The adjusted odds of poor health among children whose mothers smoked daily were twice as high as among children whose mothers did not smoke.

The odds of poor health among children of mothers with low education were relatively high, but the difference was not statistically significant. Likewise, the association of poor child health with teenage births, family type and household income disappeared when the other factors were introduced into the analytical model.

Early childhood asthma

In 1994/95, according to the NLSCY, 6% of Canadian children younger than age 3 had been

diagnosed with asthma. The prevalence of asthma tended to be associated with the biological and social characteristics of the children and their mothers.

Asthma was especially common among children whose mother also had asthma (15%) (Table 2, Appendix Table C). The prevalence of asthma was also high among children who had been preterm low birthweight babies or whose mother had been a teenager when she gave birth (11% and 10%, respectively). The age of children was related to asthma: 8% of 2-year-olds had been diagnosed, compared with 2% of children younger than age 1. Asthma affected a higher percentage of boys than girls: 7% versus 4%. As well, low maternal education, maternal smoking, lone parenthood, and low household income tended to be related to high rates of asthma.

As was true for general health status, many of these social environmental factors are associated with each other. Yet even after adjusting for such potentially confounding effects, the odds of asthma among children of mothers with asthma were still three times the odds for children whose mother did not have asthma.

The relationship between asthma and preterm low birthweight also persisted, with such children's odds of having asthma two times the odds for full-term normal birthweight children. Children who had been full-term low birthweight babies or preterm normal birthweight babies did not have significantly high odds of having been diagnosed with asthma.

The mother's education was significantly associated with her child being diagnosed with asthma. After controlling for the other factors, the odds of asthma among children of mothers with less than high school graduation were 1.7 times the odds for children whose mother was a postsecondary graduate.

As has been shown in earlier research,[45-47] asthma is related to the child's sex. Even after the effects of the other variables were controlled, boys' odds of having asthma were 1.8 times those of girls.

While the odds of asthma among children of mothers who smoked were high relative to those of children of non-smoking mothers, the difference was not statistically significant after controlling for other factors. Similarly, the associations of family type and household income with childhood asthma were not significant after adjusting for the other factors.

Table 2
Prevalence and adjusted odds ratios for asthma among children younger than age 3, by selected characteristics, Canada excluding territories, 1994/95

	Prevalence	Adjusted odds ratio	99% confidence interval
	%		
Characteristics of child			
Birth outcome			
Preterm low birthweight	11.3	2.1**	1.2, 3.6
Full-term low birthweight	3.6	0.6	0.2, 2.6
Preterm normal birthweight	4.9	0.8	0.4, 1.5
Full-term normal birthweight†	5.5	1.0	...
Age			
Younger than 1†	2.1	1.0	...
1	6.3	3.1**	1.9, 5.0
2	8.4	4.4**	2.8, 7.0
Sex			
Male†	7.1	1.8**	1.3, 2.5
Female	4.1	1.0	...
Characteristics of mother			
Has asthma			
Yes	14.8	3.2**	2.0, 5.0
No†	5.2	1.0	...
Educational attainment			
Less than high school	7.9	1.7**	1.0, 2.8
High school graduation/Some postsecondary	6.2	1.4	0.9, 1.9
Postsecondary graduation†	4.2	1.0	...
Smoking status			
Daily	7.7	1.3	0.9, 1.8
Occasional	3.5	0.7	0.3, 1.7
Non-smoker†	5.1	1.0	...
Age at birth of child			
Younger than 20	9.9	1.1	0.6, 2.3
20-24	5.4	0.8	0.5, 1.2
25-34†	5.9	1.0	...
35+	3.5	0.7	0.4, 1.1
Household characteristics			
Family type			
Lone mother	8.2	1.1	0.7, 1.7
Two-parent family†	5.3	1.0	...
Income			
Low	7.4	1.0	0.5, 1.8
Middle	5.3	1.0	0.6, 1.6
High†	4.7	1.0	...

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *The multivariate analysis is based on 5,810 children younger than age 3 whose mothers reported information on all variables in the model. Tests with p-values of less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design. Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.*
† Reference category, for which odds ratio is 1.0
*** $p < 0.01$*
... Not applicable

Other health outcomes

Aside from the mother's health, the factor that emerges most consistently as being related to both the child's general health and asthma status is preterm low birthweight. And according to the 1994/95 NLSCY, preterm low birthweight had a persistent and independent effect on other aspects of child health as well (Table 3).

For example, preterm low birthweight children had about seven times the odds of having an activity limitation, compared with full-term normal birthweight children, even after controlling for the effects of child age and sex, maternal health status, education, smoking and age at the time of the birth, and family type and household income. The odds that preterm low birthweight children would have bronchitis or frequent nose or throat infections were also significantly elevated. In addition, children who had been preterm but of normal birthweight had high odds of frequent nose or throat infections. And full-term low birthweight children had significantly high odds of having suffered an injury in the past year.

Given the prevalence of health problems among preterm low birthweight children, it is hardly surprising that their odds of having frequent physician contacts, regularly using prescription drugs, or having been hospitalized exceeded those of children who had been full-term normal birthweight babies. However, low birthweight children who had been full-term and preterm children of normal birthweight did not have significantly high odds of health care utilization.

Implications

Clearly, the risk of poor health tends to be greater for preterm low birthweight children than for full-term normal birthweight children. According to the 1994/95 National Longitudinal Survey of Children and Youth, a substantial number of children younger than age 3—an estimated 41,000—had been preterm low birthweight babies. Moreover, rates of low birthweight and preterm births, especially the latter, have shown little decline in recent years.[48-50]

Table 3
Prevalence and adjusted odds ratios for selected health outcomes and health care utilization among children younger than age 3, by gestational age and birthweight, Canada excluding territories, 1994/95

	Preterm low birthweight			Full-term low birthweight			Preterm normal birthweight			Full-term normal birthweight†		
	%	Adjusted odds ratio	99% confidence interval	%	Adjusted odds ratio	99% confidence interval	%	Adjusted odds ratio	99% confidence interval	%	Adjusted odds ratio	99% confidence interval
Bronchitis	5.3	2.3**	1.0, 5.0	2.9	1.1	0.2, 5.6	2.2	0.8	0.3, 2.1	2.3	1.0	...
Frequent nose or throat infections	10.1	2.4**	1.3, 4.3	1.0	0.2	0.0, 2.9	8.6	1.9**	1.1, 3.3	4.4	1.0	...
Any injury	8.0	1.2	0.6, 2.3	17.6	3.1**	1.5, 6.5	9.8	1.3	0.8, 2.1	6.9	1.0	...
Any long-term activity limitation	12.4	6.8**	3.8, 12.3	3.6	1.9	0.5, 8.1	2.0	1.1	0.4, 3.2	1.9	1.0	...
Frequent contact with physician or pediatrician	41.5	1.6**	1.1, 2.3	30.3	1.0	0.5, 1.7	37.7	1.3	0.9, 1.8	31.6	1.0	...
Regular use of prescription drugs	16.4	2.7**	1.7, 4.4	3.6	0.5	0.1, 2.1	9.0	1.3	0.8, 2.2	6.7	1.0	...
Overnight hospitalization in past year	19.7	2.4**	1.5, 3.8	6.7	0.7	0.2, 2.0	12.7	1.4	0.9, 2.1	9.1	1.0	...

Data source: *1994/95 National Longitudinal Survey of Children and Youth*

Note: *Odds ratios adjusted for child age and sex, maternal health status, maternal education, maternal smoking, maternal age at birth of child, family type and household income. The multivariate analyses are based on 5,810 children younger than age 3 whose mothers reported information on all variables in the model. Tests with p-values of less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design. Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.*

† Reference category, for which odds ratio is 1.0

*** $p < 0.01$*

... Not applicable

It has been suggested that the fetal environment may permanently change or "program" the structure and function of the body and have a profound influence on susceptibility to illness in childhood and later life.[14,54] The heightened vulnerability of preterm low birthweight children has been attributed to possible structural abnormalities or impairments (such as pulmonary growth retardation), birth defects, birth asphyxia or neonatal complications of prematurity.[4,6,7,15,55]

It is also noteworthy that maternal education had an important effect on childhood asthma after adjusting for birth outcome, maternal asthma status and smoking behaviour, family type, household income, and teenage motherhood. The link between low maternal education and the poor health of young children could be partially attributed to a "lack of knowledge and unhealthy parental attitudes and behaviour patterns."[56]

This analysis demonstrates that the association between household income and child health may be explained by other factors. The observations in an earlier study are relevant: "Certain parental characteristics, such as age, marital status, physical health, education ... may predispose to poverty and ill health in children. This assumes that lack of parental skills, time, dedication or knowledge can adversely affect the health of children. For example, chronically ill parents who are poor may have less time and energy to provide proper care and supervision for their children. Single parents may not be able to earn a living and care for children adequately. Adolescent parents are usually poor and may lack maturity. Parents who have a limited educational background ... may not know how to care for their child adequately or understand the health care system."[43]

Even after birth outcome and other social environmental factors were taken into account, children whose mothers smoked daily were at higher risk of poor health than were the children of non-smoking mothers. Protecting children from passive smoking within their homes is acknowledged to be a major public health issue.[57-59] In Canada, recognition of the importance of smoke-free homes for children increased between 1992 and 1996, although in 1996, most children with parents who smoked (80%) still did not live in smoke-free homes.[59]

Limitations

The National Longitudinal Survey of Children and Youth collected information about gestational age and birthweight only for children younger than age 3. Both, but especially the former, may be subject to recall error or errors due to lack of accuracy in the assessment.[2,51] Restriction of the analysis to information provided by biological mothers may help minimize such errors. However, children who were low birthweight babies tend to have a higher risk of institutionalization.[5] Therefore, because this study was based on data from a household population, the effects of preterm low birthweight on subsequent child health could be underestimated.

