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Chronic conditions, physical limitations and dependency among seniors living in the community

*Kathryn Wilkins and Evelyn Park**

Abstract

The majority (75%) of people aged 55 and over who live in the community, as opposed to living in long-term health care institutions, report having at least one chronic condition. However, only about one in six has some physical limitation. As well, one in six men and one in four women who live in the community need help with everyday activities such as housework or meal preparation. With advancing age, the prevalence of most chronic conditions increases, as does the prevalence of physical problems and dependency.

The contribution of particular conditions to physical limitations and dependency varies. According to Statistics Canada's 1994-95 National Population Health Survey, the conditions most strongly related to physical limitations and to the need for help with activities of daily living were epilepsy and the effects of stroke, neither of which affected a large percentage of the household population aged 55 and over. By contrast, arthritis/rheumatism, non-arthritic back problems and cataracts, which were also associated with physical limitations and dependency, affected a relatively large percentage of community-dwelling seniors.

This article shows the prevalence of specific chronic conditions, physical limitations and dependency among people aged 55 and over living in the community, by sex and age. Logistic regression is used to examine relationships between each chronic condition and the existence of physical limitations and dependency.

Key words: *disabled, activities of daily living, chronic disease*

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It is well known that the prevalence of most chronic conditions increases with age, and that some of them have particularly disabling effects.[a] Less well understood is the degree to which particular chronic conditions contribute to physical limitations and dependency. Some that entail a great deal of debility are quite rare among the household population aged 55 and over, because people with these conditions are likely to be in long-term health care institutions.[1] But a number of other conditions, which are also associated with considerable physical limitation and dependency, are relatively common among community-dwelling seniors.

The public health consequences of particular chronic conditions vary. Seniors with very disabling conditions are at imminent risk of institutionalization. Most people, though, are living with conditions that are somewhat less debilitating. Information about the prevalence of such conditions, together with the physical limitations and dependency associated with each, provides some indication of the support required to enable people to continue to live in the community and to "age in place."

Using data from the household component of Statistics Canada's 1994-95 National Population Health Survey (NPHS), this article shows the prevalence of various chronic conditions, physical limitations, and dependency among people aged 55 and over living in the community (see *Methods*). The article then goes on to examine the relationship of specific chronic conditions to physical limitations and dependency.

[a] *For ease of reference, the generic term "chronic conditions" is used in this article to refer collectively to the various chronic conditions and diseases listed in the Appendix.*

Differences between men and women

Differences in demographic, socioeconomic and lifestyle characteristics could have an effect on the prevalence of various chronic conditions among men and women aged 55 and over living in the community. For instance, more senior women survive to older ages—23% of women, compared with 19% of men, were aged 75 or over (Table 1). A much higher percentage of senior men were living with a partner, and they were more likely than women to be in households with adequate income. Health-related behaviour differed as well, with a larger share of men than women describing themselves as physically active and regular drinkers. Senior men were also considerably less likely than women to have never smoked.

Most seniors have chronic conditions

The majority of the household population aged 55 and over—72% of men and 78% of women, 4.3 million people altogether—reported having at least one chronic condition in 1994-95 *(see Definitions)*. Arthritis/rheumatism was the most prevalent, affecting 28% of men and 41% of women (Table 2). High blood pressure ranked second, followed by non-arthritic back problems. The relatively high prevalence of musculoskeletal problems is consistent with the results of earlier Canadian surveys.[2,3]

By contrast, some other conditions were relatively rare among seniors in the community. Urinary incontinence and the effects of stroke each affected just 3%, and epilepsy and Alzheimer's disease, fewer than 1%. This is not surprising, as these conditions (with the exception of epilepsy) are likely to result in institutionalization.[1]

Methods

Data source

The data are from the household component (which excludes long-term health care facilities) of the National Population Health Survey (NPHS), conducted by Statistics Canada from June 1994 through June 1995.[4,5] From a sample of 27,263 households, interviewers collected data on health status, health care utilization, and socioeconomic and demographic characteristics.

In each household, one person was selected for the interview. Information on physical limitations was collected for the selected household member only. Information on the need for help with activities of daily living and the presence of chronic conditions was collected for every household member.

The survey response rate (the proportion of selected households where agreement to participate was obtained, including households later rejected for sampling reasons) was 89%.[2] Among participating households, the response rate for individuals aged 55 and over was 97%.

This article analyses data from the 2,117 men and 2,976 women aged 55 and over who were surveyed in the NPHS, representing 2.6 million men and 3.2 million women in this age group living in the community—the household population. (Data from the Northwest Territories and the Yukon were not available.)

Analytical techniques

Prevalence rates for specific chronic conditions, physical limitations, and dependency were calculated by age and sex. Four separate categories of physical limitation were studied—vision, hearing, mobility and the presence of at least one physical limitation (also including dexterity or speech)—as well as the need for assistance with at least one activity of daily living. Logistic regressions were performed to examine the relationships of chronic conditions, together with social and demographic characteristics and health-related behaviours, to physical limitations and dependency. The following independent variables were specified: chronic conditions, age, sex, marital status, household income, smoking, alcohol use, body mass index, recreational physical activity, self-rated health, and region.

The prevalence data were weighted to reflect the age and sex distribution of the national population. The logistic regressions were weighted using survey weights rescaled to sum to the sample size.

Limitations

This analysis is limited by the cross-sectional nature of the data. That is, information about having a chronic condition was collected at the same time as data about physical limitations and dependency. Therefore, it cannot be assumed that a particular condition or a combination of them caused a physical limitation or dependency.

An additional limitation of cross-sectional data is that they fail to reflect the dynamic nature of functional status in older people. While the physical functioning of older people may deteriorate, it can also improve, just as is the case for younger people.

As well, using only data from the household component of the NPHS, and excluding people living in institutions, restricts the analysis. For example, among people in the community, the prevalence of Alzheimer's disease is very low, whereas 30% of residents of long-term health care facilities have the disease.[1] However, the purpose of focusing exclusively on the household population is to study the conditions with which people are able to cope while still living in the community.

Differences between men and women in the prevalence of some chronic conditions were notable. For instance, arthritis/rheumatism, high blood pressure, non-food allergies, cataracts, and migraine headaches were reported more frequently by women, while heart disease, diabetes, and bronchitis/emphysema were reported more often by men.

Table 1
Selected characteristics, household population aged 55 and over, Canada, 1994-95

	Both sexes	Men	Women
		%	
Total household population aged 55+	**100.0**	**100.0**	**100.0**
Age			
55-64	43.1	45.2	41.4
65-74	36.1	36.1	36.1
75+	20.9	18.8	22.5
Marital status			
With partner	67.1	79.4	57.1
Not with partner†	32.9	20.6	42.9
Household income			
Adequate	72.8	78.2	68.4
Inadequate	21.5	16.4	25.5
Unknown	5.8	5.4	6.1
Smoking			
Never smoked	38.1	21.1	51.7
Occasional or former smoker	45.3	59.7	33.7
Current, regular smoker	16.6	19.2	14.5
Alcohol use			
At least one drink per week	32.3	43.4	23.4
Less than one drink per week	34.7	32.4	36.5
Never	33.0	24.3	40.1
Body mass index‡			
Appropriate	57.8	58.4	57.3
Underweight	6.7	4.2	8.7
Overweight	35.6	37.4	34.1
Recreational physical activity			
Active	14.9	19.1	11.5
Moderate	19.9	18.0	21.4
Inactive	59.0	53.8	63.1
Unknown	6.3	9.1	4.1
Self-rated health			
Excellent	14.8	14.2	15.4
Very good	28.8	30.0	27.9
Good	33.5	33.7	33.3
Fair	17.6	16.6	18.4
Poor	5.3	5.6	5.1

Source: *National Population Health Survey, 1994-95*
Note: *Percentages may not sum to total because of rounding.*
† *Single, divorced or widowed.*
‡ *Appropriate: 20-27; underweight: <20; overweight: >27.*

Definitions

To measure the prevalence of chronic conditions, the 1994-95 NPHS asked, "Do(es) . . . have any of the following long-term conditions that have been diagnosed by a health professional: .... ?" A list was read to respondents, who were instructed to identify as many conditions as were applicable (see *Appendix*).

Information on physical limitations was collected through a series of questions about respondents' "usual abilities." For this analysis, the following criteria were used to categorize respondents as having physical limitations:

- Vision: Unable (even with corrective lenses) to read newsprint or to recognize someone at a distance, or unable to see at all.
- Hearing: Has difficulty (even with a hearing aid) hearing what is said in conversation with one other person, or with a group of at least three other people, or unable to hear at all.
- Speech: Unable to be fully understood when speaking in own language.
- Mobility: Needs mechanical aids (such as braces, a cane, crutches or a wheelchair) to get around (with or without help of another person), or unable to walk at all.
- Dexterity: Needs help of another person or assistive devices because of limitations in use of hands or fingers. People who did not require such help, even if they reported problems in grasping and holding small objects such as a pencil and scissors, were not categorized as having a dexterity limitation.

Respondents were classified as dependent if, for reasons of health, they reported needing and receiving help in performing any activity of daily living. Specifically, respondents were asked whether, as the result of "any condition or health problem," they need help preparing meals, shopping for groceries and necessities, doing everyday housework, doing heavy household chores, personal care (washing, dressing, eating), and moving about inside the house.

The NPHS also collected information on respondents' demographic and socioeconomic characteristics, including marital status and annual household income. For this analysis, households were grouped into two categories based on the number of people in the household and their combined annual income:

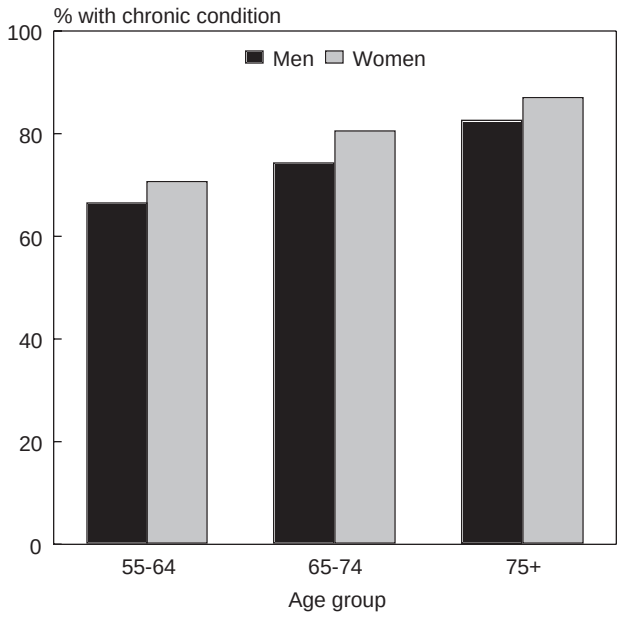
	Persons per household		
Household income	1 or 2	3 or 4	5+
Inadequate	<$15,000	<$20,000	<$30,000
Adequate	$15,000+	$20,000+	$30,000+

Of the 5,093 respondents aged 55 and over, 271 (6%) did not provide information on income. These respondents, however, were included in the analysis. Their income was designated as unknown.

The marital status of respondents was obtained by asking if they were "now married," "living common-law," "living with a partner," "single (never married)," "widowed," "separated," or "divorced." For this analysis, those in the first three categories were designated as "living with a partner," and those in the other categories, "not living with a partner."

Chart 1

Prevalence of one or more chronic conditions, household population aged 55 and over, by sex and age group, Canada, 1994-95



Source: *National Population Health Survey, 1994-95*

With advancing age, the percentage of seniors in the household population who reported at least one chronic condition tended to rise (Chart 1). The exceptions were non-food allergies and migraine headaches, which were less prevalent at older ages. As well, the prevalence of non-arthritic back problems and stomach or intestinal ulcers varied little by age among women, and actually decreased at older ages among men.

Physical limitations rise sharply with age

Despite the high prevalence of chronic conditions, comparatively few seniors living in the community had physical limitations. In 1994-95, 16% of men and 18% of women aged 55 and over—just under one million people—reported having one or more physical limitations (Table 3).

Not surprisingly, the prevalence of physical limitations increased with age. At age 75 and over, 29% of men and 38% of women reported at least one limitation, whereas at ages 55-64, just 10% of men and 9% of women were affected. The higher overall prevalence of limitations among older women than older men partially reflects women's longer life expectancy, and the resulting higher proportion of the very old among women aged 75 and over.[6]

Table 2

Chronic conditions, household population aged 55 and over, by sex and age group, Canada, 1994-95

	Both sexes				Men				Women			
	55+	55-64	65-74	75+	55+	55-64	65-74	75+	55+	55-64	65-74	75+
	% with condition											
Arthritis, rheumatism	34.7	27.2	37.5	45.4	27.6	20.4	31.2	38.1	40.5	33.1	42.7	50.4
High blood pressure	25.2	20.6	28.0	29.8	21.2	18.4	25.0	20.6	28.4	22.6	30.4	36.1
Non-arthritic back problems	19.3	21.1	18.5	17.2	19.4	22.2	18.6	14.2	19.3	20.1	18.4	19.2
Non-food allergies	12.9	14.8	12.4	9.8	10.0	12.1	8.9	6.9	15.3	17.3	15.2	11.8
Heart disease	12.4	6.7	13.7	21.8	14.1	8.7	16.8	22.1	11.0	5.0	11.1	21.6
Diabetes	9.2	6.4	11.1	11.4	10.1	6.9	12.5	13.0	8.4	6.0	9.9	10.4
Cataracts	9.2	3.0	9.2	22.2	6.6	3.1	5.4	17.1	11.3	2.9	12.2	25.6
Chronic bronchitis, emphysema	5.7	4.7	5.4	8.3	6.4	5.0	6.6	9.1	5.2	4.5	4.4	7.8
Stomach, intestinal ulcers	5.1	5.3	5.3	4.4	5.4	5.8	5.6	4.0	4.9	4.9	5.1	4.6
Asthma	4.9	5.0	4.9	4.5	4.8	4.3	5.5	4.5	4.9	5.5	4.5	4.5
Migraine headaches	4.9	6.0	4.6	3.3	2.8	3.0	3.0	2.1	6.6	8.7	5.9	4.0
Cancer	4.2	3.1	4.7	5.6	3.8	2.2	5.1	5.2	4.5	3.9	4.3	5.9
Glaucoma	3.4	1.9	3.4	6.8	3.2	2.3	3.0	5.9	3.6	1.5	3.6	7.5
Urinary incontinence	3.1	1.8	3.2	5.5	2.7	1.4	2.5	6.4	3.4	2.2	3.8	4.9
Effects of stroke	2.9	1.5	3.4	5.0	3.6	1.9	4.6	5.5	2.3	1.1	2.3	4.7
Epilepsy	0.6	0.7	0.6	0.5	0.5	0.5	0.7	0.1	0.7	1.0	0.5	0.8
Alzheimer's disease, other dementia	0.4	0.1	0.3	1.0	0.3	0.1	0.3	0.7	0.4	0.1	0.3	1.2

Source: *National Population Health Survey, 1994-95*

The most common limitation among senior women in the community was mobility, affecting 9% of them. For men, hearing limitations were just as prevalent as mobility limitations (6%), and slightly exceeded the percentage of women with hearing limitations (5%). Understandably, given the relationship between hearing and speech, a somewhat higher percentage of men than women reported speech limitations. On the other hand, higher percentages of women reported vision and dexterity limitations.

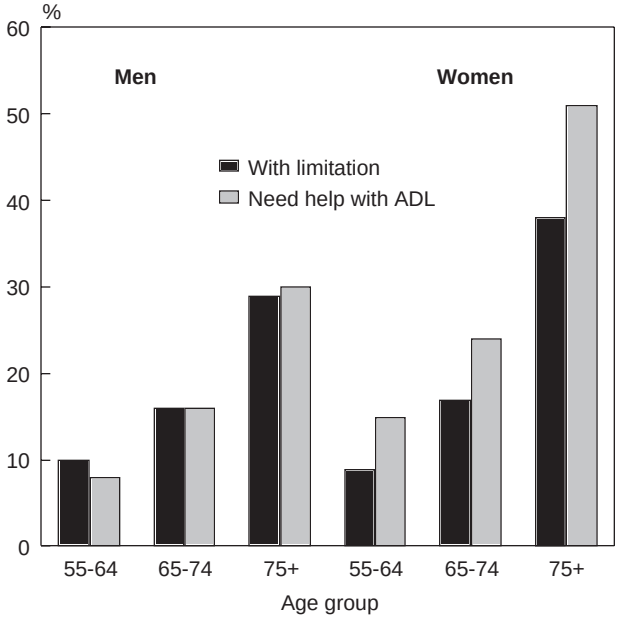
As expected, most limitations tended to become more prevalent at older ages. For instance, at age 75 and over, 7% of men and 16% of women reported vision limitations that were not fully corrected, even with glasses or contact lenses, whereas at ages 55-64, the percentages were just 3% and 4%. The exception was speech limitations among women, which varied little with age.

Greater need for help among women

Within each age group, the proportion of men needing and receiving help with activities of daily living (ADL) was about the same as the proportion with at least one physical limitation. However, among women of all ages, the proportion with an ADL dependency appreciably exceeded the proportion reporting a physical limitation (Chart 2).

Chart 2

Prevalence of one or more physical limitations and need for help with one or more ADL, household population aged 55 and over, by sex and age group, Canada, 1994-95



Source: *National Population Health Survey, 1994-95*

In 1994-95, 15% of men and 26% of women aged 55 and over living in the community—1.2 million people—reported that they depended on others for assistance with at least one ADL. For tasks that tend to affect the ability to live at home (preparing meals, personal care, moving about inside the house), the percentages of men and women receiving help did not vary substantially. However, a considerably larger share of women than men received help with housework and shopping for necessities (Table 4).