Studies of the health of low birthweight babies have tended to focus on very low birthweight (less than 1,500 g) and preterm small-for-gestational age births.[3,4,52] Preterm and small-for-gestational age, two components of low birthweight, may have different effects on child health.[10,53] However, the NLSCY sample sizes were too small for reliable estimates, so no further breakdown of low birthweight below 2,500 g was used in this analysis. While the data reveal disproportionately high odds of health problems associated with an interaction between preterm births and small-for-gestational-age births, the results are not shown because of small sample size.

All information about the child's health was provided by his or her mother; there was no independent clinical verification of the presence or absence of health problems. Nor were data collected on the severity of asthma or of other reported health conditions. As well, the need to restrict the analysis to children younger than age 3 may have limited the examination of asthma rates because of the greater chance of misdiagnosis. In this age group, other respiratory problems such as bronchiolitis are sometimes confounded with asthma.

Some mothers may have been unwilling to report harmful behaviour, notably smoking. This may explain the weaker-than-expected association between maternal smoking and childhood asthma.

The NLSCY contained questions about other health outcomes such as epilepsy, cerebral palsy, kidney conditions and mental disabilities. However, the sample size for each of these outcomes among children younger than age 3 was too small to examine these conditions individually.

The data from the NLSCY suggest that attempts to improve child health cannot be compartmentalized. While birth outcome is important to health in early childhood, the health of the child's mother is also influential. Consequently, one implication of this analysis is that efforts to improve the health of children must take a broad approach. Child health cannot be viewed in isolation. Rather, it should be considered in the context of the health of other family members.[48]

The results of this analysis underscore the importance of both birth outcome and social environmental factors to the health of young children.[11] The provision of a healthy environment for children before they are born and in the early years of life is a challenge that requires the combined efforts of parents, community organizations, the educational system and health care workers. ●

References

1 McCormick MC. The outcomes of very low birthweight infants: are we asking the right questions? *Pediatrics* 1997; 99(6): 869-76.

2 Hack M, Klein NK, Taylor HG. Long-term developmental outcomes of low birth weight infants. *The Future of Children* 1995; 5(1): 176-96.

3 McGauhey PJ, Starfield B, Alexander C, et al. Social environment and vulnerability of low birth weight children: a social-epidemiological perspective. *Pediatrics* 1991; 88(5): 943-53.

4 Aylward GP, Pfeiffer SI, Wright A, et al. Outcome studies of low birth weight infants published in the last decade: a meta-analysis. *The Journal of Pediatrics* 1989; 115(4): 515-20.

5 Overpeck MD, Moss AJ, Hoffman HJ, et al. A comparison of the childhood health status of normal birth weight and low birth weight infants. *Public Health Reports* 1989; 104(1): 58-70.

6 Shaheen S. The beginnings of chronic airflow obstruction. *British Medical Bulletin* 1997; 53(1): 58-70.

7 McCormick MC. The contribution of low birth weight to infant mortality and childhood morbidity. *New England Journal of Medicine* 1985; 312(2): 82-90.

8 Kline J, Stein Z, Susser M. *Conception to Birth: Epidemiology of Prenatal Development.* New York: Oxford University Press, Inc., 1989: 182-3.

9 Schreuder AM, Veen S, Ens-Dokkum MH, et al. Standardized method of follow-up assessment of preterm infants at the age of 5 years: use of the WHO classification of impairments, disabilities and handicaps. *Paediatric and Perinatal Epidemiology* 1992; 6: 363-80.

10 Kramer MS. Determinants of low birth weight: methodological assessment and meta-analysis. *Bulletin of the World Health Organization* 1987; 65(5): 663-737.

11 Ens-Dokkum MH, Schreuder AM, Veen S, et al. Evaluation of care for preterm infants: review of literature on follow-up of preterm and low birthweight infants. Report from the collaborative project on preterm and small for gestational age infants (POPS) in the Netherlands. *Paediatric and Perinatal Epidemiology* 1992; 6(4): 434-59.

12 Wadsworth MEJ. Health inequalities in the life course perspective. *Social Science and Medicine* 1997; 44(6): 859-69.

13 Federal, Provincial and Territorial Advisory Committee on Population Health. *Strategies for Population Health. Investing in the Health of Canadians* (Catalogue H39-316/1994E) Ottawa: Minister of Supply and Services Canada, 1994.

14 Barker DJP. Fetal nutrition and cardiovascular disease in later life. *British Medical Bulletin* 1997; 53(1): 96-108.

15 National Forum on Health. *Canada Health Action: Building on the Legacy. Volume 1. The Final Report of the National Forum on Health* (Catalogue H21-126/5-1-1997E) Ottawa: Minister of Public Works and Government Services, 1997.

16 National Council on Welfare. *Healthy Parents, Healthy Babies.* (Catalogue H68-42/1997E) Ottawa: Minister of Public Works and Government Services, 1997.

17 Greene, B (Chair). *Canada's Children: Investing in our Future, Report of the Sub-Committee on Poverty of the Commons Standing Committee on Health and Welfare, Social Affairs, Seniors and the Status of Women.* Ottawa: Supply and Services Canada, 1998.

18 Paneth NS. The problem of low birth weight. *The Future of Children* 1995; 5(1): 19-34.

19 Colin, C. *Naître égaux et en santé.* Montreal: Gouvernement du Québec, Ministère de la santé et des services sociaux, 1989.

20 Wilkins R, Sherman GJ, Best PAF. Birth outcomes and infant mortality by income in urban Canada, 1986. *Health Reports* (Statistics Canada, Catalogue 82-003) 1991; 3(1): 7-31.

21 Millar WJ, Chen J. Maternal education and risk factors for small-for-gestational-age births. *Health Reports* (Statistics Canada, Catalogue 82-003) 1998; 10(2): 43-51.

22 Chen J, Fair M, Wilkins R, et al. Maternal education and fetal and infant mortality in Quebec. *Health Reports* (Statistics Canada, Catalogue 82-003) 1998; 10(2): 53-64.

23 Weitzman M, Gortmaker S, Sobol A. Racial, social, and environmental risks for childhood asthma. *American Journal of Diseases of Children* 1990; 144(11): 1189-94.

24 Halfon N, Newacheck PW. Childhood asthma and poverty: Differential impacts and utilization of health services. *Pediatrics* 1993; 91(1): 56-61.

25 Schwartz J, Gold D, Dockery DW, et al. Predictors of asthma and persistent wheeze in a national sample of children in the United States: Association with social class, perinatal events, and race. *American Review of Respiratory Disease* 1990; 142(3): 555-62.

26 Sears MR, Holdaway MD, Flannery EM, et al. Parental and neonatal risk factors for atopy, airway hyper-responsiveness, and asthma. *Archives of Disease in Childhood* 1996; 75(5): 392-8.

27 Cunningham J, Dockery DW, Speizer FE. Race, asthma and persistent wheeze in Philadelphia school children. *American Journal of Public Health* 1996; 86(10): 1406-9.

28 Hertzman C, Wiens M. Child development and long-term outcomes: a population health perspective and summary of successful interventions. *Social Science and Medicine* 1996; 43(7): 1083-95.

29 Dooley MD, Curtis L, Lipman EL, et al. Child health and family socioeconomic status. *Policy Options* 1998; September: 13-8.

30 Coiro MJ, Zill N, Bloom B. *Health of Our Nation's Children*. Vital Health Stat 10(191). Washington, D.C.: National Center for Health Statistics, 1994.

31 Statistics Canada and Human Resources Development Canada. *National Longitudinal Survey of Children and Youth. User's Handbook and Microdata Guide*. Ottawa: Statistics Canada, 1997.

32 Statistics Canada and Human Resources Development Canada. *Growing Up in Canada. National Longitudinal Survey of Children and Youth* (Catalogue 89-550-MPE, no. 1) Ottawa: Minister of Industry, 1996.

33 Scholle SH, Whiteside L, Kelleher K, et al. Health status of preterm low-birth-weight infants: Comparisons of maternal reports. *Archives of Pediatric and Adolescent Medicine* 1995; 149(12): 1351-7.

34 McCormick MC, Brooks-Gunn J, Workman-Daniels K, et al. Maternal rating of child health at school age: Does the vulnerable child syndrome persist? *Pediatrics* 1993; 92(3): 380-8.

35 Brown CM, Anderson HA, Etzel RA. Asthma. The states' challenge. *Public Health Reports* 1997; 112(3): 198-205.

36 Mielck A, Reitmeir P, Wjst M. Severity of childhood asthma by socioeconomic status. *International Journal of Epidemiology* 1996; 25(2): 388-93.

37 Bloomberg GR, Strunk RC. Crisis in asthma care. *Pediatric Clinics of North America* 1998; 39(6): 1225-41.

38 Bhat BR, Friedman S, Adimoolam S. Study of social, educational, environmental and cultural aspects of childhood asthma in clinic and private patients in the city of New York. *Annals of Allergy* 1978; 41(2): 89-92.

39 Morris NM. The biological advantages and social disadvantages of teenage pregnancy. *American Journal of Public Health* 1981; 71(8): 796.

40 Infante-Rivard C. Young maternal age: a risk factor for childhood asthma? *Epidemiology* 1995; 6(2): 178-80.

41 U.S. Department of Health and Human Services. *Preventing Tobacco Use among Young People. A Report of the Surgeon General* (S/N 017-001-00491-0) Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1994.

42 Aber JL, Bennett NG, Conley DC, et al. The effects of poverty on child health and development. *Annual Review of Public Health* 1997; 18: 463-83.

43 Shah CP, Kahan M, Krauser J. The health of children of low-income families. *Canadian Medical Association Journal* 1987; 137(15): 485-90.

44 Doull IJM, Holgate ST. Asthma: early predisposing factors. *British Medical Bulletin* 1997; 53(1): 71-80.

45 Millar WJ, Hill GB. Prevalence and hospital morbidity of childhood asthma. *Health Reports* (Statistics Canada, Catalogue 82-003)1998; 10(3): 9-21.

46 Dales RE, Raizenne M, El-Saadany S, et al. Prevalence of childhood asthma across Canada. *International Journal of Epidemiology* 1994; 23(4): 775-81.

47 Anderson HR, Bland MJ, Peckham CS. Risk factors for asthma up to 16 years of age. Evidence from a National Cohort Study. *Chest* 1987; 91(6) (Suppl)): 127s-30s.

48 Haas JS, McCormick MC. Hospital use and health status of women during the 5 years following the birth of a premature, low-birthweight infant. *American Journal of Public Health* 1997; 87(7): 1151-5.

49 Kramer MS, Platt R, Yang H, et al. Secular trends in preterm birth: a hospital-based cohort study. *Journal of the American Medical Association* 1998; 280(21): 1849-54.

50 Joseph KS, Kramer MS, Marcoux S, et al. Determinants of preterm birth rates in Canada from 1981 through 1983 and from 1992 through 1994. *The New England Journal of Medicine* 1998; 339(20): 1434-9.

51 Gjessing HK, Skjærven R, Wilcox AJ. Errors in gestational age: evidence of bleeding early in pregnancy. *American Journal of Public Health* 1999; 89(2): 213-8.

52 Pena IC, Teberg AJ, Finello KM. The premature small-for-gestational-age infant during the first year of life: Comparison by birth weight and gestational age. *The Journal of Pediatrics* 1988; 113(6): 1066-73.

53 Kiely JL, Susser M. Editorials: Preterm birth, intrauterine growth retardation, and perinatal mortality. *American Journal of Public Health* 1992; 82(3): 343-4.

54 Strauss RS. Effects of the intrauterine environment on childhood growth. *British Medical Bulletin* 1997; 53(1): 81-95.

55 Morgan WJ, Martinez FD. Risk factors for developing wheezing and asthma in childhood. *Pediatric Clinics of North America* 1992; 39(6): 1185-203.

56 Zill N. Parental schooling and children's health. *Public Health Reports* 1996; 111(1): 34-43.

57 U.S. Department of Health and Human Services. *The Health Consequences of Involuntary Smoking: A Report of the Surgeon General* (DHHS Pub. No. 90-8416) Washington D.C.: Superintendent of Documents, U.S. Government Printing Office, 1986.

58 DiFranza JR, Lew RA. Morbidity and mortality in children associated with the use of tobacco products by other people. *Pediatrics* 1996; 97(4): 560-8.

59 Ashley MJ, Cohen J, Ferrence R, et al. Smoking in the home: changing attitudes and current practices. *American Journal of Public Health* 1998; 88(5): 797-800.

Appendix

Table A
Distribution of selected characteristics among children younger than age 3, Canada excluding territories, 1994/95

	Sample size	Estimated population '000	% of total†
Total	**5,888**	**1,006**	**100**
Characteristics of child			
Birth outcome			
Preterm low birthweight	232	41	4
Full-term low birthweight	104	17	2
Preterm normal birthweight	340	58	6
Full-term normal birthweight	5,164	880	87
Missing	48	11	1
Age			
Younger than 1	1,992	329	33
1	2,175	330	33
2	1,721	348	35
Sex			
Male	2,976	512	51
Female	2,912	494	49
Characteristics of mother			
Health status			
Poor/Fair	207	31	3
Good/Very good/Excellent	5,655	972	97
Missing	26	4	- -
Has asthma			
Yes	369	54	5
No	5,506	952	95
Missing	13	1	- -
Educational attainment			
Less than high school	967	158	16
High school graduation/Some postsecondary	2,693	440	44
Postsecondary graduation	2,214	407	40
Missing	14	1	- -
Smoking status			
Daily	1,672	264	26
Occasional	319	47	5
Non-smoker	3,868	692	69
Missing	29	4	- -
Age at birth of child			
Younger than 20	238	36	4
20-24	1,123	165	16
25-34	3,889	671	67
35+	638	135	13
Household characteristics			
Family type			
Lone mother	770	143	14
Two-parent family	5,116	863	86
Missing	2	- -	- -
Income			
Low	1,289	202	20
Middle	3,981	663	66
High	618	141	14

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
† Percentage may not add to 100 because of rounding.
- - Amount too small to be expressed.

Table B
Unadjusted odds ratios for poor health among children younger than age 3, by selected characteristics, Canada excluding territories, 1994/95

	Unadjusted odds ratio	99% confidence interval
Characteristics of child		
Birth outcome		
Preterm low birthweight	3.4**	1.7, 7.1
Full-term low birthweight	2.2	0.6, 8.3
Preterm normal birthweight	1.1	0.4, 3.0
Full-term normal birthweight†	1.0	...
Age		
Younger than 1†	1.0	...
1	1.5	0.8, 2.9
2	2.1**	1.2, 3.9
Sex		
Male	1.3	0.8, 2.1
Female†	1.0	...
Characteristics of mother		
Health status		
Poor/Fair	6.5**	3.4,12.5
Good/Very good/Excellent†	1.0	...
Educational attainment		
Less than high school	2.9**	1.5, 5.7
High school graduation/Some postsecondary	2.1**	1.2, 3.8
Postsecondary graduation†	1.0	...
Smoking status		
Daily	2.8**	1.7, 4.5
Occasional	1.2	0.4, 4.2
Non-smoker†	1.0	...
Age at birth of child		
Younger than 20	2.1	0.8, 5.3
20-24	1.1	0.6, 2.1
25-34†	1.0	...
35+	1.1	0.6, 2.2
Household characteristics		
Family type		
Lone mother	2.6**	1.5, 4.3
Two-parent family†	1.0	...
Income		
Low	2.2	1.0, 4.7
Middle	1.0	0.5, 2.1
High†	1.0	...

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *The sample sizes for the analyses ranged from 5,840 to 5,888 children younger than age 3. Tests with p-values of less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design.*
† Reference category, for which odds ratio is 1.0
*** $p < 0.01$*
... Not applicable

Table C
Unadjusted odds ratios for asthma among children younger than age 3, by selected characteristics, Canada excluding territories, 1994/95

	Unadjusted odds ratio	99% confidence interval
Characteristics of child		
Birth outcome		
Preterm low birthweight	2.2**	1.3, 3.8
Full-term low birthweight	0.6	0.2, 2.6
Preterm normal birthweight	0.9	0.5, 1.7
Full-term normal birthweight†	1.0	...
Age		
Younger than 1†	1.0	...
1	3.1**	1.9, 4.9
2	4.2**	2.7, 6.6
Sex		
Male	1.8**	1.3, 2.4
Female†	1.0	...
Characteristics of mother		
Has asthma		
Yes	3.2**	2.1, 4.9
No†	1.0	...
Educational attainment		
Less than high school	2.0**	1.3, 2.9
High school graduation/Some postsecondary	1.5**	1.1, 2.1
Postsecondary graduation†	1.0	...
Smoking status		
Daily	1.6**	1.1, 2.1
Occasional	0.7	0.3, 1.6
Non-smoker†	1.0	...
Age at birth of child		
Younger than 20	1.7	0.9, 3.2
20-24	0.9	0.6, 1.4
25-34†	1.0	...
35+	0.6**	0.3, 1.0
Household characteristics		
Family type		
Lone mother	1.6**	1.1, 2.3
Two-parent family†	1.0	...
Income		
Low	1.6	1.0, 2.7
Middle	1.1	0.7, 1.8
High†	1.0	...

Data source: *1994/95 National Longitudinal Survey of Children and Youth*
Note: *The sample sizes for the analyses ranged from 5,840 to 5,888 children younger than age 3. Tests with p-values of less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design. Because of rounding, some confidence intervals with 1.0 as the upper limit were significant.*
† Reference category, for which odds ratio is 1.0
*** $p < 0.01$*
... Not applicable

The National Population Health Survey – its longitudinal nature

Larry Swain, Gary Catlin and Marie P. Beaudet

Abstract

Objectives

This article discusses some of the benefits and challenges of data from a longitudinal panel as exemplified by the National Population Health Survey (NPHS).