Assistance with ADL increased markedly with age. This was particularly the case for heavy housework—27% of men and 46% of women aged 75 and over reported receiving help with such chores in 1994-95, a finding similar to that of a household survey conducted almost a decade earlier.[7]

Table 3

Physical limitations, household population aged 55 and over, by sex and age group, Canada, 1994-95

	Physical limitation					
	Vision	Hearing	Speech	Mobility	Dexterity	At least one
	% with limitation					
Men 55+	**3.9**	**6.3**	**1.9**	**6.2**	**0.7**	**15.5**
55-64	2.7	4.3	1.0	2.6	0.3	9.9
65-74	3.8	6.1	2.3	6.3	0.9	15.8
75+	7.1	11.7	3.2	14.8	1.4	28.5
Women 55+	**7.3**	**4.9**	**1.5**	**9.2**	**1.1**	**18.4**
55-64	3.8	2.0	1.1	3.4	0.8	9.2
65-74	5.8	5.9	2.3	6.9	1.2	17.0
75+	16.0	8.7	0.8	23.5	1.3	37.7

Source: *National Population Health Survey, 1994-95*

Table 4

Need for help with ADL, household population aged 55 and over, by sex and age group, Canada, 1994-95

	Activity of daily living						
	Heavy house-work	Every-day house-work	Shopping for neces-sities	Pre-paring meals	Personal care	Moving about inside house	At least one
	% needing help						
Men 55+	**13.9**	**5.7**	**4.9**	**3.8**	**2.8**	**1.4**	**15.4**
55-64	7.6	1.8	2.0	1.5	1.1	0.5	8.4
65-74	15.1	5.1	3.9	2.5	1.4	1.9	16.4
75+	27.0	15.9	13.9	11.7	9.5	2.8	30.4
Women 55+	**24.0**	**11.8**	**10.3**	**5.1**	**2.8**	**2.2**	**26.1**
55-64	13.6	6.2	4.2	1.4	0.7	1.0	14.6
65-74	22.1	9.6	6.9	3.6	1.6	1.4	23.6
75+	46.3	25.8	26.8	14.3	8.4	5.7	51.3

Source: *National Population Health Survey, 1994-95*

Table 5

Odds ratios relating chronic conditions, socio-demographic and behavioural characteristics to physical limitations and need for help with activities of daily living, household population aged 55 and over, Canada, 1994-95

	Physical limitation				Need help with one or more ADL
	Vision	Hearing	Mobility	One or more limitations†	
Chronic condition‡					
Arthritis, rheumatism	1.40*	1.14	2.51**	1.58**	2.02**
High blood pressure	0.75	1.02	0.97	0.93	1.17
Non-arthritic back problems	1.12	1.12	1.38*	1.20	2.25**
Non-food allergies	1.17	1.20	0.90	1.14	1.24
Heart disease	1.19	0.86	1.17	1.01	2.19**
Diabetes	1.72**	0.87	0.86	0.86	1.03
Cataracts	2.52**	1.03	1.51*	1.75**	1.42**
Chronic bronchitis, emphysema	0.95	1.32	0.79	1.16	1.78**
Stomach, intestinal ulcers	1.16	1.68*	0.91	1.25	1.14
Asthma	0.65	0.98	0.92	0.90	1.48*
Migraine headaches	1.02	0.73	1.77*	1.04	0.92
Cancer	1.09	0.85	1.10	0.95	1.14
Glaucoma	1.54	0.53	1.10	1.27	1.60*
Urinary incontinence	0.78	0.79	1.75*	1.31	2.88**
Effects of stroke	1.43	2.27**	4.09**	4.66**	3.71**
Epilepsy	1.04	0.27	5.20**	2.43*	4.66**
Alzheimer's disease, other dementia	2.39	1.42	1.07	2.15	1.20
Sex					
Male§	1.00	1.00	1.00	1.00	1.00
Female	1.58**	0.78	1.00	1.03	1.91**
Age					
55-64§	1.00	1.00	1.00	1.00	1.00
65-74	1.22	2.16**	1.68**	1.59**	1.61**
75+	2.49**	3.98**	4.55**	3.31**	4.05**
Marital status					
With partner §	1.00	1.00	1.00	1.00	1.00
Not with partner	1.19	0.72*	1.42*	1.11	1.16
Household income					
Adequate §	1.00	1.00	1.00	1.00	1.00
Inadequate	1.00	1.00	1.20	1.07	1.31**
Unknown	1.38	0.35*	1.59	0.93	1.02
Smoking					
Never smoked §	1.00	1.00	1.00	1.00	1.00
Occasional or former smoker	0.98	0.80	0.85	0.95	1.17
Current, regular smoker	1.19	1.28	1.64**	1.40**	1.45**
Alcohol use					
At least one drink per week §	1.00	1.00	1.00	1.00	1.00
Less than one drink per week	1.26	0.83	1.71**	1.35**	1.10
Never	1.04	0.97	1.43*	1.21	0.99
Body mass index ††					
Appropriate§	1.00	1.00	1.00	1.00	1.00
Underweight	1.29	0.96	1.08	1.21	1.50**
Overweight	0.97	1.22	1.14	1.08	0.93
Recreational physical activity					
Active§	1.00	1.00	1.00	1.00	1.00
Moderate	1.64	1.79*	1.51	1.63**	1.40*
Inactive	1.36	1.41	2.93**	1.60**	1.58**
Unknown	2.20*	2.27**	5.85**	3.81**	1.74**
Self-rated health					
Excellent, very good, good §	1.00	1.00	1.00	1.00	1.00
Fair, poor	1.31	1.55**	3.18**	2.11**	3.10**
Region					
Atlantic §	1.00	1.00	1.00	1.00	1.00
Quebec	1.86*	0.68	1.16	0.99	0.79
Ontario	1.23	0.94	1.51	1.15	0.72*
Prairies	1.50	1.49	1.35	1.35	0.82
British Columbia	0.85	1.05	1.79*	1.08	0.87

Source: *National Population Health Survey, 1994-95*
Note: *These are the results of five separate logistic regressions using as dependent variables vision limitations, hearing limitations, mobility limitations, one or more physical limitations, and need for help with one or more ADL.*
† *Includes limitations in vision, hearing, mobility, dexerity and speaking.*
‡ *The reference category (not shown) is the absence of the chronic disease.*
§ *Indicates the reference category, for which the odds ratio is always 1.00.*
†† *Appropriate: 20-27; underweight:* <20; overweight: >27.
* $p < 0.05$
** $p < 0.01$

Limitations and dependency vary with chronic conditions

A complex set of factors in addition to chronic conditions influences physical limitations and ADL dependency. Logistic regression was used to control for the influence of some of these factors. This technique was employed to estimate the risk (or odds) that people with a specific condition will have a physical limitation or an ADL dependency, compared with people who do not have that condition.

To properly assess these results, odds ratios should be considered in conjunction with the prevalence of the condition in question. The conditions most closely associated with physical limitations and dependency—epilepsy, the effects of stroke, and incontinence—are relatively rare among seniors living in the community. Consequently, although the burden of these conditions is relatively great at the individual level, their impact on the entire household population is less than that of conditions that are usually less disabling but more prevalent, such as arthritis/rheumatism, non-arthritic back problems, and cataracts.

As expected, different chronic conditions had different associations with physical disability. For example, arthritis/rheumatism, non-arthritic back problems, and the effects of stroke were significantly associated with mobility limitations. People with arthritis/rheumatism had odds more than double (odds ratio = 2.51) those for people without the disease of reporting a mobility limitation (Table 5). Not surprisingly, cataracts (2.52) and diabetes (1.72) were significantly associated with vision limitations.

Three conditions that were prevalent among community-dwelling seniors—arthritis/rheumatism, non-arthritic back problems, and heart disease—were strongly associated with ADL dependency. In each instance, the odds of receiving such assistance were at least twice as high among people with these conditions as among those who did not report having them. The association of arthritis/rheumatism with limitations in mobility and the need for help with ADL was anticipated and is similar to findings reported in Ontario and in the United States.[8-11] The likelihood of dependency was also relatively high among people with chronic bronchitis/emphysema (1.78), asthma (1.48), and cataracts (1.42).

Strong associations with age and sex

In addition to specific chronic conditions, physical limitations and dependency were associated with a number of personal characteristics. Predictably, old age was strongly related to vision, hearing and mobility problems. For instance, compared with people aged 55-64, the odds that those aged 75 and over would have a mobility limitation were more than four times (4.55) as great. Differences between the sexes were less clear-cut. Being female was related to limitations in vision, but not mobility.

Some physical limitations varied with marital status: people living with a partner had significantly lower odds of reporting mobility limitations than did people not living with a partner, but significantly higher odds of reporting hearing problems. The latter relationship is partially explained by the higher prevalence of hearing problems in senior men, who are more likely than women to be living with a partner.

Dependency was associated with advancing age and being female. The odds of receiving help with one or more ADL were four times as great among people aged 75 and over (4.05) as among those aged 55-64. And the odds for women receiving help were almost twice those for men (1.91).

ADL dependency tended to be greater among seniors with low socioeconomic status, as reflected by inadequate household income. This may be partly due to a reporting or perceptual difference between people with adequate income and those with inadequate means. Individuals who can afford to pay for help with ADL, and who have long had such help (for example, cleaning services), may not regard this as being dependent. They may be unaware that they would be unable to perform these tasks if they lacked the resources to pay for the service. However, socioeconomic status is a well-known determinant of health, so it is likely that seniors with inadequate income are in genuinely greater need of help with ADL than are those with adequate income.[12] This finding is consistent with other research and supports the premise of a social component in the performance of everyday tasks, and in particular, the capacity to perform ADL.[13,14]

Implications

This analysis illustrates the importance of measuring the relative burden of chronic conditions not only in terms of prevalence and mortality, but also in terms of their relationship to physical function and ADL dependency. It is notable that heart disease and cancer, the chronic conditions that account for most of the deaths in Canada, were not significantly associated with physical limitations among seniors living in the community.[15] And although heart disease was associated with ADL dependency, cancer was not.

The high odds ratios relating physical limitations and dependency to epilepsy and the effects of stroke reflect the incapacitating effects of these conditions on physical functioning. The low prevalence of the effects of stroke in the household population is attributable not only to the lower overall incidence of stroke compared with conditions such as arthritis/rheumatism, but also to the greater risk of institutionalization among affected people. By the same token, the lack of statistical significance of the odds ratios for Alzheimer's disease/other dementia reflects only the small number of people with this condition, and not the degree of physical limitation or dependency that the condition entails. The odds ratios for musculoskeletal problems are somewhat lower than those for epilepsy and stroke, but because the former conditions are far more prevalent, they account for more of the physical limitations and dependency experienced by the household population aged 55 and over.

Knowledge of the prevalence of various chronic conditions among seniors living in the community, and the extent to which these conditions are associated with physical limitations and dependency, is important from a public health perspective. This information can be used to allocate publicly supported in-home assistance so that people with the most debilitating conditions can receive help based on need. In addition, estimates can be made of the resources necessary to provide the support that will enable the growing senior population to age in place and avoid, or at least delay, the upheaval and expense of institutional care.

References

1. Tully P, Mohl C. Older residents of health care institutions. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(3): 27-30.
2. Statistics Canada. *Health Status of Canadians: Report of the 1991 General Social Survey* (Catalogue 11-612E, No. 8) Ottawa: Minister of Industry, Science and Technology, 1994.
3. Health and Welfare Canada, Statistics Canada. *The Health of Canadians: Report of the Canada Health Survey* (Catalogue 82-538E) Ottawa: Minister of Supply and Services Canada, 1981.
4. 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.
5. Statistics Canada. *National Population Health Survey Overview* (Catalogue 82-567) Ottawa: Minister of Industry, 1995.
6. Millar WJ. Life expectancy of Canadians. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(3): 23-6.
7. Hagey J. Help around the house: Support for older Canadians. *Canadian Social Trends* (Statistics Canada, Catalogue 11-008) 1989; 14: 22-4.
8. Badley EM, Rasooly Y, Webster GK. Relative importance of musculoskeletal disorders as a cause of chronic health problems, disability and health care utilization: Findings from the 1990 Ontario Health Survey. *Journal of Rheumatology* 1994; 21: 505-14.
9. Hubert HB, Bloch DA, Fries JF. Risk factors for physical disability in an aging cohort: The NHANES I Epidemiologic Follow-up Study. *Journal of Rheumatology* 1993; 20: 480-8.
10. Jette AM, Branch LG. Impairment and disability in the aged. *Journal of Chronic Diseases* 1985; 38: 59-65.
11. Guccione AA, Felson DT, Anderson JJ, et al. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. *American Journal of Public Health* 1994; 84: 351-8.
12. Roberge R, Berthelot J-M, Wolfson M. The Health Utility Index: Measuring health differences in Ontario by socioeconomic status. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(2): 25-32.
13. Kelly-Hayes M, Jette AM, Wolf PA, et al. Functional limitations and disability among elders in the Framingham Study. *American Journal of Public Health* 1992; 82: 841-5.
14. Nagi SZ. Some conceptual issues in disability and rehabilitation. In: Sussman MB (editor). *Sociology and Rehabilitation*. Washington DC: American Sociological Association; 1965: 100-13.
15. Nault F, Wilkins K. Deaths, 1993. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 51-60.

Appendix

National Population Health Survey questions on chronic conditions, physical limitations, and dependency

Chronic conditions

Do(es). . . have any of the following long-term conditions (long-term conditions refer to conditions that have lasted or are expected to last 6 months or more) that have been diagnosed by a health professional:

Food allergies? *[Not included in this analysis because of low frequency of occurrence]*

Other allergies?

Asthma?

Arthritis or rheumatism?

Back problems excluding arthritis?

High blood pressure?

Migraine headaches?

Chronic bronchitis or emphysema?

Sinusitis? *[Not included in this analysis because of low frequency of occurrence]*

Diabetes?

Epilepsy?

Heart disease?

Cancer?

Stomach or intestinal ulcers?

Effects of stroke?

Urinary incontinence?

Alzheimer's disease or other dementia?

Cataracts?

Glaucoma?

Any other long term condition? (Specify)_____

Physical limitations

The next set of questions ask about ... (r/'s) day to day health. The questions are **not** about illnesses like colds that affect people for short periods of time. They are concerned with a person's usual abilities. You may feel that some of these questions do not apply to you/him/her, but it is important that we ask the same questions of everyone.

Vision

Are/Is ... *usually* able to see well enough to read ordinary newsprint *without* glasses or contact lenses? (Yes, No, Don't know/Refusal)

Are/Is you/he/she *usually* able to see well enough to read ordinary newsprint *with* glasses or contact lenses? (Yes, No)

Are you/he/she able to see at all? (Yes, No, Don't know/Refusal)

Are/Is you/he/she able to see well enough to recognize a friend on the other side of the street *without* glasses or contact lenses? (Yes, No, Don't know/Refusal)

Are/Is you/he/she *usually* able to see well enough to recognize a friend on the other side of the street *with* glasses or contact lenses? (Yes, No)

Hearing

Are/Is ... *usually* able to hear what is said in a group conversation with at least three other people *without* a hearing aid? (Yes, No, Don't know/Refusal)

Are/Is you/he/she *usually* able to hear what is said in a group conversation with at least three other people *with* a hearing aid? (Yes, No)

Are/Is you/he/she able to hear at all? (Yes, No, Don't know/Refusal)

Are/Is you/he/she *usually* able to hear what is said in a conversation with one other person in a quiet room *without* a hearing aid? (Yes, No, Refusal)

Are/Is you/he/she *usually* able to hear what is said in a conversation with one other person in a quiet room *with* a hearing aid? (Yes, No)

Speech

Are/Is ... *usually* able to be understood *completely* when speaking with strangers in your own language? (Yes, No, Refusal)

Are/Is you/he/she able to be understood *partially* when speaking with strangers? (Yes, No)

Are/Is you/he/she able to be understood *completely* when speaking with those who know you/him/her well? (Yes, No, Refusal)

Are/Is you/he/she able to be understood *partially* when speaking with those who know you/him/her well? (Yes, No)

Getting around

Are/Is ... *usually* able to walk around the neighbourhood *without* difficulty and *without* mechanical support such as braces, a cane or crutches? (Yes, No, Don't know/Refusal)

Are/Is you/he/she able to walk at all? (Yes, No, Don't know/Refusal)

Do/Does you/he/she require mechanical support such as braces, a cane or crutches to be able to walk around the neighbourhood? (Yes, No)

Do/Does you/he/she require the help of another person to be able to walk? (Yes, No)

Do/Does you/he/she require a wheelchair to get around? (Yes, No, Don't know/Refusal)

How often do/does you/he/she use a wheelchair? (Always, Often, Sometimes, Never)

Do/Does you/he/she need the help of another person to get around in the wheelchair? (Yes, No)

Hands and fingers

Are/Is ... *usually* able to grasp and handle small objects such as a pencil and scissors? (Yes, No, Don't know/Refusal)

Do/Does you/he/she require the help of another person because of limitations in the use of hands or fingers? (Yes, No, Don't know/Refusal)

Do/Does you/he/she require the help of another person with: Some tasks? Most tasks? Almost all tasks? All tasks?

Do/Does you/he/she require special equipment, for example, devices to assist in dressing because of limitations in the use of hands or fingers? (Yes, No)

Dependency

The next question asks about help received. This may not apply to ..., but we need to ask the same question of everyone. Because of any condition or health problem, do(es) ... need the help of another person in:

Preparing meals?

Shopping for groceries or other necessities?

Doing normal everyday housework?

Doing heavy housework such as washing walls, yard work, etc.?

Personal care such as washing, dressing or eating?

Moving about inside the house?

Trends in mammography utilization, 1981 to 1994

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Abstract

From 1981 to 1994, the annual number of mammograms performed in Canada increased from less than 200,000 to more than 1.4 million. By 1994, about three in five women aged 40 and over reported having had a mammogram at some time in their lives. Most of the increase that occurred between 1985 and 1991 was because of greater use of mammography for breast screening. In the early 1990s, the annual numbers and rates stabilized as the number of mammograms performed on a fee-for-service basis declined slightly, while those conducted by provincial/territorial breast screening programs rose.

Mammography is increasingly targeted to women aged 50-69 for whom screening is considered to be most effective. About 30% of Canadian women aged 50-69 have had a mammogram within the past year, although just one-fifth of these mammograms were obtained through provincial/territorial breast screening programs.

Most mammography in Canada is provided through the fee-for-service system, although about 80% of fee-for-service mammograms are done for screening purposes, and the remaining 20% for diagnostic assessment.

This article is based on administrative data provided by provincial/territorial departments of health and by breast screening programs, as well as on data from the National Population Health Survey. Some implications of mammography utilization for breast cancer incidence and mortality rates are assessed, but because of the long lead time between detection and death, it may be too early to reach definitive conclusions.

Key words: *mammography, breast neoplasms, administrative data, breast screening*

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Among Canadian women, breast cancer is the form of cancer most frequently diagnosed, and it ranks second after lung cancer as the leading cause of cancer death.[1,2] Many of the risk factors associated with breast cancer—for example, early menarche, late menopause, and a family history of the disease—do not lend themselves to prevention strategies.[3,4] However, early detection through mammography, used alone or in combination with a thorough physical examination of the breast, can find smaller tumours that allow for wider treatment options. Advances in the treatment of early breast cancer afford some hope of reducing mortality rates.[3,5] Thus, screening offers perhaps the best chance of improving the control of breast cancer at this time.[5,6]

Although mammography was originally developed in the early part of this century, a standard technique for general application did not evolve until the 1950s and 1960s.[7] At first, mammography was used primarily as a *diagnostic* tool to evaluate women with symptoms or signs of breast disease. As the ability of mammograms to detect early breast cancers became apparent, *screening* of asymptomatic women was developed.[3,5,8] The effectiveness of large-scale screening mammography was first determined by the Health Insurance Plan (or HIP) study in New York in the 1960s, and later, by a number of studies in the 1970s and 1980s.[3,5,8] Canada has contributed significantly to assessing the role of mammographic screening in reducing breast cancer mortality through the Canadian National Breast Screening Study, the National Workshop on the Early Detection of Breast Cancer, and the National Forum on Breast Cancer[9-12] (see *Breast screening initiatives*).

Between 1988 and 1991, breast screening programs offering mammography through dedicated centres were established in five Canadian provinces and one territory. A network of dedicated breast cancer screening centres allowing universal access with high quality facilities and specially trained staff are key components for a reduction in breast cancer mortality.[13] Further, high-volume centres have the potential to achieve relatively low-cost mammography while maintaining high quality.[3]

Methods

Data sources

Data on the annual number of mammograms, by five-year age group where possible, were collected from administrative sources. Breast screening program data were provided by provincial and territorial breast screening programs. Fee-for-service data were provided by the departments of health.

Data on mammography are also available from the household component (which excludes long-term health care facilities) of Statistics Canada's 1994-95 National Population Health Survey (NPHS).[14,15] The NPHS is a longitudinal survey that measures the health status of the Canadian population. The target population is household residents in all provinces, except persons living on Indian reserves, on Canadian Forces bases, or in some remote areas.

The NPHS collects most information from one household member who is selected randomly. The final 1994-95 sample size was 27,263 households. The final response rate (the proportion of selected households agreeing to participate, including households later rejected for sampling reasons) was 89%. (NPHS data from the Northwest Territories and the Yukon were not available.)