Data source

The NPHS collects both cross-sectional and longitudinal data from a sample of randomly selected individuals. The longitudinal sample will be re-interviewed every 2 years for up to 20 years. Two NPHS cycles have been completed: cycle 1 in 1994/95 and cycle 2 in 1996/97.

Summary

Selected findings from the NPHS are presented to illustrate the benefits of longitudinal data. An overview of questionnaire content, collection methods follows, and sample design is provided. A summary of response rates is followed by a discussion of the methods used to maintain response and to adjust the survey weights in order to reduce nonresponse bias. Confidentiality, dissemination, inconsistencies in reporting, proxy reporting and changes in coding conventions are also discussed.

Key words

health surveys, longitudinal studies

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Some aspects of health have a clear cause-and-effect sequence. Exposure to a virus, for instance, may bring on a bout of the flu. A traffic accident may result in broken bones. However, in most instances, the relationship between cause and outcome is much less obvious. For example, people with higher levels of education and income tend to enjoy better health than do those with less education and lower incomes. But does high socioeconomic status facilitate access to conditions that promote good health, or does good health enable an individual to achieve high socioeconomic status?

Typically, attempts to answer such questions are based on cross-sectional surveys, which gather information about conditions prevailing at one point in time. Inferences about the health consequences of specific characteristics are made by comparing groups with and without the characteristics.

This article is adapted from and expands upon "The National Population Health Survey: Its Longitudinal Nature," by Larry Swain and Gary Catlin, which was presented at the Joint IASS/IAOS Conference, Statistics for Economic and Social Development, September 1998.

But instead of gathering information at various intervals from different people by means of a number of cross-sectional surveys, it would be preferable to look at the same individuals repeatedly and identify changes in their characteristics over time to determine whether there have been corresponding changes in health (panel survey). With such longitudinal data, cause and effect are still difficult to disentangle, but the evidence is stronger because some information on the sequence of events is available. Despite this advantage, previous research and theoretical knowledge must be relied upon to guide the research and the interpretation of findings.

To examine the dynamics of health, Statistics Canada conducts the National Population Health Survey (NPHS). The NPHS collects both cross-sectional and longitudinal data on the physical and mental health of Canadians and their use of health care services. The broad objectives are to:[1]

- measure the health status of the population and its relationship to the use of health care services and determinants of health;
- collect data on the economic, social, demographic, occupational and environmental correlates of health;
- provide information on a panel of individuals who will be followed over time to reflect the dynamic process of health and illness;
- allow the possibility of linking survey data to routinely collected administrative data such as vital statistics, environmental measures, community variables and health services utilization.

This article is an overview of the NPHS content and collection methods. It describes some of the special methodological and operational approaches necessary for the longitudinal and cross-sectional components of the household survey conducted in the 10 provinces.

The first cycle of data collection took place in 1994/95; the second, in 1996/97. The third cycle began in June 1998 and will continue through June 1999. Thus, to date, only two cycles of data are available for analysis. Even so, the results illustrate the unique value of longitudinal information.

In just two years ...

Our health may be influenced by certain physical, social and environmental factors, the effects of which may take many years to emerge. Yet evidence to date, from just two cycles of the NPHS, suggests that some factors have important influences on our health.[2,3]

For instance, in just two years, the harmful effects of smoking are apparent. Among people who had no activity limitations in 1994/95, the odds of becoming limited in daily activities because of respiratory, heart or other circulatory diseases were double for those who smoked regularly, compared with those who had never smoked. This association persisted, even when age, sex, education and household income were taken into account. As well, the odds that smokers who were aged 45 to 84 in 1994/95 would have died by 1996/97 were twice those of people in the same age range who had never smoked.

Seniors generally experience higher rates of chronic disease and loss of function than younger adults. However, this is not necessarily a one-way process. One in five people aged 65 or older who had physical limitations in 1994/95 and who had required help with tasks such as meal preparation or grocery shopping no longer needed such assistance two years later. Improvements in functional ability were also observed among seniors who had had more serious activity limitations and who had relied on others for more basic care such as washing, dressing or eating.

Cross-sectional information may show an apparent stability that is not borne out when longitudinal data are investigated. In 1994/95, for example, an estimated 2.4% of the population aged 18 or older received some type of government-supported home care. The figure was similar in 1996/97, at 2.5%. However, only 36% of people who had received home care in 1994/95 were still receiving services in 1996/97. Almost half of them (46%) were living at home but no longer receiving home care, 14% had died, and 4% had entered institutional health care facilities.

Cross-sectional data reveal a decrease in smoking prevalence from 31% in 1994/95 to 29% in 1996/97

among people aged 15 or older. Longitudinal data provide a look behind the scenes of this overall decline. Among the population who did not smoke in 1994/95, 6% had started smoking for the first time or were relapsed former smokers by 1996/97. In contrast, 14% of those who smoked in 1994/95 had quit by 1996/97.

These early findings illustrate the value of data that can be derived from a longitudinal survey. Such surveys require a number of operational and methodological approaches to maintain, as much as possible, the statistical representativeness of the sample over time and to minimize response error.

Content and collection

In every participating NPHS household, one knowledgeable person provides general demographic, socioeconomic and health information about each household member. This is known as the *general component* (see *Definitions*). In addition, one randomly selected individual—not necessarily the same person—is chosen to provide in-depth information about his or her own health for the *health component*. If the selected respondent is younger than 12, *proxy responses* are obtained. Only the randomly selected individual is followed up every second year for longitudinal purposes.

The questionnaire includes sections of *core* content on health status, use of health services, risk factors, and demographic and socioeconomic characteristics (Appendix Table A). Health status is measured with questions on self-perceived health, functional ability, chronic conditions and activity restriction. The use of health services is measured with questions on visits to health care providers, hospital care and medication use. Behavioural risk factors include smoking, alcohol use and physical activity. Demographic and socioeconomic information includes age, sex, education, ethnicity, income and labour force status.

Each cycle contains *focus* content; that is, additional questions on a specific topic. The focus for the first cycle was psycho-social factors that may influence health, such as stress, self-esteem and mastery. In the second cycle, access to health care services was highlighted, while the third cycle centres on self-care and family medical history. Such focus content is intended for one cycle only, although it may be repeated in future cycles.

Data collection takes place in each of the four seasons, and is done through computer-assisted interviewing (CAI). Cycle 1 was conducted primarily through personal interviews at the selected dwellings. Data for subsequent cycles were and will be collected mainly by telephone. Possible effects of this change in collection methodology have not been researched. All data were obtained by self-reporting (or proxy reporting). No physical measures were taken within the NPHS.

To increase the analytic usefulness of the data, research is under way to link external provincial health records with NPHS responses about use of health care services. Such linkage is done only with the respondent's permission.

Cycle 2—new content

In 1996/97, questions on repetitive strain injuries and alcohol dependence were added to the NPHS health component. The former will appear in all future cycles, while the latter will be added on an occasional basis. As cycle 2 focused on access to health care services, questions were asked about the use of services, reasons for use, barriers encountered, and reasons for non-use or infrequent use. Health services include blood pressure measurements, Pap tests, mammography, breast examinations, physical check-ups, flu shots, dental visits and eye examinations. Questions were also asked about supplementary insurance coverage for dental services, eyeglasses or contact lenses, hospital charges for a private or semi-private room, and prescription medications. A question on the use of emergency services was also included.

To reduce collection costs, health promotion questions sponsored by Health Canada were integrated into appropriate sections of cycle 2. (In 1994/95, a separate supplementary questionnaire had been used.) The topics included sexual health, road safety, actions taken to improve health, and opinions about smoking and alcohol use.

An asthma supplement to cycle 2, sponsored as a separate survey by Health Canada, provided information on the severity of attacks, associated risk factors, management and treatment practices, use of medical services, and asthma education.

As part of an agreement with Alberta Health, supplementary questions were asked in that province about sources of health information, sun exposure, social support, attitudes toward parents, health services, sexual health, violence and personal safety, and coping. Questions on the quality and availability of child health services were asked only in the supplementary samples in Alberta and Manitoba.

Definitions

The *general component* of the National Population Health Survey (NPHS) questionnaire contains demographic, socioeconomic and limited health information about each person in the household. This information is obtained from a knowledgeable person in the household.

The *health component* of the questionnaire contains detailed health questions about one randomly selected individual per household. This information is usually provided by the selected individual.

Proxy responses are those obtained for a particular household member from another member of the household; for example, a parent may answer on behalf of a young child. For the general component of the questionnaire, one person answers on behalf of each member of the household (a combination of non-proxy and proxy responses for households with two or more members). For the health component, the randomly selected individual usually answers on his or her own behalf (non-proxy). However, for children and in some special circumstances, proxy responses are accepted for some topics in the health component. Proxy responses are not permitted for topics such as mental health.

Core content refers to those questions that are asked in each cycle. *Focus* content is special content asked in a specific cycle and integrated into the NPHS questionnaire. *Supplemental* content consists of additional content purchased by a client outside Statistics Canada. This supplemental content is collected in a separate survey or integrated into the NPHS questionnaire.

The *longitudinal (core) sample* consists of the 17,276 randomly selected individuals from the first cycle (1994/95) who will be followed (or recontacted) every 2 years for up to 20 years. To be included, respondents must have completed at least the general component of the questionnaire in 1994/95. Respondents to the 1994/95 supplemental sample were excluded.