As part of the NPHS interview, women aged 35 and over were asked, "Have you ever had a mammogram, that is, a breast x-ray?" Those who replied affirmatively were asked, "When was the last time?" Women who had had a mammogram were also asked, "Why did you have your last mammogram?" Of three possible responses—"breast problem," "check-up, no particular problem," or "other"—only one was recorded. Response rates to these questions ranged from 98% to 100%. Proxy responses were not allowed. The data analyzed in this article are based on the 5,030 women aged 40 and over who answered the NPHS questions on mammography.

Limitations

Data about fee-for-service mammograms were not available before 1986 for Manitoba and Saskatchewan, before 1987 for New Brunswick, before 1988 for Prince Edward Island, and before 1992 for the Yukon. Ontario reported estimates of fee-for-service mammograms before 1988. No fee-for-service data were available from Nova Scotia or the Northwest Territories. Fee-for-service data for New Brunswick, Prince Edward Island, Manitoba, Saskatchewan, Alberta, British Columbia, and Ontario (1980-1982) were usually reported by fiscal, not calendar, years. As well, fee-for-service data include mammograms (less than 1% of the total) performed on a small number of men. Age breakdowns were available for only five provinces: Quebec, Ontario, Saskatchewan, Alberta, and British Columbia. However, between 1985 and 1994, 87% of Canadian women aged 40 and over lived in these provinces.

Provinces and territories generally used similar methods to compile breast screening program data, although Nova Scotia reported for fiscal years, while all other programs reported for calendar years.

For several reasons, total mammography rates calculated from administrative sources for women aged 40 and over may be overestimated. Fee-for-service figures include mammographic examinations of women younger than age 40. Data for those provinces and years for which age breakdowns are available indicate that mammograms performed on women younger than age 40 accounted for around 20% of the annual total in the mid-1980s, but had dropped to about 10% in the 1990s.

Also, in any given year, some women have more than one mammogram. For example, some would require two or more diagnostic examinations through the fee-for-service system. As well, the approximately 6% of women with abnormal results from breast screening programs would usually be referred to the fee-for-service system for further diagnostic assessment. An Ontario study found that 14% of fee-for-service mammograms provided in that province over an 18-month period were repeat mammograms.[16] The percentage would likely be somewhat lower (around 10%) within the 12-month reference period used here.

On the other hand, underestimation may occur because some women receive mammograms through services not included in this analysis, such as those conducted from 1980 to 1985 as part of the National Breast Screening Study. Further, some provinces provide block funding to certain hospitals for mammographic services, and counts of these mammograms are not reported to the provincial departments of health. Such examinations are thought to represent fewer than 10% of the total.

On balance, the reasons for overestimation tend to outweigh those leading to underestimation, such that mammography rates based on administrative data could be overestimated by about 10%.

Comparison of administrative and survey data

In several respects, mammography rates based on administrative data are comparable to rates calculated using the 1994-95 NPHS. Both sources show rising east-to-west gradients and agree closely on the rank order of provinces. Patterns by age are also similar. However, the NPHS yielded rates five to ten percentage points above annual rates derived from administrative data. These results do not support the high validity cited for self-reported mammography.[17]

Several factors may contribute to the difference between rates for survey and administrative data. NPHS respondents might not have remembered the exact date of their last mammogram and misreported it as having taken place within the previous 11 months, an occurrence that has also been noted in the United States.[18] In addition, women who are included in and agree to respond to a survey such as the NPHS may also be more likely than non-respondents or those out-of-scope (for example, those in institutions) to have engaged in health-promoting behaviours such as having a screening mammogram. Some respondents, wishing to provide a socially desirable answer, may have said they had a mammogram, when in fact, they had not. Further, respondents might have replied affirmatively, assuming that the chest x-ray or other breast examination that they had was actually a mammogram or breast x-ray. And some women may have obtained mammograms from sources other than the fee-for service system or a breast screening program, for example, from hospitals that received block funding for this service.

Mortality reductions of approximately 40% among women aged 50 and over have been found five to seven years after screening was started, in research studies where participation rates ranged from 65% to 90%.[8,11,19,20] Population-based screening programs in Canada were set up on the assumption that screening could reduce mortality by 30% in women aged 50-69, providing that 70% of women in this age range received a screening mammogram every two years.[12]

This article analyzes data from several sources to document trends in mammography utilization in Canada, in the context of recommendations and initiatives related to breast cancer screening (see *Methods* and *Definitions*).

Numbers and rates rise

The annual number of mammograms performed in Canada increased slowly from 162,000 to 250,000 between 1981 and 1985, then climbed to 1.3 million by 1991. The increase levelled off, and by 1994, the total was 1.4 million (Chart 1; Appendix, Table A).

Trends in annual mammography rates paralleled the sharp rise and levelling off of the numbers. As a percentage of women aged 40 and over, the rate rose from 5% in 1985 to 23% in 1991, and has since been relatively stable. The sharp upturn between 1985 and 1991 largely reflects increases in mammography performed for screening, whether provided through breast screening programs or the fee-for-service system.

Majority fee-for-service

Most mammography is conducted on a fee-for-service basis. The number of fee-for-service mammograms peaked in 1991 at just over 1.2 million, and then declined slightly. By contrast, between 1988 and 1994, as breast screening programs were established in several provinces, the number of mammograms these programs provided surged from 4,500 to 231,000. In 1994, mammography conducted through breast screening programs accounted for 16% of the national total. The stabilization of the total mammography rate after 1991 occurred partly because of shifts from the fee-for-service system to breast screening programs, and partly because, in accordance with guidelines in most provinces, women may be having a mammogram every two years rather than annually.

Highest rates in provinces with well-established screening programs

In all provinces, total mammography rates mirrored the national trend, increasing rapidly in the late 1980s, and levelling off in the early 1990s. By 1994, as a percentage of women aged 40 and over, total mammography rates ranged from 17% in Newfoundland to 32% in British Columbia. Provinces with well-established breast screening programs tended to have high total mammography rates, and among the lowest rates of fee-for-service mammography.

The highest breast screening program mammography rates were 16% in British Columbia and 12% in Saskatchewan, where about half of all mammography was conducted by such programs. Provincial fee-for-

Definitions

A *mammogram* is a safe, low-dose x-ray of the breast that uses a special technique to find tumours at an early stage. Several views of the breast may be taken at any one *mammographic examination*. The mammograms taken at each examination are reviewed by a radiologist who specializes in the diagnosis of breast disease. In this article, the terms "mammogram" and "mammographic examination" are used interchangeably.

Breast screening program mammography is offered through government-sponsored programs at dedicated screening centres, and at no cost to women in the target age group. Referral from a physician is not necessary for women in the target age range. Most programs do not accept women of other ages unless they have been referred by a physician or have been previously screened by the program. Breast screening programs provide a mammographic examination, supplemented in some provinces with a physical examination of the breast. *Screening mammography* such as this is done on a mass basis, through standard protocols aiming to separate abnormal from normal mammograms. Any abnormalities detected are followed up through more intensive diagnostic processes.[21]

Fee-for-service mammography refers to mammographic examinations conducted by a radiologist for diagnostic assessment. Women must be referred by a physician, and the costs are paid to the radiologist on a fee-for-service basis by the provincial health care system. To the extent that this service may be used for breast check-ups rather than for diagnosis of a suspected problem, a portion of fee-for-service mammograms are done for screening. Fee-for-service data, however, cannot be disaggregated by the reason for the examination.

The *mammography rate* is calculated as the annual number of mammograms per 100 women aged 40 and over to provide a general indication of mammography utilization by province and over time. *Total mammography rates* include both breast screening program and fee-for-service examinations.

An *age-specific mammography rate* is the number of mammograms per 100 women in a given age group. These rates are of most value in assessing the coverage of breast screening programs. However, annual, not biennial, rates are calculated to minimize the impact of duplicates. Because of the lack of age-specific information for a number of provinces and over time, national age-standardized mammography rates have not been calculated.

Breast screening initiatives

The National Breast Screening Study

The National Breast Screening Study (NBSS), the first large-scale study of mammography in Canada, was designed to evaluate the effect of mammographic screening, alone or in combination with physical examination, on breast cancer incidence and mortality rates among women aged 40-59.[9,10] When the NBSS was designed in 1979, there was no evidence that screening was effective in reducing breast cancer mortality among women aged 40-49. By contrast, for women aged 50 and over, mammographic screening, alone or combined with physical breast examination, had been found to be effective in reducing breast cancer mortality. However, the contribution of mammography beyond any benefit from physical examination alone was unclear.

The aim of the NBSS for women aged 40-49 was to evaluate the efficacy of the combination of annual mammographic screening, physical breast examination, and the teaching of breast self-examination in reducing the breast cancer mortality rate. For women aged 50-59, the aim was to evaluate the efficacy of annual mammograms over and above annual physical examination of the breasts and the teaching of breast self-examination. From January 1980 through March 1985, 50,430 women aged 40-49 and 39,405 women aged 50-59 were enrolled in the study.

The first NBSS results were published in 1992.[9,10] For women aged 40-49, annual mammographic screening and physical examination of the breasts detected considerably more small, node-negative tumours (that is, tumours localized to the breast) than usual care, but had no impact on the rate of breast cancer death among the participants up to seven years' follow-up from entry in the study. Similarly, for women aged 50-59, annual mammographic screening detected considerably more small, node-negative tumours than physical examination alone. But again, during seven years' follow-up, mammographic screening had no effect on mortality compared with having only a thorough physical examination. An 11-year follow-up on incidence and a 13-year follow-up on mortality are now in progress.

Workshop on the Early Detection of Breast Cancer

After completion of the data collection phase of the NBSS in 1985, pressure had emerged to make mammographic screening widely available. The National Workshop on the Early Detection of Breast Cancer was convened in 1988.[11] The Workshop Report, developed by representatives of government, volunteer and professional groups from across Canada, recommended that women aged 50-69 be offered and encouraged to participate in an early breast cancer detection program, a component of which would be biennial mammography. The Workshop proposed the establishment of dedicated screening centres to ensure the highest standards in image quality, personnel, interpretation, follow-up, and pathology review, as well as the lowest unit costs.

Provincial/territorial screening programs

British Columbia set up the first breast screening program in 1988, followed by Saskatchewan, Ontario and Alberta in 1990, and Nova Scotia and the Yukon in 1991. In 1995, Manitoba and New Brunswick, and in 1996, Newfoundland, instituted programs. The Northwest Territories has prepared and distributed guidelines that are undergoing regional review. Prince Edward Island is establishing a program, while Quebec does not yet have a screening program.

British Columbia initially targeted women aged 40 and over for annual screening, but since 1995, has concentrated on those aged 50-70. The other jurisdictions target women aged 50-69 for biennial screening. The goal of the provincial programs is to screen 70% of their target populations, and to achieve a 30% reduction in mortality after five to seven years.

The National Forum on Breast Cancer

The National Forum on Breast Cancer was held in Montreal in November 1993 under the sponsorship of the Canadian Cancer Society, the National Cancer Institute of Canada, the Medical Research Council, the Canadian Breast Cancer Foundation, and Health Canada.[12] The purpose was to develop consensus on breast cancer research, prevention, and care. The Forum recommended that funding be increased to allow provincial programs to reach at least 70% of women aged 50-69 every two years.

Breast screening programs, Canada, 1994

	British Columbia	Saskatchewan	Ontario†	Alberta	Nova Scotia	Yukon
Start date	July 1988	April 1990	June 1990	October 1990	June 1991	Mid-1991
Target age group	40+†	50-69‡	50-69‡	50-69‡	50-69§	50-69‡
Screening frequency	annual	biennial	biennial	biennial	biennial	biennial
Includes physical breast exam	no	no	yes (nurse examiner)	no	yes (technologist)	yes (general practitioner)

Source: *Provincial and territorial screening programs and departments of health*

Note: *Start dates for other programs: 1995 - Manitoba, New Brunswick; 1996 - Newfoundland; None - Prince Edward Island, Quebec, Northwest Territories*

† *Since 1995, program has concentrated on women aged 50-70.*

‡ *Program accepts women over age 69 on request.*

§ *Program accepts women aged 40-49 and 70-72 on request.*

service mammography rates were 16% for British Columbia and 13% in Saskatchewan. In other provinces, fee-for-service rates ranged from 17% in Alberta to 27% in New Brunswick.

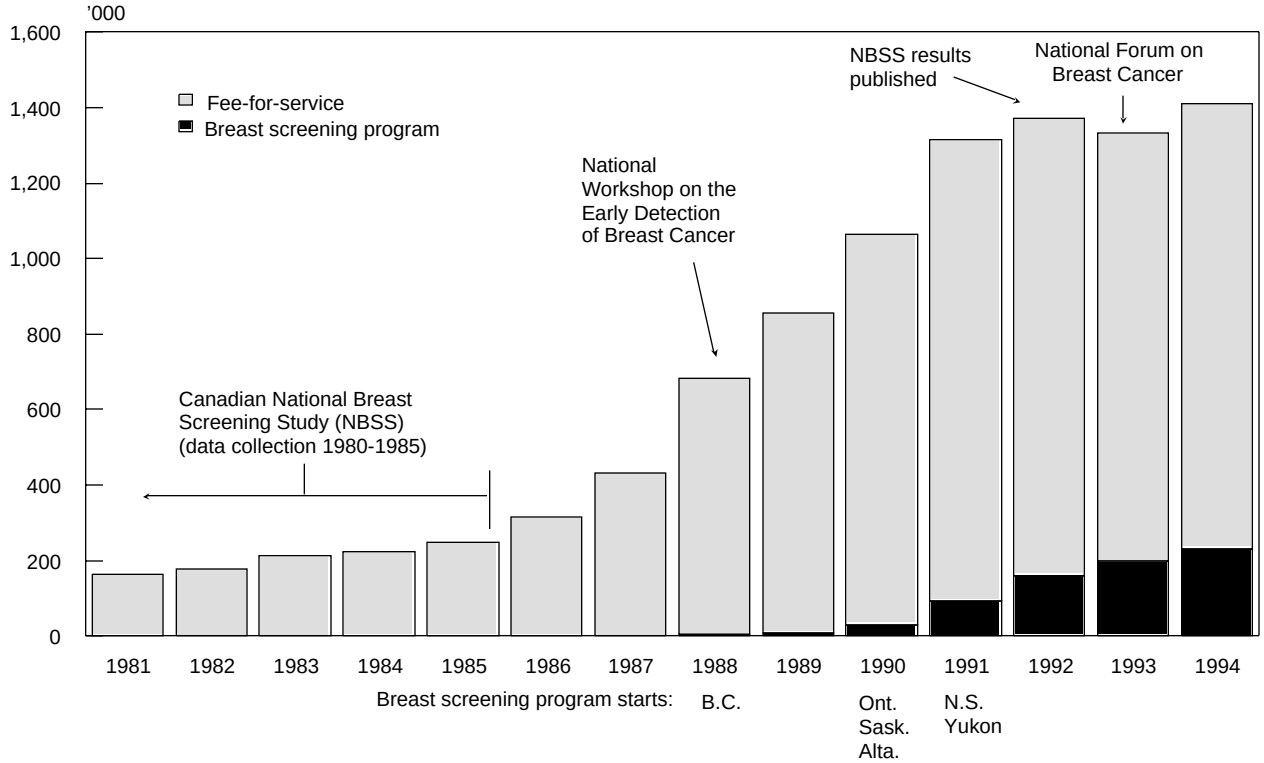
Mammography increasingly targeted to ages 50-69

Age breakdowns of mammography data are available for Quebec, Ontario, Saskatchewan, Alberta, and British Columbia. In each of these provinces, age-specific mammography rates rose dramatically from the mid- to late-1980s to the early 1990s, and then levelled off or even declined slightly. Rates for each ten-year age group were highest in British Columbia and Saskatchewan, the two provinces with the greatest proportions of mammography conducted by breast screening programs (Appendix, Table B).

At 32% in 1993, the mammography rate was highest for women aged 50-59. The rate for this age group had tended to stabilize around 1992. The mammography rate for women aged 60-69 also stabilized in 1992, and by 1993, was about 26%. Saskatchewan and British Columbia were the only provinces with a marked decline in fee-for-service mammography rates for both age groups. However, between 20% and 26% of women in their fifties and sixties had a mammogram through the provinces' breast screening programs in 1994. As a result, that year, Saskatchewan, along with British Columbia, had the highest total mammography rates (at least 37%) for women aged 50-69, the age group targeted for screening mammography. In these two provinces, over half of all mammograms performed on women in this age range were conducted through breast screening programs (Table 1). Elsewhere, most, if not all, mammography was provided to women in the targeted age groups by the fee-for-service system.

Stabilization of the overall mammography rate in the early 1990s may partially reflect rates close to a saturation level for women aged 50-69. By 1994, rates for women in their fifties and sixties in the five provinces were approaching 30% or more. This may indicate that the desired goal—70% of women screened every two years—was close to being achieved. The levelling off also results from less mammography among women in their forties, possibly because of greater awareness that no conclusive evidence has shown this age group to benefit from mass screening.[3,5,8]

Chart 1
Number of mammograms, Canada, 1981-1994



Source: *Provincial and territorial departments of health and breast screening programs*
Note: *Data coverage of the population increases from 85% in 1981 to 97% by 1988.*

In fact, among women in their forties, the mammography rate was 18% in 1993, a drop from 22% in 1991. This was entirely attributable to a downturn in fee-for-service rates, since except for British Columbia, almost no mammograms were provided to women aged 40-49 though breast screening programs. Declines in fee-for-service mammography for women in their forties were particularly marked in the provinces with breast screening programs (Appendix, Table B).

At around 16% in 1993, the total mammography rates for women in their seventies were also low. That year, about 3% of women aged 70-79 had mammograms from breast screening programs, with the highest rates reported for British Columbia (12%) and Saskatchewan (8%).

Table 1
Mammograms conducted by breast screening programs, by age group, four provinces, 1994

	Age group		
	40-49	50-59	60-69
	Breast screening program mammograms as % of total mammograms		
Ontario			
1990	–	–	–
1991	–	5	5
1992	–	11	12
1993	–	13	15
1994	..	..	..
Saskatchewan			
1990	...	22	32
1991	...	39	46
1992	...	38	46
1993	...	60	66
1994	...	64	70
Alberta			
1990	–	1	2
1991	1	10	11
1992	2	21	28
1993	2	26	25
1994	1	20	29
British Columbia			
1988	5	5	4
1989	8	8	8
1990	15	15	14
1991	27	27	29
1992	38	39	41
1993	46	45	47
1994	50	51	53

Source: *Provincial departments of health and breast screening programs*

Majority have had mammogram

As the increase in the annual number of mammograms indicates, a growing number of Canadian women have had the procedure. According to the National Population Health Survey (NPHS), by 1994-95, 64% of women aged 40 and over had had at least one mammogram (Table 2). The highest lifetime rate was among women in their fifties (74%), one of the age groups targeted by screening programs. Moreover, this was up from 58% in 1990, as reported by the Health Promotion Survey.[22] In 1994-95, 71% of women in their sixties reported having had a mammogram, a substantial increase from 51% in 1990. At 54% in 1994-95, the lifetime rate among women aged 70 and over was much lower, but this was a considerable jump from 32% in 1990.

There was a rising east-to-west gradient in the percentage of women reporting ever having had a mammogram, from 43% in Newfoundland to 69% in British Columbia. A major exception to this pattern was Quebec, where the figure was 67%.

Most mammograms performed for screening

NPHS respondents' reasons for their last mammogram reflect the increased use of mammography for screening, as opposed to diagnostic purposes. Of women aged 40-79 who had ever had a mammogram, 80% reported that a "check-up" was the reason for the last one, while "breast problem" was mentioned by just 17%. (Similar percentages were found when the analysis was restricted to women who had a mammogram in the previous year.) At 84%, the percentage of mammograms conducted for a check-up was highest for women aged 50-69, the age group targeted for screening (Chart 2). The highest percentage of respondents reporting that their last mammogram was to "investigate a breast problem" was among women in their forties (25%). This is not surprising, because in most provinces women in their forties are not targeted for screening.

These data suggest that a large majority of fee-for-service mammograms are performed for screening rather than diagnostic purposes. The 17% of mammograms reported by the NPHS to be conducted for "breast problems" can be considered equivalent to diagnostic mammography, and is similar to figures derived from other sources. Assuming that most fee-for-service mammograms performed in Canada before 1986 (around 250,000 annually) were diagnostic (Appendix, Table A), and that screening accounts for most of the rise since then, in 1994, just 20% of fee-for-service mammograms

would have been performed for diagnostic assessments. Therefore, in Canada in 1994, about 80% of fee-for-service mammography appears to have been for screening, although the proportion would be lower in provinces with well-established screening programs.

These results are consistent with an Ontario survey which indicated that, depending on the definition of breast disease used, between 72% and 89% of fee-for-service mammograms were for screening.[23] Similarly, data from an Alberta survey showed that in 1992, only about 25% of fee-for-service mammograms were for diagnostic purposes.[24]

Implications for control of breast cancer

Since the mid-1980s, the use of mammography has increased substantially in Canada. As the procedure became more well known, growing demand by the public and by physicians for access to mammography led to the implementation of organized screening programs, as well as to increased use of diagnostic assessments through the fee-for-service system.

Since mammography detects breast cancers earlier than they otherwise would have been diagnosed, an increase in mammograms can be expected to produce an initial upturn in incidence, not because there is more cancer, but because tumours are being detected at an earlier stage. This artifactual increase in the incidence rate because of the earlier date of detection will eventually disappear as the rate falls back to its natural level, a trend that has been noted in the United States.[25,26]

In Canada, among women in their fifties, moderate increases in breast cancer incidence occurred from 1988 to 1992, which coincides with the upsurge in mammography.[2] Breast cancer incidence rates among women in their sixties rose sharply between 1986 and 1988, and then more slowly, again coinciding with rising mammography rates. Among women in their seventies, breast cancer incidence rates increased sharply between 1987 and 1989, but these rates had been rising steadily since 1981, suggesting that earlier detection through mammography was not the only factor associated with the increase. And despite rapidly rising mammography rates, there is no evidence of any change in breast cancer incidence rates among women in their forties.

While mammography may be an important factor in the increased diagnosis of breast cancer, the crucial question is whether earlier detection will affect breast cancer mortality rates. Because of the relatively long survival time for breast cancer patients, and because earlier detection will improve the prognosis for only some of them, a reduction in mortality may not be evident for many years after implementation of breast screening programs.[27] Moreover, by pushing back the date of diagnosis, earlier detection might appear to lengthen survival, even if the woman dies at the same time that she would have had the tumour been discovered later.

Table 2

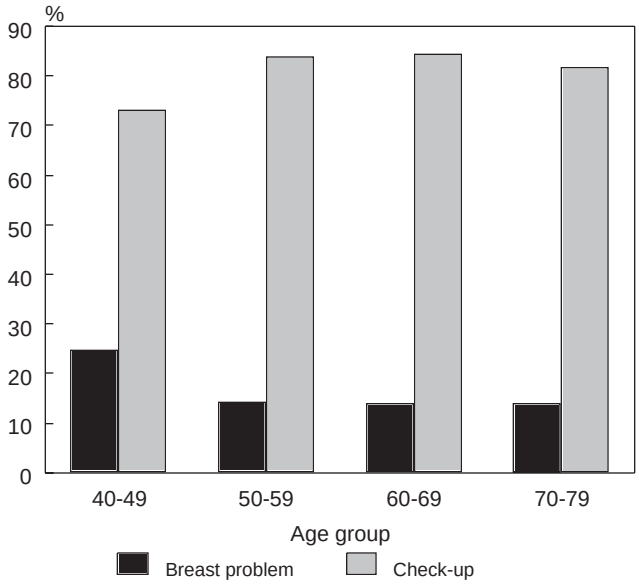
Percent of women who have ever had a mammogram, by age group, Canada and provinces, 1994-95

	Age group					
	Total 40+	40-49	50-59	60-69	70-79	80+
	%					
Canada	**64**	**59**	**74**	**71**	**59**	**40**
Newfoundland	43	48	52	--	--	--
Prince Edward Island	58	50	76	71	--	--
Nova Scotia	49	47	54	57	--	--
New Brunswick	57	57	75	50	38	--
Quebec	67	66	81	67	57	--
Ontario	63	56	71	77	61	40
Manitoba	58	52	67	64	66	--
Saskatchewan	65	52	83	81	57	--
Alberta	65	55	71	83	67	--
British Columbia	69	66	82	70	64	--

Source: *National Population Health Survey, 1994-95*

Chart 2

Reason for last mammogram, by age group, Canada, 1994-95



Source: *National Population Health Survey, 1994-95*

And if the tumours detected through screening have limited malignant potential, no differences in mortality will be observed.[27]

It is not yet possible to conclude definitively that the rapid increase in mammography in the late 1980s has had an impact on breast cancer mortality in Canada. However, declines in the breast cancer mortality rate in the United States since 1990 have been attributed to early detection through mammography combined with treatment advances, particularly for disease that had spread to the regional lymph nodes.[28] Trends are similar in Canada, and in 1993, the Canadian breast cancer mortality rate was at its lowest point since 1950.[2] The mortality rate declined between 1990 and 1994, as a result of a significant downturn in mortality rates at ages 60-69 and continuing declines in women under age 60.[2] Rates at older ages have remained stable since the late 1980s, but this followed an earlier tendency to increase. Further, the lowest breast cancer mortality rates have occurred in the two provinces with the most extensive breast screening programs and among the highest levels of mammography.[2]

Continued research and monitoring of mortality trends is needed to confirm whether mammography alone, or in combination with other factors, is responsible for these age-specific trends and geographic patterns. The value of screening can only be determined by whether breast cancer mortality rates continue to decline in the future, particularly among women in their fifties and sixties.

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References

1. National Cancer Institute of Canada. *Canadian Cancer Statistics 1996*. Toronto: National Cancer Institute of Canada, 1996.
2. Gaudette LA, Silberberger C, Altmayer CA, et al. Trends in breast cancer incidence and mortality. *Health Reports* (Statistics Canada Catalogue 82-003) 1996; 8(2): 29-37.
3. Miller AB. Mammography: Reviewing the evidence. *Canadian Family Physician* 1993; 39: 85-90.
4. Kelsey JL. Breast cancer epidemiology: Summary and future directions. *Epidemiologic Reviews* 1993; 15(1): 256-63.
5. Morrison AS. Screening for cancer of the breast. *Epidemiologic Reviews* 1993; 15(1): 244-55.
6. National Cancer Institute of Canada. *Canadian Cancer Statistics 1993*. Toronto: National Cancer Institute of Canada, 1993.
7. Dodd GD. Thirty years of mammography. *Radiologic Practice* 1989; 10-3.
8. Baines CJ. The Canadian National Breast Screening Study. Why? What next? And so what? *Cancer* 1995; 76(10): 2107-12.
9. Miller AB, Baines CJ, To T, et al. Canadian National Breast Screening Study: 1. Breast cancer detection and death rates among women aged 40-49 years. *Canadian Medical Association Journal* 1992; 147(10): 1459-76.
10. Miller AB, Baines CJ, To T, et al. Canadian National Breast Screening Study: 2. Breast cancer detection and death rates among women aged 50-59 years. *Canadian Medical Association Journal* 1992; 147(10): 1477-88.
11. The Workshop Group. Reducing deaths from breast cancer in Canada. *Canadian Medical Association Journal* 1989; 141: 199-201.
12. Health Canada, Canadian Cancer Society, National Cancer Institute of Canada, Medical Research Council of Canada, Canadian Breast Cancer Foundation. *Report on the National Forum on Breast Cancer*. Ottawa: Minister of Supply and Services Canada, 1994.
13. Perrault DJ, Libstug AR. Organized breast screening in Ontario: Accomplishments and challenges. *Chronic Diseases in Canada* 1994; 15(1 Suppl): S12-S15.
14. Tambay JL, Catlin G. Sample design of the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 29-38.
15. Statistics Canada. *National Population Health Survey 1994-95 Public Use Microdata File* (Catalogue 82F0001XCB) Ottawa: Statistics Canada, 1995.
16. Iron K, Goel V, Williams JI. *A Review of Mammography Utilization in Ontario*. ICES Working Paper No. 41. Toronto: Institute for Clinical and Evaluative Sciences, 1995.
17. King ES, Rimer BK, Trock B, et al. How valid are mammography self-reports? *American Journal of Public Health* 1990; 80(11): 1386-8.
18. Zapka JG, Bigelow C, Hurley T, et al. Mammography use among sociodemographically diverse women: The accuracy of self-report. *American Journal of Public Health* 1996; 86(7): 1016-21.
19. Holleb AI, Fink DJ, Murphy GP. *American Cancer Society Textbook of Clinical Oncology*. Atlanta, Georgia: The American Cancer Society, 1991.
20. Morrison AS, Brisson J, Khalid N. Breast cancer incidence and mortality in the Breast Cancer Detection Demonstration Project. *Journal of the National Cancer Institute* 1988; 80(19): 1540-7.
21. McLelland R. What is breast screening? *Radiologic Practice* 1989; 7-9.
22. O'Connor A. Women's cancer prevention practices. In: Stephens T, Graham DF (editors). *Canada's Health Promotion Survey*. Ottawa: Minister of Supply and Services, 1993.
23. Mercer SL, Goel V. *Factors Associated with Mammography Utilization: Results from the Ontario Health Survey*. ICES Working Paper No. 22. Toronto: Institute for Clinical and Evaluative Sciences, 1994.
24. Bryant H, Mah Z. Breast cancer screening attitudes and behaviors of rural and urban women. *Preventive Medicine* 1992; 21: 405-18.
25. Feuer EJ, Wun LM. How much of the recent rise in breast cancer incidence can be explained by increases in mammography utilization? A dynamic population model approach. *American Journal of Epidemiology* 1992; 136(12): 1423-36.
26. Miller BA, Feuer EJ, Hankey BF. The significance of the rising incidence of breast cancer in the United States. In: DeVita VT, Hellman S, Rosenberg SA (editors). *Important Advances in Oncology*. 1994; 193-207.

27. Newcomb PA, Lantz PM. Recent trends in breast cancer incidence, mortality, and mammography. *Breast Cancer Research and Treatment* 1993; 28(2): 97-106.

28. Chu KC, Tarone RE, Kessler LG, et al. Recent trends in U.S. breast cancer incidence, survival, and mortality rates. *Journal of the National Cancer Institute* 1996; 88(21): 1571-9.

Appendix
Table A
Annual mammograms and mammography rates, by provider, Canada, provinces and Yukon, 1981-1994

	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.†	Ont.‡	Man.	Sask.	Alta.	B.C.	Yukon
						Number of mammograms						
Fee-for-service§												
1981	161,907	213	..	..	..	96,699	45,000	..	..	4,811	15,184	..
1982	177,792	426	..	..	..	103,649	50,400	..	..	5,835	17,482	..
1983	212,639	161	..	..	..	120,396	62,000	..	..	7,271	22,811	..
1984	224,808	735	..	..	..	109,734	74,000	..	..	10,952	29,387	..
1985	249,601	989	..	..	..	93,717	98,000	..	..	18,745	38,150	..
1986	314,499	1,072	..	..	..	101,707	123,000	11,349	1,193	25,680	50,498	..
1987	433,664	1,729	..	..	11,047	129,705	155,699	14,867	6,326	38,878	75,413	..
1988	679,693	4,672	3,579	..	14,546	195,965	261,412	18,729	14,407	56,738	109,645	..
1989	847,002	5,946	4,752	..	23,803	234,055	334,545	24,590	23,519	69,172	126,620	..
1990	1,032,246	7,330	5,255	..	27,950	282,854	412,465	23,178	34,739	84,523	153,952	..
1991	1,219,140	11,835	5,559	..	33,872	337,052	497,518	29,317	39,842	99,751	164,394	..
1992	1,210,300	10,085	6,283	..	38,476	341,639	500,004	30,753	44,524	96,292	142,012	232
1993	1,133,378	18,175	6,776	..	38,588	322,790	458,854	32,178	31,860	85,518	138,451	188
1994	1,179,655	19,174	6,529	..	42,470	343,292	481,330	44,633	28,099	85,614	128,319	195
Breast screening program												
1988	4,475	...	...	...	...	...	...	...	...	...	4,475	...
1989	9,371	...	...	...	...	...	...	...	...	...	9,371	...
1990	30,536	...	...	...	...	...	590	...	6,336	626	22,984	...
1991	94,407	...	...	2,872	...	...	15,391	...	14,313	5,948	55,883	...
1992	160,706	...	...	4,132	...	...	40,307	...	15,746	15,837	83,963	721
1993	198,473	...	...	5,723	...	...	45,456	...	26,063	16,148	104,378	705
1994	231,053	...	...	9,991	...	...	55,566	...	25,546	15,371	123,879	700
Total												
1988	684,168	4,672	3,579	..	14,546	195,965	261,412	18,729	14,407	56,738	114,120	..
1989	856,373	5,946	4,752	..	23,803	234,055	334,545	24,590	23,519	69,172	135,991	..
1990	1,062,782	7,330	5,255	..	27,950	282,854	413,055	23,178	41,075	85,149	176,936	..
1991	1,313,547	11,835	5,559	2,872	33,872	337,052	512,909	29,317	54,155	105,699	220,277	..
1992	1,371,006	10,085	6,283	4,132	38,476	341,639	540,311	30,753	60,270	112,129	225,975	953
1993	1,331,851	18,175	6,776	5,723	38,588	322,790	504,310	32,178	57,923	101,666	242,829	893
1994	1,410,708	19,174	6,529	9,991	42,470	343,292	536,896	44,633	53,645	100,985	252,198	895
						Mammograms as % of women aged 40+						
Fee-for-service§												
1981	4	–	..	..	..	8	3	..	..	1	3	..
1982	4	1	..	..	..	9	3	..	..	2	3	..
1983	5	–	..	..	..	10	4	..	..	2	4	..
1984	5	1	..	..	..	9	4	..	..	3	5	..
1985	5	1	..	..	..	7	5	..	..	5	7	..
1986	6	1	..	..	..	8	7	5	1	7	9	..
1987	9	2	..	..	8	10	8	7	3	10	12	..
1988	13	5	14	..	11	14	13	9	7	14	17	..
1989	16	6	19	..	17	17	17	11	12	17	19	..
1990	19	7	20	..	19	19	20	10	18	20	23	..
1991	22	12	21	..	23	23	23	13	20	23	23	..
1992	21	10	23	..	25	22	23	13	22	21	19	6
1993	19	17	25	..	25	21	20	14	16	18	18	4
1994	19	17	23	..	27	21	21	19	13	17	16	4
Breast screening program												
1988	–	...	...	...	...	...	...	...	...	...	1	...
1989	–	...	...	...	...	...	...	...	...	...	1	...
1990	1	...	...	...	...	...	–	...	3	–	3	...
1991	2	...	...	2	...	...	1	...	7	1	8	...
1992	3	...	...	2	...	...	2	...	8	3	12	18
1993	3	...	...	3	...	...	2	...	13	3	14	16
1994	4	...	...	5	...	...	2	...	12	3	16	16
Total												
1988	13	5	14	..	11	14	13	9	7	14	18	..
1989	16	6	19	..	17	17	17	11	12	17	21	..
1990	19	7	20	..	19	19	20	10	21	20	26	..
1991	23	12	21	2	23	23	24	13	27	24	31	..
1992	24	10	23	2	25	22	25	13	30	25	31	23
1993	22	17	25	3	25	21	22	14	28	21	32	21
1994	23	17	23	5	27	21	23	19	26	20	32	20

Source: *Provincial and territorial departments of health and breast screening programs*
Note: *Rates based on estimated population on July 1 in each year.*
Coverage of the population ranges from 85% in 1981 to 97% by 1988.
† *Quebec data from 1981 to 1985 may include up to 10% duplicate reports.*
‡ *Ontario fee-for-service data estimated for 1981 to 1986.*
§ *Includes small number of men (less than 1% of all mammograms).*

Table B
Annual age-specific mammography rates, by provider, Canada and selected provinces, 1985-1994

Age group and year	Total†						Fee-for-service						Breast screening program					
	Total†	Que.	Ont.	Sask.	Alta.	B.C.	Total†	Que.	Ont.	Sask.	Alta.	B.C.	Total	Que.	Ont.	Sask.	Alta.	B.C.
	%																	
40-49																		
1985	..	7	..	..	5	..	..	7	..	..	5	..	...	...	...	...	...	...
1986	..	7	..	..	7	..	..	7	..	..	7	..	...	...	...	...	...	...
1987	..	9	8	4	10	..	..	9	8	4	10	..	...	...	...	...	...	...
1988	14	13	13	9	14	18	13	13	13	9	14	17	–	...	...	...	...	1
1989	16	15	16	14	16	21	16	15	16	14	16	19	–	...	...	...	...	2
1990	19	18	19	19	18	26	19	18	19	19	18	22	1	...	–	...	–	4
1991	22	21	21	23	20	30	21	21	21	23	20	22	1	...	–	...	–	8
1992	21	20	20	24	18	29	19	20	19	24	18	18	2	...	–	...	–	11
1993	18	17	17	17	14	29	17	17	17	17	14	16	2	...	–	...	–	13
1994	..	17	..	15	14	27	16	17	16	15	13	14	..	...	..	...	–	14
50-59																		
1985	..	6	..	..	4	..	..	6	..	..	4	..	...	...	...	...	...	...
1986	..	7	..	..	6	..	..	7	..	..	6	..	...	...	...	...	...	...
1987	..	10	8	4	9	..	..	10	8	4	9	..	...	...	...	...	...	...
1988	15	15	15	8	14	20	15	15	15	8	14	19	–	...	...	...	...	1
1989	19	19	19	15	18	24	19	19	19	15	18	22	–	...	...	...	...	2
1990	24	23	24	28	22	30	24	23	24	22	22	26	1	...	–	6	–	5
1991	30	27	30	39	29	37	28	27	29	24	26	27	3	...	2	15	3	10
1992	32	28	33	41	32	37	28	28	29	26	25	23	5	...	4	16	7	15
1993	32	28	31	44	32	40	26	28	27	17	24	22	6	...	4	27	8	18
1994	..	30	..	39	29	41	27	30	28	14	23	20	..	...	..	25	6	21
60-69																		
1985	..	4	..	..	3	..	..	4	..	..	3	..	...	...	...	...	...	...
1986	..	5	..	..	4	..	..	5	..	..	4	..	...	...	...	...	...	...
1987	..	7	7	2	7	..	..	7	7	2	7	..	...	...	...	...	...	...
1988	12	11	11	6	11	17	12	11	11	6	11	16	–	...	...	...	...	1
1989	15	13	15	10	13	19	14	13	15	10	13	18	–	...	...	...	...	1
1990	19	16	18	24	18	25	18	16	18	16	17	22	1	...	–	8	–	4
1991	24	20	24	32	24	32	21	20	23	17	21	22	3	...	1	15	3	9
1992	27	21	27	37	29	33	22	21	24	20	21	19	5	...	3	17	8	13
1993	26	21	26	41	26	35	21	21	22	14	20	19	6	...	4	27	6	16
1994	..	23	..	37	27	37	22	23	23	11	19	17	..	...	..	26	8	20
70-79																		
1985	..	3	..	..	1	..	..	3	..	..	1	..	...	...	...	...	...	...
1986	..	3	..	..	2	..	..	3	..	..	2	..	...	...	...	...	...	...
1987	..	5	5	2	4	..	..	5	5	2	4	..	...	...	...	...	...	...
1988	8	8	8	3	6	10	8	8	8	3	6	10	–	...	...	...	...	–
1989	9	8	8	6	7	13	9	8	8	6	7	12	–	...	...	...	...	1
1990	11	10	11	11	10	17	11	10	11	10	10	15	–	...	–	1	–	2
1991	15	12	14	16	13	23	14	12	14	13	12	17	1	...	1	3	–	6
1992	17	13	16	20	14	24	14	13	15	16	13	15	3	...	2	4	1	9
1993	16	13	16	20	13	27	13	13	14	12	12	15	3	...	2	8	1	12
1994	..	13	..	21	13	28	14	13	15	12	12	13	..	...	..	9	2	14

Source: *Provincial departments of health and breast screening programs*
Note: *Rates based on estimated population on July 1 in each year.*
Saskatchewan and Quebec fee-for-service data for ages 70-79 contain ages 80+.
Ontario fee-for-service data for ages 70-79 contain ages 80+ in 1987 and 1988.
Ontario breast screening program data for ages 40-49 contain ages <40.
Ontario breast screening program data for ages 70-79 contain ages 80+.
† *Data cover 87% of Canadian population.*

Health Expectancy by Immigrant Status, 1986 and 1991

*Jiajian Chen, Russell Wilkins and Edward Ng**

Abstract

Analyses based on census data, vital statistics, and data from the Health and Activity Limitation Surveys show that immigrants, especially those from non-European countries, had a longer life expectancy and more years of life free of disability and dependency than did the Canadian-born. But while immigrants were less likely than the Canadian-born to be disabled, they were only slightly less likely to be dependent on others for help with activities of daily living. The reasons for immigrants' longevity and good health are likely related to the "healthy immigrant effect."