Longitudinal data are available from three NPHS files (Table 2). The data in each file are weighted to the 1994 Canadian population.

- The *longitudinal square file* contains data for the 17,276 randomly selected individuals in the longitudinal sample, irrespective of their status in the 1996/97 cycle.
- The *longitudinal full file* includes those for whom complete information is available for both 1994/95 and 1996/97. This file contains data only on the 15,670 individuals from the longitudinal sample who had completed both the general and health components of the questionnaire in 1994/95, and who in 1996/97 had: completed both the general and health components of the questionnaire, were institutionalized and had completed the institutional questionnaire, or had died.
- The *longitudinal partial file* includes those 16,168 individuals for whom at least partial information is available for both 1994/95 and 1996/97—the 15,670 persons on the longitudinal full file as well as the 498 persons who: had completed both the general and health components of the questionnaire in 1994/95, but only the general component in 1996/97; or had completed only the general component of the questionnaire in 1994/95, and in 1996/97 had completed at least the general component, were institutionalized, or had died.

The *cross-sectional sample* for a specific collection cycle consists of the longitudinal sample, the supplemental samples and, where applicable, a top-up sample.

Some provinces purchase s*upplemental samples* (*buy-ins)* for cross-sectional purposes to increase provincial sample sizes for a specific cycle of collection.

A *top-up sample* is added in a specific collection cycle to improve cross-sectional representation of the selected respondents. Without a top-up, the NPHS cross-sectional sample would not adequately represent some segments of the population over time (children and immigrants, for example).

For the purpose of this article, *continuers* are the 15,670 people from the longitudinal full file. *Dropouts* are the 1,606 individuals from the longitudinal sample who either provided partial information in 1994/95 or 1996/97, or were nonrespondents in 1996/97 (that is, they refused to participate or they could not be traced).

Sample design

The NPHS employed a stratified two-stage design[1] (clusters, dwellings) based on Statistics Canada's Labour Force Survey, except in the province of Quebec where Santé Québec's design for the "Enquête sociale et de santé" was used. Base sample sizes for each province were determined using the Kish allocation,[4] which balanced the reliability requirements at national and provincial levels. A minimum of 1,200 households in each province was needed to ensure a specified reliability by sex and broad age groups. Populations on Indian reserves, on Canadian Forces bases, and in some remote areas of Quebec and Ontario were excluded from the household component of the survey. Separate surveys were designed for the North and for health care institutions.

Data were weighted to reflect the sample design, adjustments for nonresponse, and poststratification. For complex survey designs like the NPHS, the usual "textbook" formulas for variance calculations are not appropriate, and more sophisticated methods must be used.[5,6] The jackknife procedure is available to calculate variances for cycle 1; the bootstrap procedure, for cycle 2. These methods take into account the design effect resulting from the complex survey design. Both techniques involve dividing the sample into subgroups (replicates) and calculating a point estimate from a sample composed of a subset of replicates. It is then possible to determine the variation or variance in the estimates from the resulting preset number of samples. Tables of approximate coefficients of variation for both cycles were prepared using these procedures.

Keeping a balanced sample

Because just one member in each sampled household responds to the in-depth health questions and, where applicable, becomes the longitudinal respondent, an individual's chance of being included is inversely related to the number of people in the household. That is, those in smaller households—for the most part single people and the elderly—would be more likely to be selected than would members of larger households (generally parents and dependent children). Although correction could be done with appropriate weighting, this over- or underrepresentation of the longitudinal sample would produce an imbalance of some important analytical domains in meeting prespecified levels of reliability, an imbalance that would continue throughout the 20-year span of the longitudinal panel if not addressed.

To adjust this potential imbalance, a rejective method was applied in cycle 1 to increase the representation of parents and children. A portion of the sample of households, usually between 19% and 40% of the sample, was identified for screening. After the roster of household members was completed, screened households that had no member under age 25 were dropped.[7]

A comparison of the resulting sample with the rejective method and simulated results without the rejective method shows that the approach was quite successful (Table 1). The representation of children (under age 12) and youth (12 to 24) was improved relative to the actual distribution of the population from the 1991 Census. This improvement was not at the expense of parents (generally 25 to 44), whose representation improved as well. Seniors (65 or older) were still overrepresented, but to a lesser degree.

Since this redistribution of the sample was closer to the population distribution, variances decreased for the domains of children and youth and increased for the senior's domain. However, at the overall level, the coefficients of variation increased slightly with the rejective method.

Table 1
Age distribution of randomly selected National Population Health Survey respondents, with and without rejective method, Canada excluding territories, 1994/95

Age group	NPHS respondents		1991 Census
	With rejective method	Without rejective method	
	%	%	%
Total	**100.0**	**100.0**	**100.0**
0- 11	11.9	9.9	16.7
12-24	16.4	13.7	18.2
25-44	33.0	32.2	34.2
45-64	22.1	24.4	20.0
65+	16.5	19.8	11.0

Data sources: *1991 Census; 1994/95 National Population Health Survey*
Note: *Percentages may not add to 100 because of rounding.*

The cycle 2 sample

For cycle 2, a distinction must be made between the longitudinal and cross-sectional samples.

The *longitudinal (or core) sample* contains those randomly selected individuals from the 1994/95 survey for whom at least the general component of the questionnaire had been completed. In total, 17,276 individuals from 1994/95 were eligible for re-interview in 1996/97 (Table 2). This includes 2,022 respondents who were younger than 12 in cycle 1 and who had been interviewed as part of the 1994/95 National Longitudinal Survey of Children and Youth. They were included in the 1996/97 NPHS and will be interviewed in future cycles. To date, for these children, only those data items related to health, socioeconomic or demographic concepts comparable to those collected in the NPHS are contained on the NPHS longitudinal files. For example, chronic conditions and health status are included on the NPHS longitudinal files, but family relationships and parenting practices are not.

Of the 17,276 persons, 16,168 (93.6%) responded in cycle 2. This longitudinal responding sample consists of:

- 15,334 individuals with full information (responses to the general and health components in both cycles);
- 61 who were institutionalized, with a completed institutional questionnaire for the second cycle and full information in the first cycle;
- 275 who had died but for whom full information was provided in the first cycle; and
- 498 with partial information (responses in both cycles but with only the general component in one or both years; some had died or were institutionalized).

The remaining 1,108 were nonrespondents in 1996/97.

Three longitudinal files were created: *full* (15,670 persons = 15,334 + 61 + 275), *partial* (16,168 = 15,670 + 498) and *square* (17,276 persons = 16,168 + 1,108).

Table 2
The National Population Health Survey longitudinal sample, Canada excluding territories, 1994/95 and 1996/97

	Sample size	In 1994/95, responded to: General component	In 1994/95, responded to: Health component	In 1996/97, responded to: General component	In 1996/97, responded to: Health component
Longitudinal square file = 17,276† / Longitudinal partial file = 16,168 / Longitudinal full file = 15,670	15,334	X	X	X	X
	61	X	X	Institutionalized	
	275	X	X	Died	
	498	X	X	X	Nonresponse
		X	Nonresponse	X	Nonresponse
		X	Nonresponse	X	X
		X	Nonresponse	Institutionalized	
		X	Nonresponse	Died	
	1,108	X	Nonresponse	Nonresponse	
		X	X	Nonresponse	

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

† Includes 14,786 respondents aged 12 or older with responses to both the general and health components in 1994/95, 468 respondents aged 12 or older with responses to the general component only in 1994/95, and 2,022 respondents who were younger than 12 in cycle 1 and who had been interviewed as part of the 1994/95 National Longitudinal Survey of Children and Youth.

People eligible for the longitudinal sample who moved into an institution, to the Northwest Territories or the Yukon, to an Indian reserve, to a Canadian Forces base, or temporarily out of Canada between the two cycles were followed up.

A total of 2,840 respondents from cycle 1 who were sponsored by the provincial governments that elected to enlarge the sample size in their provinces (buy-ins) were not followed up in 1996/97.

Cross-sectional data collected in cycle 1 (1994/95) are available for 58,439 respondents for the general component of the questionnaire and 17,626 respondents (aged 12 or older) for the in-depth health component (Table 3). For cycle 2 in 1996/97, *supplemental samples (buy-ins)* for cross-sectional purposes in three provinces raised the number of respondents to 210,377 for the general component (173,216 aged 12 or older) and 81,804 for the in-depth health questions (73,402 aged 12 or older). The *cross-sectional sample* for cycle 2 thus consists of the longitudinal sample and the supplemental buy-in samples. There was no *top-up sample* in cycle 2.

The buy-ins for cycle 2 were sponsored by the provincial ministries of health in Alberta, Manitoba and Ontario and were designed to provide pre-specified levels of reliability by health area. These supplemental samples were selected using random digit dialing (RDD) techniques and telephone interviews. Stratification of the RDD samples was based on groups of telephone exchanges. In all three provinces, the general component of the questionnaire was completed for all household members, and one person aged 12 or older was randomly selected for the health component. In Alberta and Manitoba, when possible, a child under age 12 was also selected for the health component.