Key words: *life expectancy, mortality, disabled, dependency, immigrants*

Since the 1950s, immigrants have made up about 16% of Canada's total population and have accounted for about 26% of the country's population growth.[1] The recent resurgence of some infectious diseases throughout the world and high rates of illness in some immigrant groups have created concerns about immigrant health.[2-4] However, several health status indicators suggest that immigrants to Canada, especially those from non-European countries, are healthier than the Canadian-born population.[5] This relative good health manifests itself not only in longer life expectancy, but also in more years free of disability and dependency (see *Immigrant status*).

Immigrant status

For ease of reference, immigrant status was classified in this article into three broad groups defined by place of birth: Canadian-born, European immigrants, and non-European immigrants. All persons born in Canada were included in the Canadian-born category, regardless of ethnic origin. European birthplaces included the United States, Australia, and New Zealand, as well as Europe. Non-European birthplaces were all other countries. The term "immigrants" refers not only to recent immigrants to Canada, but also to those who immigrated some time ago.

The European/non-European classification was based on several considerations. First, a majority of immigrants to Canada now come from non-European countries; of those who arrived between 1981 and 1991, 75% were from non-European countries.[6,7] Second, immigrants from European countries tend to have cultural, lifestyle, and linguistic characteristics more like those of the Canadian-born population than is the case for non-European immigrants. Since these factors are important determinants of health, there may be differences in the health status of these two broad categories of immigrants.

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Methods

Data sources

Death data for 1985-1987 and 1990-1992 were obtained from the Canadian Vital Statistics Data Base. The percentage of death records lacking information about place of birth was higher in Quebec (9% in 1985-87 and 13% in 1990-92) than in the rest of Canada (less than 1% in 1985-87 and 1% in 1990-92). For these incomplete death records, birthplace was imputed using the regional distribution from death records with a stated place of birth. However, the potential bias on mortality estimates at the national level resulting from the imputation of place of birth for a large number of Quebec death records is likely to be small, as estimated life table values for the total Canadian population by place of birth were almost the same as those generated from non-Quebec regions.

Population data from the 1986 and 1991 Censuses, including both residents of households and institutions, were used in the calculation of mortality rates. The census collects information about the mother tongue of residents of institutions, but not their place of birth. Therefore, the place of birth of institutional residents was imputed based on the distribution of place of birth among the household population by mother tongue. This procedure tended to yield more conservative estimates of the number of immigrants residing in institutions than would have been the case by directly applying the distribution of the household population by place of birth. Even so, the number of immigrants in institutions may still be somewhat overestimated. In particular, recent immigrants (the majority of whom were non-European) were not likely to have entered institutions so shortly after arriving in Canada.

Because the 1986 Census did not count non-permanent residents and the 1991 Census did, for purposes of comparison, non-permanent residents were excluded from the 1991 total population. Exclusion of the non-permanent population tended to decrease the denominators and thus increase the mortality rates and reduce the life expectancy of immigrants in 1991. (Non-permanent residents accounted for about 5% of the non-Canadian-born population.)

Census population estimates used to calculate mortality rates were not adjusted for net undercoverage, because adjustments were not available by place of birth or immigration status. Use of an adjusted census population would have had a greater effect on the estimated mortality and life expectancy of non-European immigrants. This is because the reported net undercoverage rates for persons with English, French, Italian or German as their mother tongues were considerably lower than the rates for those with other mother tongues, i.e., 2.5% or less versus 5.8% or more in 1991.[8] As a result, use of the unadjusted population tended to increase mortality rates and decrease life expectancy slightly for the total population, and especially for non-European immigrants.

The disability and dependency data are from the 1986-87 and 1991 Health and Activity Limitation Surveys (HALS). Because disability and dependency are clearly related to age, all disability and dependency prevalences included both household and institutional residents and were age-standardized by the direct method to the total 1991 adjusted Census population.

HALS did not collect place of birth data for the health-related institutional population. The HALS institutional population by place of birth was estimated using the census distribution of the health-related institutional population by place of birth. The severity of disability and level of dependency among institutional residents were assumed to be the same across all places of birth.

Information on disability, but not dependency, was available for children under age 15 in households. Based on the severity of their disability and their place of birth, dependency among children in households was estimated using the distribution of disability and dependency by place of birth among people aged 15 to 24.

For prevalence estimates, persons aged 65 and over were grouped together. Sample size considerations limited finer age breakdowns of the senior immigrant population. However, for both men and women, the median ages of the household population aged 65 and over were similar across the three different birthplace groups. This suggests that the estimated prevalence of disability and dependency among seniors should not have been affected by differences in the age structure of the population aged 65 and over by place of birth.

To assess the quality of the data and the impact of adjustments for the estimates of life expectancy at birth by place of birth, several alternative life tables for the 1991 population were calculated using alternative assumptions (see *Appendix, Sensitivity analyses*).

Analytical techniques

Life expectancy by place of birth was derived from abridged life tables and calculated using Chiang's method.[9,10] The life table values were calculated from cross-sectional age-specific mortality rates of the Canadian population by place of birth in 1985-87 and 1990-92. These life tables reflect the combined mortality experience of age groups of a synthetic cohort in a specific period, rather than the actual lifetime mortality experienced by the same cohort over time.

To estimate health expectancy by place of birth, the total population was disaggregated by sex, age group, and place of birth. For each subgroup, the estimated number of person-years of life in each health state was calculated by multiplying the prevalence of disability or dependency in that subgroup by their expected total person-years of life. By summing from highest to lowest ages the expected persons-years lived in a given state of health, and then dividing those sums by the number of persons who survived to a specific age, expected years of life in that state of health were obtained for the people surviving to that age.[11-13]

Disability- and dependency-adjusted life expectancy were also calculated.[11,14] These health-adjusted life expectancies are summary indicators of health, which combine mortality and various aspects of morbidity into a single value.[11]

In this article, disability- and dependency-adjusted life expectancy were calculated by adding together the expected years of life spent in each discrete health state multiplied by arbitrary weights for the corresponding state. For disability-adjusted life expectancy, the weights were 1.0 for no disability, and 0.7, 0.6, 0.5, 0.4, and 0.3 for slight, moderate, severe level 1, severe level 2, and severe level 3 disability, respectively. For dependency-adjusted life expectancy, the weights were 1.0 for no disability; 0.8, 0.6, 0.5 and 0.4 for disabled but not dependent, somewhat dependent, moderately dependent, and heavily dependent, respectively.

Conventionally, mortality rates and life expectancy have been the most important indicators of the health consequences of disease. While numerous studies of immigrant health have focused on mortality, few have examined other aspects.[15-19] But increasingly, it has been recognized that the consequences of disease affect not only longevity, but also quality of life, which can be measured by disability and dependency.[20]

Health expectancy, which integrates mortality and disability or dependency into one indicator, is widely regarded as the most comprehensive indicator of health status.[21-24] This article assesses the health expectancy of Canada's immigrants compared with that of the Canadian-born population (see *Methods*).

The definitions of disability and dependency used in this article are those of the World Health Organization in the International Classification of Impairment, Disabilities, and Handicap (ICIDH). According to the ICIDH framework, an impairment is "any loss or abnormality of psychological, physical, or anatomical structure or function."[20] A disability is "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being."[20] However, if an impairment is fully corrected by an assistive device, such as a hearing aid, then an individual is not considered to have a disability (see *Definitions*).

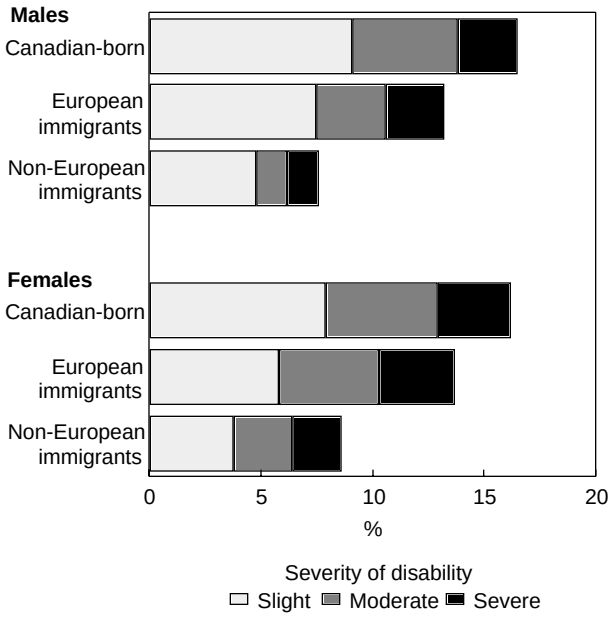
Disability

Immigrants, especially those from non-European countries, were less likely than the Canadian-born population to have a disability (Chart 1). For instance, in 1991, the age-standardized percentage of males from non-European countries who had a disability was 7.6%, compared with 16.5% of Canadian-born males. The figures for females were 8.6% and 16.2%, respectively. The prevalence of severe disability was low, but the overall ranking persisted: 1.4% for non-European males versus 2.7% for the Canadian-born; for females, 2.2% versus 3.3%. For both sexes, changes between 1986 and 1991 in the prevalence of disability by place of birth were small, especially for severe or moderate disability (Appendix, Table A).

Dependency

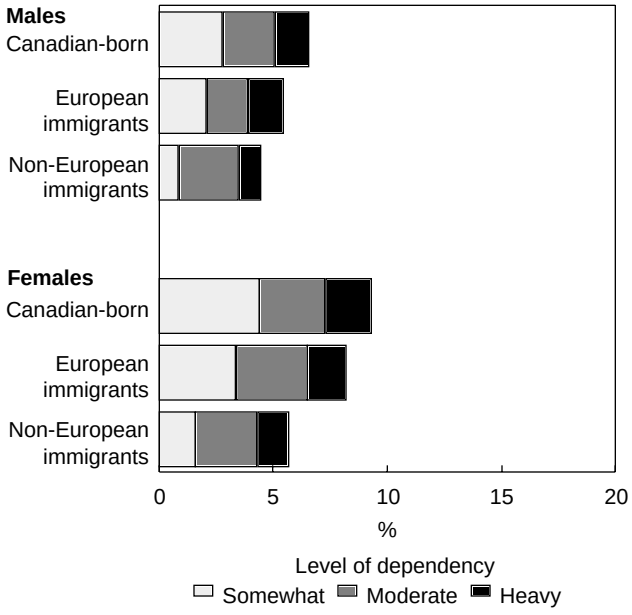
Compared with disability, the age-standardized prevalence of dependency was relatively low (Chart 2). For males in 1991, 4.5% of non-European immigrants and 5.5% of European immigrants were dependent,

Chart 1
Prevalence of disability, by severity, sex and immigrant status, Canada, 1991



Source: *Health and Activity Limitation Survey, 1991*
Note: *Percentages were age-standardized to the 1991 adjusted Census population.*

Chart 2
Prevalence of dependency, by level, sex and immigrant status, Canada, 1991



Source: *Health and Activity Limitation Survey, 1991*
Note: *Percentages were age-standardized to the 1991 adjusted Census population.*

compared with 6.6% of the Canadian-born. For females, the corresponding prevalences were 5.7%, 8.2%, and 9.3%. But while immigrants, particularly those from non-European countries, were less likely than the Canadian-born to be dependent, their levels of heavy or moderate dependency were similar to those of the Canadian-born. There were few changes in the prevalence of dependency by place of birth between 1986 and 1991 (Appendix, Table B).

Definitions

Disability

Among adults aged 15 and over residing in households or long-term health care institutions, severity of disability was derived by summing the scores from a set of screening questions concerning functional abilities that were asked on both the 1986-87 and 1991 Health and Activity Limitations Surveys (HALS). One point was given for partial loss of function, and two points for total loss of function. Severity of disability was classified according to the following categories:[25-27]

No disability: 0
Slight disability: 1-4
Moderate disability: 5-10
Severe disability: 11+
- Level 1: 11-17
- Level 2: 18-25
- Level 3: 26-42

Severity of disability among children younger than age 15 residing in households or health-related institutions was classified as follows:

No disability: 0
Slight disability: 1-2
Moderate disability: 3-4
Severe disability: 5+

At the aggregate level, children in the "severe" category were further assigned to levels 1, 2 or 3 in the same proportions as observed among persons aged 15-24.

Dependency

Dependency was classified into four levels. Only the first applicable category was assigned.

Heavily dependent: Dependent on others for personal care (such as washing, grooming, dressing, or eating), or for moving about within the residence.

Moderately dependent: Dependent on others for going out, or for help with everyday housework (such as dusting, tidying up) or meal preparation.

Somewhat dependent: Dependent or partially dependent on others for heavy housework (such as washing walls, yard work or snow removal) or shopping for groceries, or partially dependent on others for everyday housework or meal preparation.

Not dependent: Neither dependent nor partially dependent on others for the activities mentioned above.

As defined here, dependency was based on whether, for health reasons, the respondents had *received* any help, rather than on *need* for help. For persons residing in health-related institutions, the "not dependent" category was not applicable, since all persons living in such institutions were presumed to be at least somewhat dependent, that is, receiving some help.

The relatively smaller differences by place of birth in the prevalence of dependency compared with disability may be explained by several factors. Although immigrants are less likely to have a disability, those who do may be more likely to be dependent than the Canadian-born with a disability. Second, regardless of place of birth, the prevalence of heavy or moderate dependency was low. Consequently, there was little room for larger differences across the three birthplace groups. Finally, in this article, dependency was based on receipt of help as opposed to need for help. Elderly female immigrants (especially those from non-European countries) were more likely to live with relatives.[28,29] As a result, it is probable that immigrants with disabilities were more likely than the Canadian-born with disabilities to receive help.

Life expectancy

While the overall patterns were similar, in 1991, immigrants had lower mortality rates than did the Canadian-born population (Chart 3). Before age 70, mortality rates for the three birthplace groups generally ran parallel. However, at older ages, rates for the Canadian-born and European immigrants converged.

As a result of these patterns, immigrants, particularly those from non-European countries, had higher age-specific survival probabilities than did the Canadian-born in 1991. For example, 41% of male and 57% of female non-European immigrants could be expected to live to age 85; the corresponding proportions for the Canadian-born were 23% and 45%. The area under each survival curve represents the expected years of life for each group. These curves illustrate that immigrants had longer life expectancies than did the Canadian-born population.

Table 1
Life expectancy, by sex and immigrant status, Canada, 1986 and 1991

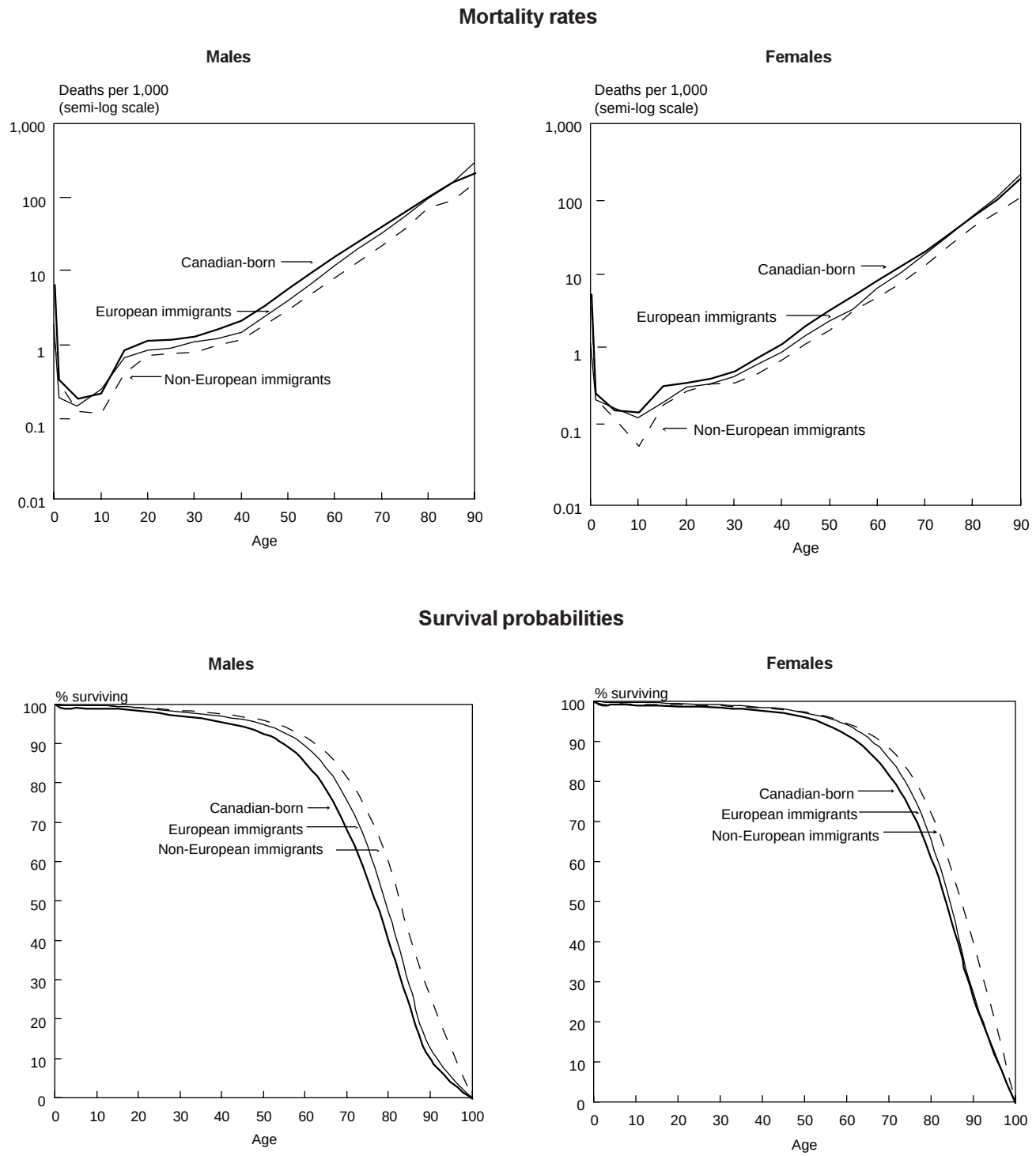
	Males			Females		
	1986	1991	Change	1986	1991	Change
	Years					
At birth						
Canadian-born	72.3	73.6	1.3	79.3	80.4	1.0
European immigrants	75.6	76.3	0.8	81.0	81.8	0.8
Non-European immigrants	77.4	80.3	2.9	83.4	85.7	2.3
At age 65						
Canadian-born	14.6	15.3	0.8	19.0	19.7	0.7
European immigrants	15.7	16.2	0.5	19.7	19.9	0.1
Non-European immigrants	17.3	19.5	2.2	21.5	23.8	2.3

Source: *1986 and 1991 Censuses; Canadian Vital Statistics Data Base, 1985-1987, 1990-1992*

In terms of life expectancy at birth, there were substantial differences between immigrants and the Canadian-born population in both 1986 and 1991 (Table 1). In 1991, the life expectancy of non-European immigrants was longer than that of the Canadian-born: 6.7 more years for males and 5.4 more years for females. Differences between European immigrants and the Canadian-born population were less pronounced: 2.7 years for males and 1.4 years for females.

Chart 3

Mortality rates and survival probabilities, by sex, age and immigrant status, Canada, 1991



Source: *1991 Census; Canadian Vital Statistics Data Base, 1990-1992*

For life expectancy at age 65, differences between non-European immigrants and the Canadian-born population were still substantial in 1991. However, the corresponding differences between the Canadian-born population and European immigrants were relatively minor, particularly for women.

Between 1986 and 1991, expected years of life at birth and at age 65 increased for each of the three groups. The largest increases were for non-European immigrants (more than two years for both males and females), followed by the Canadian-born (about one year for both males and females), and then by European immigrants (6 months for males; 2 months for females). Although European immigrants' life expectancy increased the least between 1986 and 1991, it remained longer than that of the Canadian-born.

Health expectancy

Disability-based health expectancy reveals that not only did immigrants, on average, live longer than the Canadian-born, but also that a greater proportion of their life was without moderate or severe disability (Chart 4). Dependency-based health expectancy yielded the same ranking by birthplace, but the years of life lived independently varied less widely (Chart 5).

Between 1986 and 1991, expected years of life free of severe or moderate disability increased for each of the three groups (Table 2). In this period, there were also gains in disability- and dependency-based life expectancy (Table 3). For both measures, in general, the largest gains were among non-European immigrants, followed by European immigrants, and then by the Canadian-born.

Healthy immigrant effect

The reasons for immigrants' longevity and good health are likely related to the "healthy immigrant effect." People in ill health tend not to migrate to another country.[30-32] In addition, all potential immigrants undergo medical screening.[33] As well, Canada selects immigrants partially on the basis of employability, which suggests reasonably sound health. To some extent this is evident in health differentials by place of birth that were larger for men than for women, perhaps because men were more likely to migrate for reasons of employment. The larger increases in life expectancy for non-European immigrants were attributable to a substantial increase in the flow of new arrivals from non-traditional source countries between 1986 and 1991. Because new immigrants are, on average, healthy, the influx of non-European immigrants intensified the healthy immigrant effect for the entire non-European group (which includes less recent immigrants).[7]

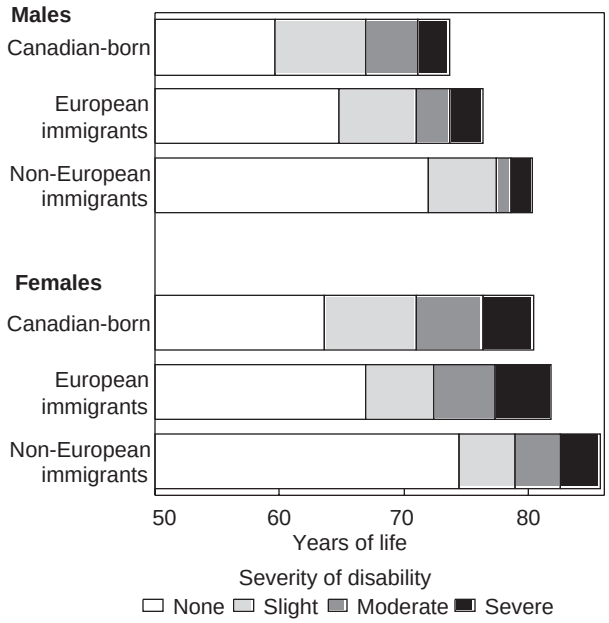
Table 2
Disability-based health expectancy, by severity, sex and immigrant status, Canada, 1991

	Total life expectancy		Disability-based life expectancy		Free of severe disability		Free of severe or moderate disability		Free of any disability	
	1991	Change 1986-91	1991	Change 1986-91	1991	Change 1986-91	1991	Change 1986-91	1991	Change 1986-91
	Years									
Males at birth										
Canadian-born	73.60	1.30	68.38	0.55	71.11	1.16	66.94	0.82	59.61	-0.98
European immigrants	76.30	0.75	71.89	0.76	73.67	0.56	70.96	0.88	64.75	0.82
Non-European immigrants	80.29	2.90	77.18	2.35	78.57	2.82	77.45	3.53	71.89	0.98
Males at age 65										
Canadian-born	15.31	0.76	12.32	0.37	13.37	0.56	10.79	0.22	7.84	-0.27
European immigrants	16.21	0.49	13.94	1.03	14.34	0.71	13.15	1.34	10.76	1.98
Non-European immigrants	19.48	2.23	17.39	1.88	18.18	2.33	18.06	3.29	13.87	0.76
Females at birth										
Canadian-born	80.35	1.03	73.77	0.14	76.27	0.88	70.94	0.30	63.61	-1.62
European immigrants	81.81	0.80	75.72	0.85	77.32	1.58	72.37	1.62	66.87	0.21
Non-European immigrants	85.71	2.28	81.09	2.49	82.51	2.40	78.90	3.51	74.43	2.72
Females at age 65										
Canadian-born	19.65	0.70	15.37	0.13	16.20	0.46	12.91	0.16	9.47	-0.91
European immigrants	19.85	0.14	16.04	0.98	16.26	1.22	13.35	1.67	11.20	1.82
Non-European immigrants	23.79	2.32	20.39	2.78	21.18	2.68	18.50	3.88	15.90	3.49

Source: *Health and Activity Limitation Surveys, 1986-87 and 1991; 1986 and 1991 Censuses; Canadian Vital Statistics Data Base, 1985-1987, 1990-1992*

Chart 4

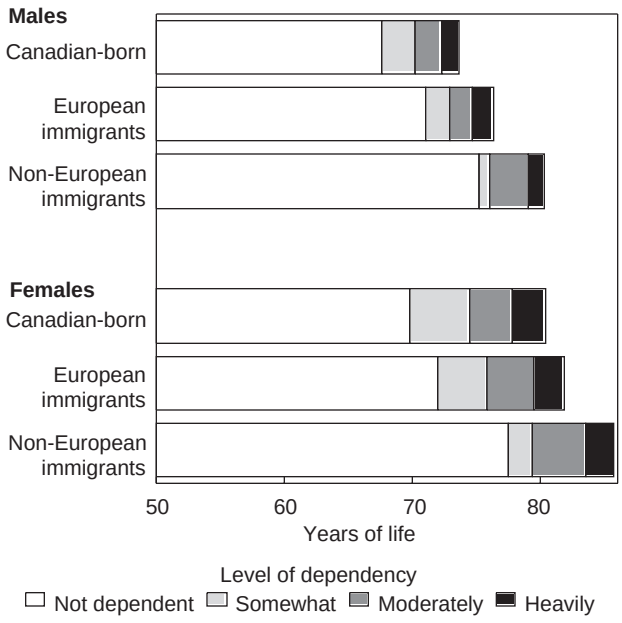
Disability-based health expectancy at birth, by severity, sex and immigrant status, Canada, 1991



Source: *Health and Activity Limitation Survey, 1991; 1991 Census; Canadian Vital Statistics Data Base, 1990-1992*

Chart 5

Dependency-based health expectancy at birth, by level, sex and immigrant status, Canada, 1991



Source: *Health and Activity Limitation Survey, 1991; 1991 Census; Canadian Vital Statistics Data Base, 1990-1992*

Table 3

Dependency-based health expectancy, by level, sex and immigrant status, Canada, 1991

	Total life expectancy		Dependency-based life expectancy		Free of heavy dependence		Free of heavy or moderate dependence		Free of any dependence	
	1991	Change 1986-91	1991	Change 1986-91	1991	Change 1986-91	1991	Change 1986-91	1991	Change 1986-91
	Years									
Males at birth										
Canadian-born	73.60	1.30	69.15	0.79	72.28	1.20	70.23	0.94	67.62	1.23
European immigrants	76.30	0.75	72.45	0.74	74.66	0.63	72.92	0.47	71.02	0.81
Non-European immigrants	80.29	2.90	77.07	2.01	79.06	2.92	76.02	1.09	75.22	1.21
Males at age 65										
Canadian-born	15.31	0.76	12.57	0.41	14.29	0.78	12.68	0.45	10.79	0.15
European immigrants	16.21	0.49	14.06	0.92	14.87	0.53	13.70	0.61	12.74	1.06
Non-European immigrants	19.48	2.23	17.23	1.58	18.40	2.27	16.12	0.87	16.00	1.07
Females at birth										
Canadian-born	80.35	1.03	74.08	0.19	77.82	0.60	74.49	0.15	69.81	0.06
European immigrants	81.81	0.80	76.06	1.07	79.50	1.54	75.81	1.42	72.02	2.04
Non-European immigrants	85.71	2.28	80.97	2.10	83.54	2.33	79.35	1.60	77.47	1.18
Females at age 65										
Canadian-born	19.65	0.70	15.35	0.08	17.29	0.30	14.73	0.00	11.83	-0.31
European immigrants	19.85	0.14	16.08	1.02	17.80	0.96	15.10	1.26	12.95	1.89
Non-European immigrants	23.79	2.32	20.16	2.09	21.81	2.34	18.22	0.97	17.20	0.60

Source: *Health and Activity Limitation Surveys, 1986-87 and 1991; 1986 and 1991 Censuses; Canadian Vital Statistics Data Base, 1985-1987, 1990-1992*

Length of residence in Canada, lifestyle, and culture may also play important roles in health differentials by place of birth. The differences in life expectancy between non-European immigrants and the Canadian-born were sharper than were those for European immigrants. This may be explained partly by duration of residence, since non-European immigrants were more likely to be recent immigrants.[5,7,30,32,34,35] Their relatively better health status may also be partly attributable to culture and lifestyle, which tend to differ more from those of the Canadian-born than is the case for European immigrants. For instance, non-European immigrants were much less likely than the Canadian-born to have ever smoked.[5,36]

Concluding remarks

Immigrants, especially those from non-European countries had a longer life expectancy and more years of life free of disability and dependency than did the Canadian-born population. These indicators show that immigrants, notably those from non-European countries, were healthier than the Canadian-born population.

Since immigrants are a heterogeneous group, studying their health with a simple breakdown by European and non-European origins is only a beginning. A finer breakdown by country of origin would be desirable for future investigations.

Acknowledgements

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References

1. Basavarajappa KG, Beaujot RP, Samuel TJ. *The Impact of Migration on Receiving Countries: Canada*. Kosinski LA (editor). Geneva: International Organization on Migration, 1993.
2. Fanning EA. The impact of global tuberculosis in Canada: We are our brothers' keepers [Editorial]. *Canadian Journal of Infectious Disease* 1995; 6(5): 225-7.
3. St. John R. Preventing the spread of infectious disease in the modern world [Editorial]. *Canadian Journal of Public Health* 1994; 85(6): 370-1.
4. Wilkins K. Tuberculosis, 1994. *Health Reports* (Statistics Canada, Catalogue 82-003) 1996; 8(1): 33-9.
5. Chen J, Ng E, Wilkins R. The health of Canada's immigrants in 1994-95. *Health Reports* (Statistics Canada, Catalogue 82-003) 1996; 7(4): 33-45.
6. Badets J. Canada's immigrants: Recent trends. *Canadian Social Trends* (Statistics Canada, Catalogue 11-008E)1993; 29: 8-11.
7. Badets J, Chui T. *Canada's Changing Immigrant Population*. (Statistics Canada, Catalogue 96-311E) Ottawa: Minister of Supply and Services Canada, 1994.
8. Statistics Canada. *1991 Census Technical Reports: Coverage* (Catalogue 92-341E) Ottawa: Minister of Industry, Science and Technology, 1994.
9. Chiang CL. *The Life Table and Its Applications.* Malabar, Florida: Krieger Publishing, 1984.
10. Ng E, Gentleman JF. The impact of estimation method and population adjustment on Canadian life table estimates. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(3): 15-22.
11. Wilkins R, Adams O. *Healthfulness of Life*. Montreal: Institute for Research on Public Policy, 1983.
12. Wilkins R, Adams O. Health expectancy in Canada, late 1970s: Demographic, regional, and social dimensions. *American Journal of Public Health* 1983; 73(9): 1073-80.
13. Sullivan DF. A single index of mortality and morbidity. *HSMHA Health Reports* 1971; 86(4): 347-54.
14. Wilkins R, Chen J, Ng E. Changes in health expectancy in Canada from 1986 to 1991. In: Mathers C, McCallum J, Robine J-M (editors). *Advances in Health Expectancies: Proceedings of the 7th Meeting of the International Network on Health Expectancy (REVES)*: February 1994; Canberra: Australian Institute of Health and Welfare, 1994: 115-32.
15. Travato F. Mortality differences among Canada's indigenous and foreign-born population, 1951-1971. *Canadian Studies in Population* 1985; 12(1): 49-80.
16. Sharma RC, Michalowski M, Verma R. Mortality differentials among immigrant populations in Canada. *International Migration* 1990; 28(4): 443-50.
17. Michalowski M. Mortality patterns of immigrants: Can they measure the adaptation? Paper presented at the XIIth World Congress of Sociology, Madrid, Spain: July 9-13, 1990.
18. Travato F, Clogg C. General and cause-specific adult mortality among immigrants in Canada, 1971 and 1981. *Canadian Studies in Population* 1992; 19(1): 47-80.
19. Travato F, Verma R, George MV, et al. *Mortality Patterns and Differentials of Visible Minorities in Canada 1980-82 and 1985-87* (Statistics Canada, uncatalogued) Ottawa: 1993.
20. World Health Organization. *International Classification of Impairments, Disabilities and Handicaps (ICIDH): A Manual of Classification Relating to the Consequences of Disease*. Geneva: World Health Organization, 1980.
21. Robine J-M, Blanchet M, Dowd JE (editors). *Health Expectancy. First Workshop of the International Healthy Life Expectancy Network (REVES).* OPCS Studies on Medical and Population Subjects, No. 54. London: HMSO, 1992.
22. Robine J, Mathers CD, Bone MR, et al (editors). *Calculation of Health Expectancies: Harmonization, Consensus Achieved and Future Perspectives.* Proceedings of the 6th REVES International Workshop (Colloques INSERM, vol. 226) London: John Libbey Eurotext, 1993.
23. Mathers C, McCallum J, Robine J (editors). *Advances in Health Expectancies. Proceedings of the 7th Meeting of the International Network on Health Expectancy (REVES).* Canberra: Australian Institute of Health and Welfare, 1994.
24. World Bank. *World Development Report 1993: Investing in Health.* New York: Oxford University Press, 1993.
25. McDowell I. *A Disability Score for the Health and Activity Limitation Survey (for adults in the household population)* (Statistics Canada, uncatalogued) Ottawa: Disability Database Program, July 8, 1988.

26. Brodeur M. *Severity Score for Adult Residents of Institutions* (Statistics Canada, uncatalogued) Ottawa: Health and Activity Limitation Survey, Disability Database Program, October 28, 1988.

27. Brodeur M. *Severity Score for Children*. (Statistics Canada, uncatalogued) Ottawa: Health and Activity Limitation Survey, Disability Database Program, 1988.

28. Boyd M. Immigration and living arrangements: Elderly women in Canada. *International Migration Review* 1991; 25: 4-27.

29. Zukewich Ghalam N. Living with relatives. *Canadian Social Trends* (Statistics Canada, Catalogue 11-008) 1996; 42: 20-4.

30. Marmot MG, Adekstein AM, Bulusu L. Lessons from the study of immigrant mortality. *Lancet* 1984; June 30: 1455-7.

31. Young CM. Changes in the demographic behaviour of migrants in Australia and the transition between generations. *Population Studies* 1990; 4: 68-89.

32. Kliewer E. Epidemiology of disease among migrants. *International Migration* 1992; 30: 141-65.

33. Marrocco FN, Goslett HM (editors). *The Annotated Immigration Act of Canada*. Toronto: Thompson Professional Publishing, 1993: Sections 11(1), 19(1)(a).

34. Stephen EH, Foote K, Hendershot GE, et al. Health of the foreign-born population: United States, 1989-90. *Advance Data from Vital and Health Statistics*. Hyattsville, Maryland: National Center for Health Statistics, 1994; 241: 1-10.

35. Donovan J, d'Espaignet E, Merton C, et al (editors). *Immigrants in Australia: A Health Profile* (Australian Institute of Health and Welfare: Ethnic Health Series, No.1) Canberra: AGPS, 1992.

36. Millar WJ. Place of birth and ethnic status: Factors associated with smoking prevalence among Canadians. *Health Reports* (Statistics Canada, Catalogue 82-003) 1992; 4(1): 7-24.