Response rates in cycle 2

The longitudinal response rate for cycle 2 was 93.6%. For cross-sectional purposes, the response rate for the health component was 93.1% for the longitudinal respondents and 75.8% for the RDD portion among respondents aged 12 or older, for an overall response rate of 79.0%. This excludes the supplementary children selected by RDD in Alberta and Manitoba. For those RDD households with a child younger than 12 and in which an adult had already responded, the response rate for children was 98.2%.

These cross-sectional rates can be broken down into response at the household level and at the selected person level (Table 4). For the longitudinal portion of the sample, the household response rate was 94.3%, with a randomly selected person response rate of 98.7%. For the RDD portion of the sample, the response rate at the household level was 80.0%, and 94.8% for the randomly selected respondent. Overall, the household response rate was 82.6%, and the randomly selected person response rate, 95.6%.

Table 3
The National Population Health Survey cross-sectional samples, Canada excluding territories, 1994/95 and 1996/97

	1994/95			1996/97		
	Total	Longitudinal (core) sample	Supplemental (buy-in) samples	Total	Longitudinal (core) sample	Supplemental (buy-in) samples
General component						
Total	**58,439**	**49,121**	**9,318**	**210,377**	**44,439**	**165,938**
Children (<12)	11,477	9,616	1,861	37,161	8,419	28,742
Adults (12+)	46,962	39,505	7,457	173,216	36,020	137,196
Health component†						
Total	**17,626**	**14,786**	**2,840**	**81,804**	**15,681**	**66,123**
Children (<12)	…	…	…	8,402	1,571	6,831
Adults (12+)	17,626	14,786	2,840	73,402	14,110	59,292

***Data source*:** *1994/95 and 1996/97 National Population Health Survey*
† The 1994/95 NPHS cross-sectional Health file excludes respondents who were younger than 12 and who had been interviewed as part of the 1994/95 National Longitudinal Survey of Children and Youth.
… Not applicable

Confidentiality and dissemination

The National Population Health Survey (NPHS) is conducted under the authority of the Statistics Act, which guarantees that the information remains confidential. All information given to Statistics Canada, whether it is collected through a survey, the Census or any other source, is confidential. The challenge for the NPHS—and other Statistics Canada surveys—is to maximize the data made available while maintaining confidentiality.

For the NPHS, master files are created containing the complete data set. For each cycle, this comprises a cross-sectional General file and a cross-sectional Health file. With cycle 2, a longitudinal file was also produced. Public-use microdata files (PUMFs) are then prepared for use outside Statistics Canada in such a way that individual respondents cannot be identified. These files must be approved by an internal Statistics Canada committee before release. Cross-sectional PUMFs on CD-ROM and diskette have been released for the first two cycles (1994/95 and 1996/97).[8,9] These PUMFs are available for purchase. University researchers and students have access to them through Statistics Canada's Data Liberation Initiative (DLI). The PUMFs are also provided to recipients of the joint Health Canada–Statistics Canada National Health Research and Development Program.

In creating the PUMFs for cycle 1, several steps were taken to meet confidentiality requirements. Univariate counts and combinations of variables were examined at the lowest geographic level in each province to identify unique records in the sample. In addition, the distribution of weights in provinces with supplemental samples was examined to see if particular strata (and therefore, data at a relatively small geographic level) could be identified. The General file was examined to determine if households could be recreated. These procedures led to suppressing or collapsing variables to create the approved NPHS cross-sectional PUMF. In some cases, derived variables were put on the PUMF rather than the more specific responses to individual questions. For example, the derived health utility index instead of the 31 individual questions on which it is based was selected for inclusion on the PUMF.

To produce the 1996/97 cross-sectional PUMFs, a more complex process was required to ensure confidentiality. This was primarily owing to the already released 1994/95 PUMF and the overlap in the cross-sectional samples between the two cycles as longitudinal respondents continued to be surveyed. In addition to the procedures used for 1994/95, the process for 1996/97 included comparing weights between the two cycles to determine if individuals or households could be identified. As well, a more detailed study of three-way tables that examined 13 key variables at the smallest geographic unit by province for which data would be released was carried out to discover unique combinations of variables occurring with high proportions. In addition, to guard against the independent creation by users of longitudinal records from the two cross-sectional PUMFs, the 1994/95 PUMF records were matched to those proposed for 1996/97 based on 12 matching variables to determine the proportion of true (the same individuals) and false (different individuals) matches to the total matches. For the true matches, individual records were reviewed to see if particular variable combinations could lead to identification of individual respondents. New variables in the 1996/97 survey were examined to find out if any threats to confidentiality had arisen since the first cycle. As in 1994/95, these procedures led to the suppression or collapsing of some variables.

Confidentiality concerns also affect the provision of variance estimation tools to users. Since detailed design information necessary for variance estimation techniques would identify geographic areas at a very detailed level, other methods are being examined. However, it is first necessary to ensure that the weights themselves cannot be used to identify small geographic areas or to match cross-sectional PUMFs from different cycles.

The longitudinal aspect of the survey, along with the volume of data, will increase the probability of identifying unique records, and therefore, specific individuals, as more data become available. Given the work required to create the cross-sectional PUMF and the current uncertainty associated with the creation of a longitudinal PUMF after only two cycles of data, it is expected that after the third cycle, verification of confidentiality for the cross-sectional data will be even more complex, and the preparation of a longitudinal PUMF will be impossible.

Because the content of PUMFs is restricted and limited research budgets may preclude users from paying for custom programming, a means of providing broad access to the data must be developed. Some success has been achieved with a service that offers remote access to the master files. Authorized users are provided with dummy NPHS files; that is, files with a similar structure to the master files, but with fictitious data. They prepare their own computer programs, test them on the dummy files and then submit them to Statistics Canada by electronic mail. NPHS staff run the programs on the internal master files, check the output to maintain confidentiality, and send the output to users by electronic mail. For variance estimation, programs can be submitted that use the weights on the master files through remote access. Other means of providing NPHS access to researchers while maintaining confidentiality are being explored (for example, under certain conditions, researchers may have access to the NPHS master files at Statistics Canada's Regional Offices or at Head Office).

Table 4
National Population Health Survey cross-sectional response rates, Canada excluding territories, 1996/97

Level of response	Longitudinal (core) sample	Random digit dialing (RDD) sample	Total (core + RDD)
		%	
Overall response rate†	93.1	75.8	79.0
Household	94.3	80.0	82.6
Randomly selected persons (excluding RDD children)	98.7	94.8	95.6

Data source: *1996/97 National Population Health Survey*
† The overall response rate for randomly selected persons based on all households is calculated by multiplying the response rate for responding households by the response rate for randomly selected persons in responding households.

Maintaining response

Because longitudinal respondents may be in the survey for up to 20 years, maintaining interest and co-operation over this period is essential. The NPHS has several strategies for maintaining and improving response rates. Respondent relations materials such as pamphlets and letters help participants understand the importance and benefits of the survey, and they also address typical concerns such as confidentiality of data (see *Confidentiality and dissemination*).

Given the long-term commitment desired of longitudinal respondents, it was felt that a personal first contact would be beneficial. Therefore, for cycle 1 in 1994/95, an interview was conducted in person at the respondent's dwelling. For subsequent cycles, most interviews were and will be conducted over the telephone, although some respondents may not have telephones or they may prefer a personal interview (about 5% in cycle 2).

Although questionnaire testing is important for any survey, it is especially important for longitudinal surveys. Health experts and focus groups are used to help develop and refine NPHS questions, and the questionnaire is tested twice before each cycle. Such tests help determine if respondents understand what they are being asked. Interviewers provide feedback that is used in the finalization of the questionnaire. Interviewer input also influences the computer screen layouts of the computer-assisted interviewing (CAI) application, which itself undergoes extensive testing.

Because the questionnaire uses a computer application, questions can be personalized for each respondent. This provides acknowledgement of previous contact. For longitudinal respondents, names and sex-specific pronouns and possessive adjectives are integrated into the questions that interviewers read. Past data are embedded in the questionnaire for follow-up. For example, if a longitudinal respondent's highest level of education was determined in an earlier cycle, that information is not requested again. The respondent would be asked only for education obtained since the last interview, with the questions dependent on the level of education already reported.

Tracing is essential for longitudinal surveys. Efforts to locate NPHS respondents who have moved between cycles without notifying Statistics Canada have generally been successful. Only 1.7% of respondents could not be found for cycle 2.

Longitudinal respondents who enter a health care institution or move to northern Canada are contacted, and their data are included in the longitudinal file. Conversely, respondents to the institutional and northern surveys who move to households in the 10 provinces are followed up for their respective longitudinal files.

A "fifth quarter" of data collection was added after cycle 1 for the sole purpose of non-response follow-up.

Nonresponse adjustment and poststratification

Despite efforts to maximize response, some nonresponse is inevitable. This has two possible effects on survey data: a loss in effective sample size and therefore an increase in variance; and biased estimates if nonrespondents differ from respondents in the characteristics measured.[10,11] In fact, for the longitudinal sample, the distribution of cycle 2 *continuers* and *dropouts* differed significantly for sex, age group, work situation, household income, and having one or more chronic conditions

(Appendix Table B). Males accounted for more dropouts than did females: 53.3% compared with 46.7%. More dropouts were from the middle age groups (18 to 24, 25 to 44 and 45 to 64) than from the youngest and oldest groups. Adjustments to the survey weights were applied to compensate for the effects of nonresponse.[12,13]

As a final step in the longitudinal weighting, adjustments were made by province, age group (0 to 11, 12 to 24, 25 to 44, 45 to 64, 65 or older) and sex so that the weighted sample would correspond to the 1994 population estimates (poststratification).