Appendix

Table A
Prevalence of disability, by severity, sex and immigrant status, Canada, 1986 and 1991

	Any disability			Severe disability			Moderate disability			Slight disability		
	1986	1991	Change	1986	1991	Change	1986	1991	Change	1986	1991	Change
						%						
Males												
Canadian-born	14.2	16.5	2.3	2.7	2.7	0.0	4.5	4.7	0.2	7.0	9.1	2.1
European immigrants	12.7	13.2	0.5	2.4	2.6	0.2	3.3	3.1	-0.2	7.0	7.5	0.5
Non-European immigrants	6.6	7.6	1.0	1.5	1.4	-0.1	1.8	1.4	-0.4	3.3	4.8	1.5
Females												
Canadian-born	13.7	16.2	2.5	3.3	3.3	0.0	4.5	5.0	0.5	5.9	7.9	2.0
European immigrants	12.2	13.7	1.5	4.0	3.4	-0.6	4.4	4.5	0.1	3.8	5.8	2.0
Non-European immigrants	8.8	8.6	-0.2	2.3	2.2	-0.1	3.3	2.6	-0.7	3.2	3.8	0.6

Source: *Health and Activity Limitation Surveys, 1986-87 and 1991*

Note: *Percentages were age-standardized to the 1991 adjusted Census population.*

Table B
Prevalence of dependency, by level, sex and immigrant status, Canada, 1986 and 1991

	Any dependency			Heavily dependent			Moderately dependent			Somewhat dependent		
	1986	1991	Change	1986	1991	Change	1986	1991	Change	1986	1991	Change
						%						
Males												
Canadian-born	6.9	6.6	-0.3	1.4	1.5	0.1	2.1	2.3	0.2	3.4	2.8	-0.6
European immigrants	5.5	5.5	0.0	1.5	1.6	0.1	1.6	1.8	0.2	2.4	2.1	-0.3
Non-European immigrants	3.3	4.5	1.2	1.1	1.0	-0.1	1.2	2.6	1.4	1.0	0.9	-0.1
Females												
Canadian-born	8.7	9.3	0.6	1.7	2.0	0.3	2.5	2.9	0.4	4.5	4.4	-0.1
European immigrants	8.9	8.2	-0.7	2.3	1.7	-0.6	2.7	3.1	0.4	3.9	3.4	-0.5
Non-European immigrants	5.5	5.7	0.2	1.5	1.4	-0.1	2.7	2.7	0.0	1.3	1.6	0.3

Source: *Health and Activity Limitation Surveys, 1986-87 and 1991*

Note: *Percentages were age-standardized to the 1991 adjusted Census population.*

Sensitivity analyses

To assess the quality of the data and the impact of adjustments for the estimates of life expectancy at birth by place of birth, several alternative life tables for the 1991 population by place of birth were calculated using alternative assumptions for data adjustment.

Because a relatively high percentage of death records in Quebec did not report place of birth (13% versus 1% for the rest of Canada), the following alternative estimates were calculated for Quebec and the rest of Canada separately. For the rest of Canada, assuming all death records with unknown place of birth were deaths of immigrants, life expectancy at birth for the Canadian-born would have increased 0.1 of a year for both males and females; that of European immigrants would have decreased by 1.1 years for males and 0.5 of a year for females; and that of non-European immigrants would have decreased by 0.6 of a year for males and 0.7 of a year for females. In other words, for Canada excluding Quebec, the effect would have been to somewhat diminish immigrants' advantage in life expectancy, but the rank order of the three groups would have remained the same.

For Quebec, the assumption that all deaths of unknown place of birth were deaths of immigrants is clearly untenable: immigrants made up less than 9% of the Quebec population but would have accounted for 22% of deaths, and their life expectancy at birth would have decreased by nine or more years, depending on place of birth and sex.

Assuming all immigrants experienced the same infant mortality as did the Canadian-born, life expectancy at birth for European immigrants would have decreased by 0.4 of a year for males and females; and that of non-European immigrants would have decreased by 0.5 of a year for males and 0.2 of a year for females.

Assuming the 1991 institutional population distribution by mother tongue and place of birth was the same as that of the 1986 household population, life expectancy at birth of the Canadian-born would have decreased by less than 0.1 of a year for both sexes; that of European immigrants would have increased by 0.1 of a year for males and 0.2 of a year for females; and that of non-European immigrants would have increased by 0.2 of a year for males and 0.6 of a year for females.

Changing Fertility Patterns, 1974 to 1994

*David Ford and François Nault**

Abstract

From 1974 to 1994, the number of children Canadian women are likely to have during their lifetime decreased. This downturn in fertility meant that the annual number of live births rose only slightly during this period, even though it marked the prime childbearing years for the baby-boom generation.

As they pursued higher education and employment in the paid workforce, women have postponed childbearing. Consequently, the average age of women giving birth has risen. More than a quarter of women over age 30 who have a baby are first-time mothers. And by starting families later in life, women tend to have fewer children. In addition, largely because of the growing number of common-law relationships, over a quarter of all births are to unmarried women.

Using data provided by the provincial and territorial Vital Statistics Registries, this article examines national and provincial/territorial trends in births and fertility from 1974 to 1994.

***Key words**: births, maternal age, birthweight, birth order*

The past twenty years have seen a decline in the number of children a woman is likely to have during her lifetime. The downturn in fertility meant that the annual number of births rose only slightly during this period, even though it marked the prime childbearing years for the baby-boom generation. However, the overall decline in fertility is mostly attributable to trends among younger women. By contrast, fertility rates of women in their thirties have risen almost steadily. Today, more than a quarter of women aged 30 and over who give birth are first-time mothers. As well, unmarried women now account for one in four births, compared with only about one in seventeen in 1974.

These fertility patterns reflect socioeconomic changes during the same period. Growing numbers of women are postponing childbearing while they obtain higher education and maintain a job in the paid workforce.[1] The rise of common-law relationships as an alternative to marriage has resulted in more children being born to couples who are not legally married.[2]

This article, which is based on **Births and Deaths, 1994** (Catalogue 84-210), presents national and provincial/territorial data on births and fertility from 1974 to 1994 by the age and marital status of mothers.[3] Data on the timing of childbearing, on birthweight, and on multiple births are also shown (see *Methods* and *Definitions*).

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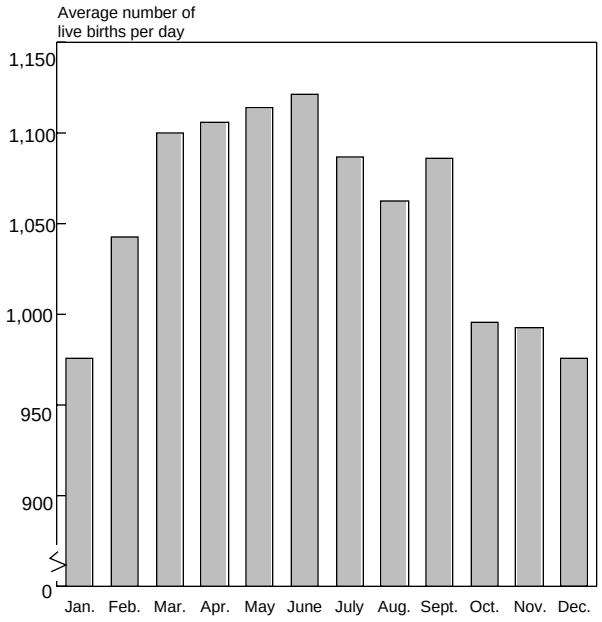
Chart 1

Average number of live births per day, by month, Canada, 1994



Source: *Catalogue 84-210*

Monthly patterns

Each day in 1994, on average, more than 1,000 babies were born in Canada. There were, however, noticeable seasonal fluctuations in the timing of the 385,112 births that occurred that year. The average daily number was highest in June, peaking at 1,122 (Chart 1). As well, there is a slight upturn in births in September, a phenomenon also observed in the United States and Europe. On the other hand, the daily average for both January and December was 976.

Births declining

1994 marked the fourth consecutive year in which the number of births declined. The 1994 total of 385,112 was down slightly from 388,394 in 1993, and was a sharp drop from the most recent high of 405,486 in 1990 (Chart 2). Between 1993 and 1994, the number of births also fell in most provinces and territories, except for British Columbia and the Northwest Territories, which experienced small increases (Appendix, Table A).

Methods

Data source

The data are from the Canadian Vital Statistics Data Base compiled from information provided to Statistics Canada by the Vital Statistics Registries in each province and territory. Provincial and territorial Vital Statistics Acts or equivalent legislation make the registration of births compulsory within their jurisdictions. The Canadian System of Vital Statistics operates under an agreement between the government of Canada and the provincial and territorial governments, by which all registrars provide a specified set of data elements.

The form for registering a birth is completed by the child's parents. The following variables are among those collected: date and place of birth; sex and weight of newborn; age, marital status and birthplace of both parents; mother's place of residence; type of birth (single or multiple); birth order; and gestation.

While the vital statistics registration system covers all births occurring in Canada, this article excludes non-Canadian residents. Births to Canadian residents that occur in the United States, but not those occurring in other countries, are included.

Response rates vary with the item, the reporting province or territory, and the year. In 1994, the response rate was virtually 100% for all the items used in this article except mother's marital status. Response rates of 86% in Ontario, 97% in Saskatchewan, 90% in British Columbia, and 99% in the Yukon yielded an overall response rate for mother's marital status of 93%. Unless otherwise indicated, calculations involving marital status exclude women whose marital status was not stated.

Population estimates adjusted for net census undercoverage and for non-permanent residents, prepared by the Demography Division of Statistics Canada, are used to calculate all rates. The reference date for annual estimates is July 1.

Limitations

Because of legal reporting requirements, the registration of births is considered to be complete. However, a small number of records received after the annual cut-off date are excluded. Births of non-permanent residents in Canada may be excluded if the declared usual place of residence of the mother is not Canada.

In 1991, an agreement with Newfoundland allowed Statistics Canada to use data from the Physician Notification of Births file, obtained from the Newfoundland Department of Health, which are more complete than data from the provincial registry. Before 1991, the registry provided only counts of births, which usually had to be adjusted for under-enumeration. Therefore, the historical data, except total number of births, exclude Newfoundland births.

The total fertility rate (the number of children a woman would have in her lifetime based on age-specific fertility rates that year) was 1.66 births per woman in 1994, the same as in 1993. The rate had fallen from 1.83 births per woman in 1974 to a low of 1.58 in 1987. A short-lived upturn at the end of the eighties brought the rate to 1.71 in 1990, but it has generally fallen since then.

In 1994, Canada's highest fertility rate was 2.74 births per woman in the Northwest Territories. Provincial rates were lower and varied substantially from 1.32 births per woman in Newfoundland to 1.95 and 1.96 in Manitoba and Saskatchewan. However, since 1974, fertility rates have declined in most provinces (Appendix, Table B).

Teenage fertility

The teenage fertility rate was 25.1 births per 1,000 in 1994.[a] This was a slight rise from the previous year, but a substantial drop from 34.8 per 1,000 in 1974. While the general trend has been downward, the past two decades have seen considerable fluctuations in teenage fertility rates, which fell as low as 22.8 per 1,000 in 1987.

[a] *The teenage fertility rate is calculated as births per 1,000 women aged 15-19, although births to women under age 15 are included in the numerator.*

Definitions

Live birth: Complete expulsion or extraction from its mother of a product of conception, regardless of the duration of pregnancy, which breathes or shows other evidence of life.

Stillbirth: Product of conception of at least 500 grams, or at least 20 weeks' gestation, that has issued from its mother, but did not after birth breathe or show other signs of life.

Multiple birth: Birth in which more than one infant is born, including live births and stillbirths.

Birthweight : First weight of the fetus or newborn obtained after birth, expressed in grams. *Low birthweight* is less than 2,500 grams.

Marital status: Legal conjugal status at the time of the birth. Common-law is not considered a legal conjugal status.

Single: A person who has never been married, or whose marriage has been annulled and who has not remarried.

Married: A person who is legally married and who is not separated.

Separated: A person who is legally married but does not live with his or her spouse because the couple no longer want to live together, but have not obtained a legal divorce.

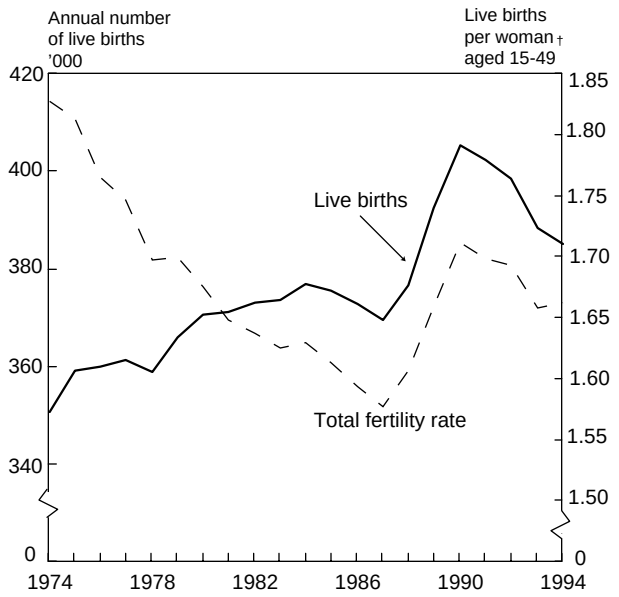
Divorced: A person who has obtained a legal divorce and who has not remarried.

Widowed: A person whose spouse has died and who has not remarried.

Total fertility rate: Number of children a woman can expect to have in her lifetime, based on the age-specific fertility rates of a given year.

Age-specific fertility rate: Number of live births per 1,000 women in a specific age interval, usually five-year age groups (15-19, ..., 45-49). The *age-specific marital fertility rate* is the number of live births per 1,000 married women in a specific age interval.

Chart 2
Live births and total fertility rate, Canada, 1974-1994



Source: *Catalogue 84-210*
Note: *Data for 1974 to 1990 exclude Newfoundland births.*
† *Numerator includes births to women under age 15 and over age 49.*

International comparisons[4]

Canada's 1994 fertility rate was well above those of several countries in western Europe (Italy, Spain, Greece), but much lower than rates in Mexico (2.90) and the United States and New Zealand (both 2.04).

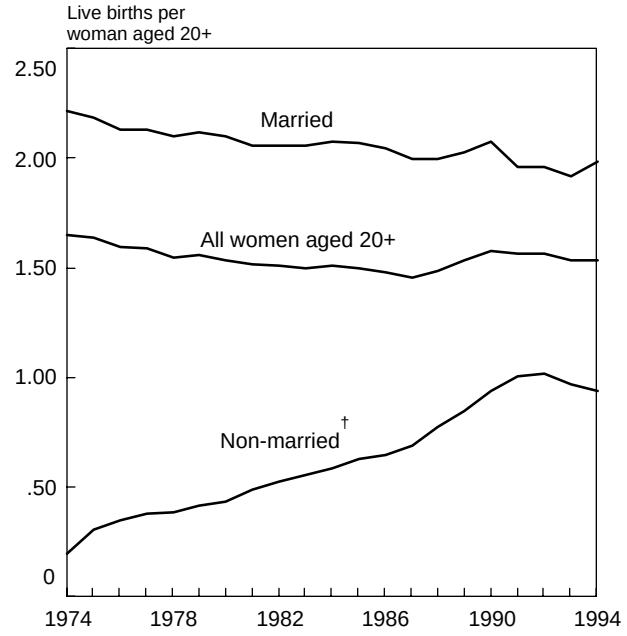
Total fertility rate, selected countries, 1994

Country	Live births per woman
Mexico	2.90
United States	2.04
New Zealand	2.04
Sweden	1.89
Norway	1.87
Ireland	1.86
Finland	1.85
Denmark	1.81
United Kingdom	1.74
France	1.66
Canada	**1.66**
Netherlands	1.56
Belgium	1.55
Japan	1.50
Switzerland	1.49
Greece	1.38
Spain	1.22
Italy	1.19

Source: *Catalogue 84-210 and Catalogue 91-209E*

Chart 3

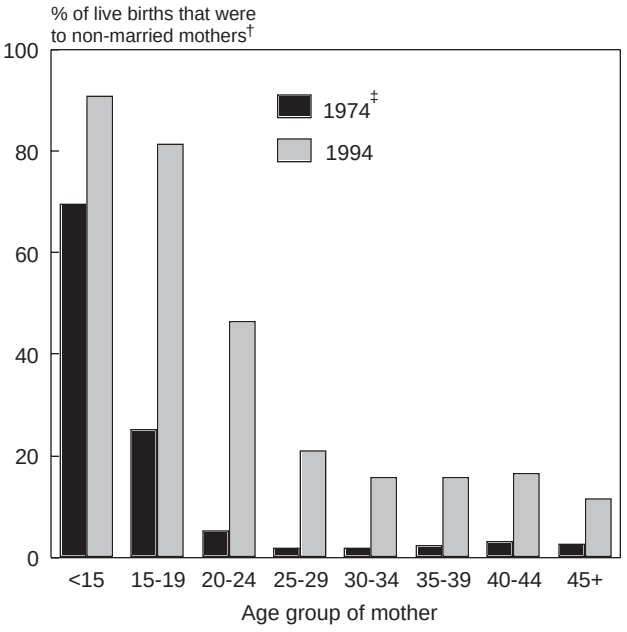
Total fertility rate, by marital status, women aged 20 and over, Canada, 1974-1994



Source: *Canadian Vital Statistics Data Base*
Note: *Data for 1974 to 1990 exclude Newfoundland births. Excludes mothers whose marital status was not stated.*
† *Single, divorced or widowed*

Chart 4

Live births to non-married mothers, by age group of mother, Canada, 1974 and 1994



Source: *Catalogue 84-210*
Note: *Excludes mothers whose marital status was not stated.*
† *Single, divorced or widowed*
‡ *Excludes Newfoundland births.*

Most teenagers who gave birth in 1994 were not married. In fact, of the births to women under age 20 that year, just 12% were to married women. By contrast, two decades earlier, most teen mothers (71%) were married by the time they had their babies.

Non-marital fertility

The increase in non-marital childbearing was not confined to teenagers. The fertility rate among non-married women (single, divorced, widowed) aged 20 and over rose between 1974 and 1994 from 0.2 to about 0.9 births per woman. On the other hand, the fertility rate of married women (including separated) fell from 2.2 to 2.0 births per woman between 1974 and 1982, and has since hovered around that level (Chart 3).[b]

Consequently, the share of births to non-married women has risen. By 1994, 30% of births were to non-married women, compared with, just 6% in 1974.[c]

At older ages, most mothers are married. Even so, non-marital childbearing also increased among older women. For example, in 1974, just 2% of women aged 30-34 who had a baby were not married; by 1994, the percentage had jumped to 16% (Chart 4).

Non-marital childbearing accounted for the majority (62%) of births in the Northwest Territories in 1994. The figure was also high in the Yukon (43%). Among the provinces, the percentage of births to non-married women was highest in Quebec (48%) .

Older mothers

During the last 20 years, there has been a growing tendency for women to delay childbearing. In 1974, the fertility rate was highest at age 25; by 1994, the peak occurred at age 28 (Chart 5). The mean age at childbearing also increased from 26.0 to 28.7 years.

Reflecting these older ages at childbearing, fertility rates declined among women in their teens and twenties, but rose among women in their thirties. By 1994, the fertility rate at ages 30-34 was 86.0 births per 1,000 women, up from 65.3 in 1974. At ages 35-39, the 1994 rate was 30.4 births per 1,000, compared with 22.7 in 1974 (Table 1).

[b] *The fertility rate of married women is the number of births a married woman can expect to have should she remain married from ages 20 through 45.*
[c] *In 1994, the mother's marital status was not reported for more than 10% of births in British Columbia, Ontario and Newfoundland. Consequently, for Canada overall, the percentage of births to non-married women could be between 28% and 35%.*

As a result, 40% of all births that occurred in 1994 were to women in their thirties, a substantial increase from 19% two decades earlier. At the same time, the percentage of births to women under age 20 fell from 12% to 6%. And though women in their twenties still accounted for most births, their share decreased from 69% to 53%.