Information available from cycle 1 was used for nonresponse adjustment. The CHAID (Chi-square Automatic Interaction Detection) algorithm within the software Knowledge Seeker was used to form weighting classes for non-response adjustment based on variables considered to be good predictors of nonresponse.[12] Classes were created wherever the greatest differential nonresponse occurred and where there was sufficient sample size for the Chi-squared significance test. Specific variables included income, age, sex, race, place of birth, dwelling owned/rented, presence of children/youths in the household, household size, and several geographic variables such as province and urban/rural designations. The variables used for creation of nonresponse adjustment classes differed from province to province. The adjustments for cycle 2 nonresponse, for the most part, successfully reduced bias among continuers on a subset of NPHS variables (Appendix Table C). Variables used in the nonresponse adjustment, or variables correlated with them, are expected to show the most success in reducing bias among the continuers.

Inconsistencies in reporting over time

The incorporation of past data in the questionnaire design can create special difficulties. Notably, inconsistencies may arise as the same individual is questioned over time. This is compounded for proxy responses.

To minimize such inconsistencies, probes that use data from cycle 1 were built into questions for cycle 2. For example, where change was reported in chronic conditions that typically do not change, verification of the change, reasons for it, and relevant dates were asked. However, if it would have compromised confidentiality, probing was omitted. For example, if a particular chronic condition (such as diabetes or epilepsy) had been recorded previously, but a proxy respondent later reported that the individual did not have that condition, the case would not be probed. Similarly, proxy responses about smoking were not probed. And although probing could validate changes in variables such as alcohol use or weight, it was not done because of the sensitivity associated with these questions.

Data that result from probing were used on the longitudinal file for the current year, but past data were not revised. Inconsistencies were left on the file for analysts to use as deemed appropriate. However, when inconsistencies occurred for date of birth and sex, which were asked in cycle 1 and confirmed in cycle 2, data from cycle 2 were used.

Proxy reporting

Questions on preventive measures and smoking were asked in the health component of the questionnaire, which had a very low proxy response rate (1.8%) for the longitudinal sample aged 12 or older, since proxy reporting was strongly discouraged for this component. In other sections (depression and self-esteem, for example), proxy responses were not permitted. However, questions about chronic conditions and activity restriction were asked in the general component of the questionnaire, where proxy responses may be given for longitudinal respondents.

Proxy reporting decreased in cycle 2 as interviewers tried to contact longitudinal respondents to answer both the general and health components. Nonetheless, inconsistencies suggest that proxy reporting may be a problem. Preliminary comparisons of estimates on the prevalence of chronic conditions from cycle 1 and cycle 2 based on both the general and health components indicate that proxy reporting has an effect, both cross-sectionally and longitudinally. (All data for selected respondents younger than age 12 are based on proxy reporting and were excluded from these analyses.)

Given these preliminary results, the short-term solution for cycle 3 was to improve the interviewer's and procedures manuals to discourage proxy reporting of the general component for longitudinal respondents.

Changes in coding conventions

Another difficulty with longitudinal data occurs when coding conventions change over time; for instance, the classification of diseases, drugs, occupations, industries and geography. The general strategy for the NPHS has been to use the same classification system throughout all cycles. That is, when a new system is adopted, historical data on the longitudinal file will be recoded. Depending on time, space and budgets, more than one classification system could be maintained if this would be meaningful for analysis.

When recoding is not implemented, differences between classification systems are noted in the NPHS documentation.

Concluding remarks

The issues outlined in this article, along with countless others that will no doubt arise during future cycles of the National Population Health Survey, are part of the nature of longitudinal data collection. Such surveys present a challenge to both the researchers who analyze the data, and the survey designers who develop, collect, process and disseminate the information.

Acknowledgements

The authors thank Yves Béland, Jiajian Chen, Leslie Geran, Jennifer Hubbard, Bryan Lafrance, Jackey Mayda, Georgia Roberts, Karen Roberts, Eric Sayre, Margot Shields, Kathryn Wilkins and Douglas Yeo for their assistance.

References

1 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.

2 Statistics Canada. National Population Health Survey: Cycle 2, 1996/97. *The Daily* (Catalogue 11-001) May 29, 1998: 3-5.

3 Statistics Canada. *National Population Health Survey Overview, 1996/97* (Catalogue 82-567) Ottawa: Minister of Industry, 1998.

4 Kish L. Multipurpose sample designs. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1988; 14(1): 19-32.

5 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.

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

7 Tambay J-L, Mohl C. Improving sample representativity through the use of a rejective method. *Proceedings of the Section on Survey Research Methods,* American Statistical Association, 1995: 29-38.

8 Statistics Canada. *National Population Health Survey, 1994/95: Public Use Microdata Files* (Statistics Canada, Catalogue 82F0001) Ottawa: Minister of Industry, 1995.

9 Statistics Canada. *National Population Health Survey, 1996/97: Public Use Microdata Files* (Catalogue 82M0009XCB, CD-ROM and 82M0009GPE, documentation) Ottawa: Minister of Industry, 1998.

10 Swain L, Dolson D. Current issues in household survey nonresponse at Statistics Canada. *Statistics in Transition*, 1998; 3(3): 439-67.

11 Swain L, Dolson D. Current issues in household survey nonresponse at Statistics Canada. *Nonresponse in Survey Research: Proceedings of the Eighth International Workshop on Household Survey Nonresponse (1997)*, Mannheim: ZUMA, 1998: 1-21. (Note: This is an abbreviated version of reference 10.)

12 Tambay J-L, Schiopu-Kratina I, Mayda J, et al. Treatment of nonresponse in cycle two of the National Population Health Survey. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1998; 24(2): 147-56.

13 Stukel DM, Mohl CA, Tambay J-L. Weighting for cycle 2 of Statistics Canada's National Population Health Survey. *Proceedings of the Survey Methods Section*, Statistical Society of Canada, 1997: 111-6.

14 Rao JNK, Thomas DR. Chi-squared tests for contingency tables. In: Skinner CJ, Holt D, Smith TMF, eds. *Analysis of Complex Surveys*. New York: Wiley, 1989: 89-114.

Appendix

Table A

Summary of content, National Population Health Survey, 1994/95 and 1996/97

	Cycle 1 (1994/95)	Cycle 2 (1996/97)
Core content		
Two-week disability	Y	Y
Health care utilization	Y	Y
Restriction of activities	Y	Y
Chronic conditions	Y	Y
Socio-demographic characteristics	Y	Y
Education	Y	Y
Labour force status	Y	Y
Income	Y	Y
Self-perceived health	Y	Y
Women's health	Y	Y
Blood pressure	Y	Y
Height/Weight	Y	Y
Health status	Y	Y
Physical activities	Y	Y
Repetitive strain injury	N	Y
Injuries	Y	Y
Use of medications	Y	Y
Smoking	Y	Y
Alcohol	Y	Y
Mental health	Y	Y
Social support	Y	Y
Sense of coherence	Y	N
Alcohol dependence	N	Y
Focus content		
Psycho-social		
Stress	Y	N
Ongoing problems	Y	N
Recent negative life events	Y	N
Childhood and adult stressors ("traumas")	Y	N
Work stress	Y	N
Self-esteem	Y	N
Mastery	Y	N
Access to services		
Blood pressure	N	Y
Pap smear test	N	Y
Mammography	N	Y
Breast examination	N	Y
Breast self-examination	N	Y
Breast-feeding	N	Y
Physical check-up	N	Y
Flu shots	N	Y
Dental visits	N	Y
Eye examination	N	Y
Emergency services	N	Y
Insurance coverage	N	Y
Supplemental (buy-in) content integrated into NPHS questionnaire		
Health Promotion Survey		
Diet/Nutrition	N	Y
Height/Weight	N	Y
Breast self-examination	N	Y
Breast-feeding	N	Y
Pregnancy	N	Y
HIV	N	Y
Smoking	N	Y
Alcohol	N	Y
Sexual health	N	Y
Road safety	N	Y
Food insecurity	N	Y
Provincial content (buy-ins)		
Coping (Alberta)	Y	Y
Coping (Manitoba)	Y	N
Health information	N	Y
Tanning and UV exposure	N	Y
Social support	N	Y
Attitudes towards parents	N	Y
Health services	N	Y
Sexual health	N	Y
Violence and personal safety	N	Y
Child health services	N	Y
Supplemental (buy-in) content collected in separate survey		
Health Promotion Survey	Y	N
Asthma Survey	N	Y

Table B
Characteristics at baseline (cycle 1) of continuers and dropouts, longitudinal sample, National Population Health Survey, 1994/95

	Continuers		Dropouts		
Personal characteristics	**Sample size**	**%**	**Sample size**	**%**	**Chi-squared**
Sex					
Male	7,209	49.1	835	53.3	5.3*
Female	8,461	50.9	771	46.7	
Age groups					
0- 11	1,908	16.9	114	11.5	30.6***
12-17	1,047	9.0	90	8.1	
18-24	1,434	8.6	228	12.5	
25-44	5,226	33.3	602	36.1	
45-64	3,509	20.7	378	22.3	
65+	2,546	11.6	194	9.5	
Marital status					
Married	7,416	49.2	806	50.9	ns
Single	5,638	40.5	587	40.0	
Previously married	2,614	10.3	211	9.1	
Work situation					
Currently working	7,288	47.0	810	49.0	18.3***
Worked in past 12 months, but not currently working	1,092	6.2	135	7.6	
Did not work in past 12 months	4,741	25.2	481	28.1	
Not applicable	2,415	21.7	148	15.3	
Household income					
Lowest	1,116	5.3	162	8.4	21.1***
Lower-middle	2,240	12.5	243	15.6	
Middle	4,661	30.5	457	30.4	
Upper-middle	5,192	36.0	439	31.7	
Highest	1,843	15.8	158	14.0	
Educational attainment					
Less than high school	4,744	33.2	518	34.2	ns
High school	1,963	14.8	221	15.2	
Some postsecondary	3,214	23.3	331	20.7	
College diploma or university degree	3,819	28.7	405	29.8	
Live alone					
No	12,749	90.7	1,336	91.6	ns
Yes	2,921	9.3	270	8.4	
Self-reported health status					
Poor	386	1.8	38	2.9	ns
Fair	1,379	7.0	105	7.6	
Good	3,834	23.7	302	25.6	
Very good	5,712	36.0	399	36.5	
Excellent	4,359	31.4	280	27.3	
One or more chronic conditions					
No	7,182	50.1	811	54.2	5.7*
Yes	8,471	49.9	775	45.8	
Suffered depression in last 12 months					
No	12,290	94.5	885	93.0	ns
Yes	781	5.5	68	7.0	

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal square file*
***Notes**: The distributions exclude the "missing" category. With the exception of household income, self-perceived health and depression, where the percentages missing were 5%, 3%, and 9%, respectively, missing values on the longitudinal square file were less than 1%. The percentages are based on weighted data. The Chi-squared test used 500 bootstrap weights and included the Rao-Scott second-order correction[14] to account for the complex survey design.*
ns Chi-squared value did not reach statistical significance.
** $p \leq 0.05$*
*** $p \leq 0.01$*
**** $p \leq 0.001$*

Table C
Characteristics at baseline of all National Population Health Survey cycle 1 (1994/95) longitudinal respondents and cycle 2 (1996/97) continuers, after and before weight adjustments for cycle 2 nonresponse

	All cycle 1 (1994/95) longitudinal respondents		Cycle 2 (1996/97) continuers only		
			After nonresponse adjustments		Before nonresponse adjustments
Personal characteristics	Sample size	%	Sample size	%	%
Sex					
Male	8,044	49.5	7,209	49.5	49.1
Female	9,232	50.5	8,461	50.5	50.9
Age groups					
0-11	2,022	16.3	1,908	16.3	16.9
12-17	1,137	8.9	1,047	9.0	9.0
18-24	1,662	9.0	1,434	8.9	8.6
25-44	5,828	33.6	5,226	33.6	33.3
45-64	3,887	20.8	3,509	20.8	20.7
65+	2,740	11.4	2,546	11.4	11.6
Marital status					
Married	8,222	49.4	7,416	49.4	49.2
Single	6,225	40.5	5,638	40.4	40.5
Previously married	2,825	10.1	2,614	10.1	10.3
Work situation					
Working	8,098	47.2	7,288	47.6	47.0
Worked in past 12 months, but currently not working	1,227	6.3	1,092	6.3	6.2
Did not work in past 12 months	5,222	25.5	4,741	25.1	25.2
Not applicable	2,563	21.0	2,415	21.1	21.7
Household income					
Lowest	1,278	5.6	1,116	5.4	5.3
Lower-middle	2,483	12.8	2,240	12.5	12.5
Middle	5,118	30.5	4,661	30.3	30.5
Upper-middle	5,631	35.6	5,192	35.9	36.0
Highest	2,001	15.6	1,843	15.9	15.8
Educational attainment					
Less than high school	5,262	33.3	4,744	33.0	33.2
High school	2,184	14.8	1,963	14.8	14.8
Some postsecondary	3,545	23.0	3,214	23.4	23.3
College diploma or university degree	4,224	28.8	3,819	28.8	28.7
Live alone					
No	14,085	90.8	12,749	90.7	90.7
Yes	3,191	9.2	2,921	9.3	9.3
Self-reported health status					
Poor	424	1.9	386	1.8	1.8
Fair	1,484	7.0	1,379	7.0	7.0
Good	4,136	23.8	3,834	23.8	23.7
Very good	6,111	36.1	5,712	36.1	36.0
Excellent	4,639	31.1	4,359	31.3	31.4
One or more chronic conditions					
No	7,993	50.6	7,182	50.2	50.1
Yes	9,246	49.4	8,471	49.8	49.9
Suffered depression in last 12 months					
No	13,175	94.4	12,290	94.5	94.5
Yes	849	5.6	781	5.5	5.5

***Data source**: 1994/95 and 1996/97 National Population Health Survey, longitudinal square and full files*
***Notes:** The distributions exclude the "missing" category. With the exception of household income and depression, where the percentages missing were each 5%, missing values on the longitudinal full file were less than 1%. The percentages are based on weighted data. All weights include the poststratification step.*

Data Releases

Synopses of recent health information produced by Statistics Canada

Hospital utilization 1996/97

Hospitals reported 3.2 million discharges in 1996/97, down from 3.3 million the previous year. As a result, the rate at which Canadians stayed overnight in hospitals fell for the 10th straight year to a record low. In 1996/97, the rate was 10,523 discharges (including deaths) for every 100,000 people, well below the peak of 16,802 in 1973. In 1995/96, the rate had been 11,165 discharges per 100,000 population.

All provinces and territories except the Yukon recorded declines in the hospital discharge rate in 1996/97. The largest decreases occurred in the Northwest Territories, Quebec and Ontario. Despite an increase in 1996/97, the Yukon continued to have the lowest hospital discharge rate at 9,701 per 100,000 population. Rates were also low in Quebec (9,788) and Ontario (9,864). Saskatchewan had the highest rate (15,043), followed by New Brunswick (14,864) and Prince Edward Island (13,028).

About 15% of discharges were related to the circulatory system. Another 14% involved pregnancy and childbirth; 11% pertained to the digestive system; 9% were related to respiratory illnesses; and 8% involved injury or poisoning. Excluding pregnancy- and childbirth-related procedures, which accounted for one in four female discharges, men and women were admitted to hospital for similar reasons. Heart diseases and stroke accounted for the largest share of discharges in 1996/97, followed by diseases of the digestive system and diseases of the respiratory system.

In 1996/97, the average patient spent 10.7 days in hospital, unchanged from the year before, but about a day shorter than a decade earlier. The 3.2 million hospital discharges in 1996/97 represented 33.9 million patient-days, down 5% from the previous year and 21% lower than a decade earlier. The elderly (65 or older) accounted for 62% of these hospital days, although seniors represented only 12% of the population.

Declines in hospital discharge rates, length of stay, and patient-days were accompanied by a decrease in the number of patients having surgery. In 1996/97, 1.8 million hospital discharges involved surgery, down 6% from the year before and 22% lower than 10 years earlier.

Just over half of all hospital discharges involved surgery. Women were considerably more likely than men to undergo surgery, at a rate of 62% compared with 38% for men. However, most of this difference can be explained by obstetrical procedures, which accounted for one in three surgical procedures performed on women. The average patient spent 8.5 days in hospital following surgery, down half a day from the year before and 1.5 days less than 10 years earlier.

A number of trends have contributed to declines in hospital discharge rates, length of stay, patient-days and surgical procedures. All jurisdictions throughout Canada are in a process of health care reform, ranging from hospital closures and administrative restructuring, to the consolidation of services. Many services historically requiring hospitalization are shifting to ambulatory care programs. Some types of surgery can be performed in hospital day-surgery units or community health clinics. In other instances, patients, such as those undergoing angioplasty, are having minimally invasive surgery and are being discharged sooner. Mothers, who used to remain in hospital up to a week after giving birth, now typically go home within 72 hours. Increased emphasis on health promotion and disease prevention, improved medical technologies and treatments, and new pharmaceuticals may have reduced the need for hospitalization or surgical intervention.

A hospital discharge is the release or death of a person admitted to a hospital. Discharge data do not indicate the number of individuals using hospital services, since one person could be admitted several times during a year. Counts of surgical discharges refer to the primary surgical procedure undertaken; a patient having two kinds of surgery during a single hospital stay would be counted as having one surgical procedure. These figures exclude newborns and patients treated on an out-patient basis in, for example, emergency wards or day-surgery programs.

The 1996/97 data on hospital discharges were collected by the Canadian Institute for Health Information. For further information on the

1996/97 data, contact Karen McCarthy (613-241-7860, ext. 4026; fax: 613-241-8120), Canadian Institute for Health Information.

For more information on hospital discharge trends, or to enquire about the concepts, methods and data quality of this release, contact Peter Morrison (613-951-1637), Health Statistics Division, Statistics Canada. ●

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

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

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

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Progress in stroke prevention: An overview. Barnett HJM. 1994; 6(1): 132-8.

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