More first births among older mothers

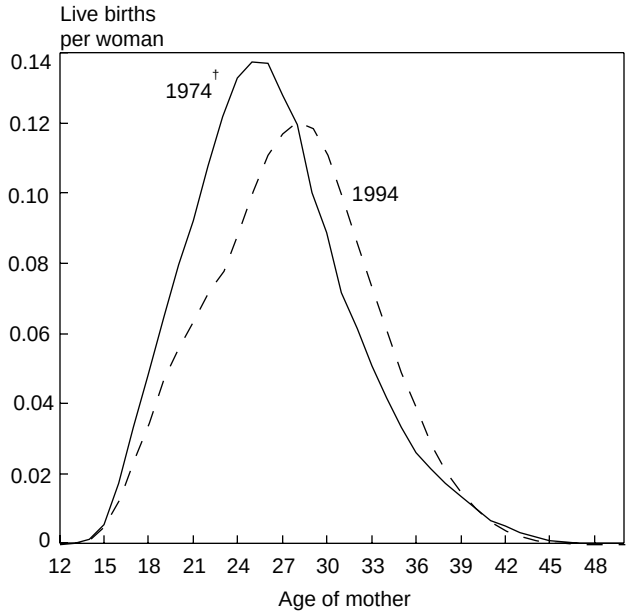
Understandably, the younger the mother, the more likely is the child to be her first birth. In 1994, 82% of births to women aged 15-19 were first births, little changed from 1974. But the growing tendency to delay childbearing meant that from 1974 to 1994, the percentage of first births increased among older women (see *Cohort fertility*). For mothers aged 35-39, the percentage of first births in 1994 was 25%, a sharp rise from 13% in 1974. The figures for women in their forties are similar. By 1994, about 25% of births to mothers in this age range were first births, compared with around 10% in 1974 (Chart 6).

Table 1
Age-specific fertility rates, Canada, 1974-1994

	Total fertility rate	15-19†	20-24	25-29	30-34	35-39	40-44	45-49‡
	Live births per 1,000 women							
1974	1,828.2	34.8	108.8	128.3	65.3	22.7	5.4	0.4
1975	1,813.9	34.8	108.4	128.8	64.2	21.4	4.8	0.4
1976	1,765.2	33.0	104.5	126.4	63.8	20.9	4.3	0.3
1977	1,746.4	31.5	102.9	125.5	65.4	20.2	3.6	0.3
1978	1,697.9	29.3	98.9	123.3	65.5	18.8	3.5	0.3
1979	1,699.9	27.4	97.5	125.4	67.1	19.1	3.3	0.2
1980	1,675.7	27.0	95.2	124.1	66.6	19.0	3.0	0.2
1981	1,648.2	25.9	91.4	123.2	66.7	19.1	3.2	0.2
1982	1,637.1	26.1	90.5	120.4	67.3	19.9	3.1	0.2
1983	1,625.2	24.6	88.1	119.9	69.1	20.2	3.0	0.2
1984	1,629.5	24.0	84.9	121.1	71.5	21.2	2.9	0.1
1985	1,613.1	23.3	81.5	120.7	72.4	21.6	3.0	0.1
1986	1,594.3	23.0	78.7	119.0	72.5	22.3	3.1	0.1
1987	1,577.8	22.8	76.1	116.7	73.2	23.2	3.3	0.2
1988	1,607.1	23.0	76.6	117.8	75.5	24.7	3.6	0.2
1989	1,659.5	24.6	78.5	119.4	79.6	26.0	3.7	0.1
1990	1,712.0	25.5	79.2	122.6	83.5	27.7	3.8	0.1
1991	1,698.8	26.0	77.5	120.3	83.6	28.3	3.9	0.2
1992	1,693.0	25.7	75.0	119.4	85.3	28.9	4.2	0.1
1993	1,658.5	25.0	73.0	114.7	84.9	29.5	4.4	0.2
1994	1,662.5	25.1	72.2	114.0	86.0	30.4	4.7	0.1

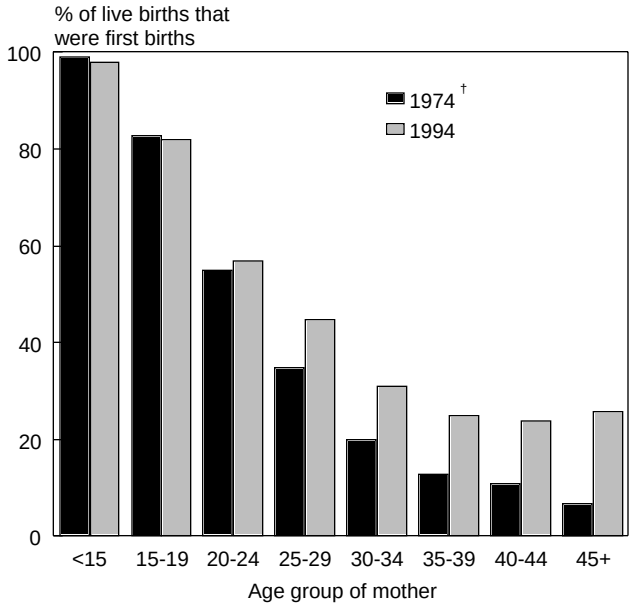
Source: *Catalogue 84-210*
Note: *Data for 1974 to 1990 exclude Newfoundland births.*
† *Live births to women less than age 20 per 1,000 women aged 15-19.*
‡ *Live births to women aged 45 and over per 1,000 women aged 45-49.*

Chart 5
Age-specific fertility rates, Canada, 1974 and 1994



Source: *Canadian Vital Statistics Data Base*
† *Excludes Newfoundland births.*

Chart 6
First births, by age of mother, Canada, 1974 and 1994



Source: *Catalogue 84-210*
† *Excludes Newfoundland births.*

Increase in low birthweight

The proportion of low birthweight infants (less than 2,500 grams) was 6.0% in 1994, up from 5.8% in 1993 and 5.4% in 1990. While the 1994 figure was an overall decrease from 6.9% in 1974, the long-term decline seems to have reversed (Chart 7).

This recent increase in the low birthweight rate may be related to the rising proportion of births to older mothers. In 1994, 7.0% of births to mothers aged 35-39 were low birthweight, and for mothers aged 40-44, the percentage was 7.8%. The increase may also be an effect of improvements in technology and pre-natal care; pregnancies that might have ended in a stillbirth several years ago may now result in a live birth of a very small infant.[d]

The Northwest Territories had the highest percentage of low birthweight infants in 1994 (6.8%). Provincial rates varied from 5.1% in British Columbia to 6.6% in Ontario. Over the past 20 years, the largest decrease in the percentage of low birthweight infants was in Quebec.

[d] *The low birthweight rate for infants born to women younger than age 20 was 7.1% in 1994, but since teenagers account for a declining share of births, they did not cause the upturn in the rate since 1990.*

Cohort fertility

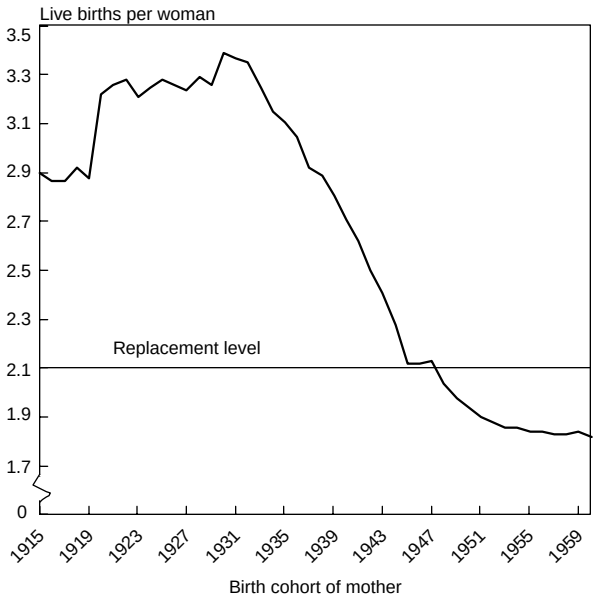
In contrast to period fertility (a snapshot of fertility patterns based on a single year), cohort fertility traces women born in a specific year as they pass through their reproductive ages. Completed fertility, therefore, is the average number of live births that women born in a particular year actually experienced.

Because women born after 1945 had not reached age 49 by 1994, their reproductive period was not over. Their completed fertility was estimated by adding age-specific fertility rates projected based on past trends, to known fertility rates.

Longitudinal analysis of women born since 1915 shows that the decline in fertility over the past 20 years is a continuation of a much longer-term trend. Women born in 1930 had the highest completed fertility—3.39 children per woman. Fertility declined among women born every year thereafter. In fact, women born in 1947 were the last whose completed fertility was at replacement level (2.1 children per woman). Their completed fertility was 2.13 children per woman.

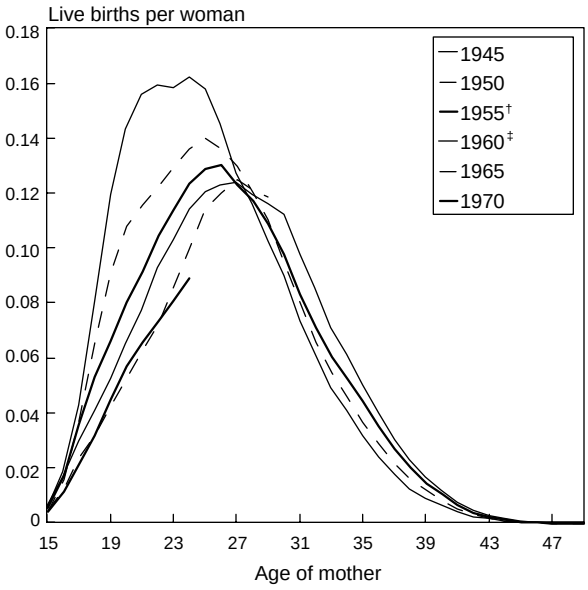
There has also been a tendency for successive postwar generations of women to delay childbearing. Fertility declined sharply among women in their teens and early twenties. Comparatively higher fertility rates at older ages failed to make up the "deficit" accumulated during these prime childbearing years. However, the women born in 1970 may represent a break with the general trend. They are the first cohort whose fertility rate in their late teens and early twenties surpassed that of the cohort born five years earlier; nonetheless, by age 23, their rate had dropped below the corresponding figure for the 1965 cohort.

Completed fertility, by birth cohort of mother, Canada



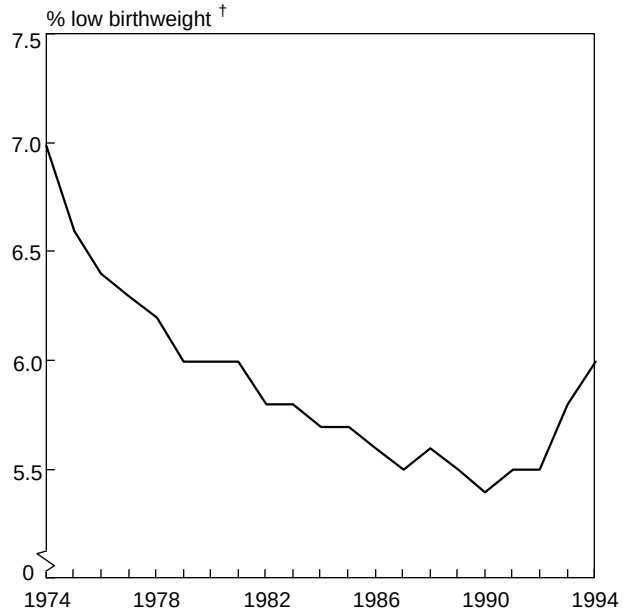
Source: *Canadian Vital Statistics Data Base*
Note: *Data for women born after 1945 are extrapolated. Excludes Newfoundland births before 1991.*

Age-specific fertility rates, selected birth cohorts of mothers, Canada



Source: *Canadian Vital Statistics Data Base*
Note: *Excludes Newfoundland births before 1991.*
† *Extrapolated after age 39.*
‡ *Extrapolated after age 34.*

Chart 7
Live births of low weight, Canada, 1974-1994



Source: *Catalogue 84-210*
Note: *Data for 1974 to 1990 exclude Newfoundland births.*
† Less than 2,500 grams

Low birthweight notwithstanding, newborns are getting heavier overall. The median birthweight in 1994 was 3,401 grams, virtually the same as the year before (3,410 grams), but a considerable gain from 3,316 grams in 1974.

Multiples risky

Multiple births are relatively rare, accounting for only a small share of annual births. They are also much more risky than single births. Out of 4,217 sets of twins born in 1994, in 2.6% of cases, one or both babies were stillborn. And for the 117 sets of triplets, the percentage in which at least one baby was stillborn was 3.4%. By contrast, only 0.5% of single births were stillborn.

References

1. Picot G, Myles J. *Social Transfers, Changing Family Structure, and Low Income among Children* (Analytical Studies Branch, Research Paper Series, No. 82) Ottawa: Statistics Canada, 1995.

2. Nault F. Twenty years of marriages. *Health Reports* (Statistics Canada, Catalogue 82-003) 1996: 8(2): 39-47.

3. Statistics Canada. *Births and Deaths, 1994* (Catalogue 84-210) Ottawa: Minister of Industry, 1996.

4. Dumas J, Bélanger A. *Report on the Demographic Situation in Canada 1995. Current Demographic Analysis* (Statistics Canada, Catalogue 91-209E) Ottawa: Minister of Industry, 1996.

Appendix

Table A

Live births, Canada, provinces and territories, 1974-1994

	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T.
1974	350,650 †	11,504 †	1,939	12,941	11,444	89,364	124,229	17,311	15,118	29,813	35,450	495	1,042
1975	359,323 †	11,213 †	1,928	13,123	11,789	93,597	125,775	17,145	15,265	31,624	36,281	408	1,175
1976	359,987 †	11,130 †	1,941	12,821	11,811	96,342	122,700	16,731	15,969	33,063	35,848	448	1,183
1977	361,400 †	11,110 †	1,969	12,374	11,515	95,690	122,757	16,716	16,547	34,406	36,691	433	1,192
1978	358,852 †	10,480 †	1,985	12,548	10,790	94,860	120,964	16,397	16,550	35,396	37,231	447	1,204
1979	366,064 †	10,170 †	1,934	12,406	10,848	98,646	121,655	16,242	16,944	37,003	38,432	501	1,283
1980	370,709 †	10,332 †	1,958	12,369	10,636	97,421	123,316	15,989	17,057	39,749	40,104	476	1,302
1981	371,346 †	10,130 †	1,897	12,079	10,503	95,322	122,183	16,073	17,209	42,638	41,474	536	1,302
1982	373,082	9,173	1,924	12,325	10,489	90,800	124,856	16,123	17,722	45,036	42,747	525	1,362
1983	373,689	8,929	1,907	12,401	10,518	88,154	126,826	16,602	17,847	45,555	42,919	540	1,491
1984	377,031	8,560	1,954	12,378	10,360	87,839	131,296	16,651	18,014	44,105	43,911	519	1,444
1985	375,727 †	8,500 †	2,008	12,450	10,121	86,340	132,208	17,097	18,162	43,813	43,127	464	1,437
1986	372,913 †	8,100 †	1,928	12,358	9,788	84,634	133,882	17,009	17,513	43,744	41,967	483	1,507
1987	369,742 †	7,769 †	1,955	12,110	9,588	83,791	134,617	16,953	17,034	42,110	41,814	478	1,523
1988	376,795 †	7,487 †	1,977	12,182	9,617	86,612	138,066	17,030	16,763	42,055	42,930	521	1,555
1989	392,661 †	7,762 †	1,937	12,533	9,667	92,373	145,338	17,321	16,651	43,351	43,769	480	1,479
1990	405,486 †	7,604 †	2,014	12,870	9,824	98,048	150,923	17,352	16,090	43,004	45,617	556	1,584
1991	402,528	7,166	1,885	12,016	9,497	97,310	151,478	17,282	15,304	42,776	45,612	568	1,634
1992	398,642	6,918	1,850	11,874	9,389	96,146	150,593	16,590	15,004	42,039	46,156	529	1,554
1993	388,394	6,421	1,754	11,568	9,049	92,391	147,848	16,709	14,269	40,292	46,026	508	1,559
1994	385,112	6,339	1,716	11,099	8,978	90,578	147,068	16,480	14,038	39,796	46,998	442	1,580

Source: *Catalogue 84-210*
† *Figures adjusted because of undercounts.*

Table B

Total fertility rate, Canada, provinces and territories, 1974-1994

	Canada†	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T
						Births per 1,000 women aged 15-49 ‡							
1974	1,828.2	..	2,274.6	1,992.7	2,139.5	1,606.5	1,840.2	2,163.4	2,374.9	2,022.2	1,758.2	2,446.8	2,957.0
1975	1,813.9	..	2,150.8	1,957.8	2,082.8	1,659.0	1,800.5	2,077.4	2,248.9	2,014.1	1,716.6	1,901.4	3,108.4
1976	1,765.2	..	2,122.9	1,855.1	1,874.1	1,680.3	1,713.4	1,980.4	2,249.4	1,984.2	1,646.1	1,949.3	3,012.7
1977	1,746.4	..	2,092.4	1,757.6	1,914.3	1,678.2	1,682.2	1,942.7	2,243.8	1,935.3	1,647.5	1,841.0	2,975.1
1978	1,697.9	..	2,040.1	1,750.8	1,760.7	1,630.9	1,629.1	1,886.1	2,175.2	1,881.8	1,629.7	1,810.2	2,917.3
1979	1,699.9	..	1,943.6	1,701.6	1,748.5	1,670.4	1,615.9	1,862.5	2,181.0	1,852.7	1,632.5	1,947.9	3,042.3
1980	1,675.7	..	1,938.3	1,669.3	1,687.2	1,616.2	1,606.0	1,823.5	2,131.0	1,856.5	1,633.8	1,788.0	3,030.4
1981	1,648.2	..	1,870.1	1,617.2	1,671.0	1,568.5	1,573.8	1,822.9	2,113.9	1,864.4	1,626.4	2,055.0	2,848.3
1982	1,637.1	..	1,894.3	1,638.4	1,661.6	1,482.8	1,586.5	1,807.6	2,137.5	1,890.9	1,654.9	1,965.4	2,818.8
1983	1,625.2	..	1,836.3	1,628.9	1,649.3	1,435.1	1,586.9	1,830.1	2,101.1	1,899.3	1,655.0	2,156.4	3,001.0
1984	1,629.5	..	1,835.3	1,606.3	1,608.9	1,427.4	1,616.3	1,818.2	2,084.9	1,864.1	1,678.5	2,071.3	2,811.2
1985	1,613.1	..	1,865.0	1,599.3	1,572.3	1,400.1	1,602.4	1,850.6	2,083.2	1,860.4	1,648.7	1,833.0	2,670.1
1986	1,594.3	..	1,784.4	1,581.2	1,528.4	1,375.2	1,597.0	1,829.1	2,019.2	1,853.1	1,608.6	1,923.6	2,817.6
1987	1,577.8	..	1,822.0	1,553.1	1,507.6	1,366.4	1,577.7	1,830.7	1,984.0	1,820.6	1,605.9	1,882.4	2,830.3
1988	1,607.1	..	1,853.5	1,571.9	1,526.0	1,427.7	1,590.3	1,853.2	1,994.3	1,842.6	1,638.8	1,987.5	2,906.2
1989	1,659.5	..	1,830.2	1,621.9	1,549.0	1,527.7	1,626.8	1,919.0	2,051.1	1,904.0	1,646.7	1,859.7	2,713.4
1990	1,712.0	..	1,933.1	1,678.9	1,583.9	1,637.7	1,668.6	1,948.9	2,070.1	1,887.0	1,686.3	2,158.4	2,801.5
1991	1,698.8	1,442.1	1,853.8	1,583.6	1,540.6	1,649.8	1,657.6	1,970.7	2,031.4	1,887.2	1,668.9	2,139.4	2,864.4
1992	1,693.0	1,397.0	1,819.5	1,582.0	1,535.0	1,650.5	1,667.0	1,915.5	2,028.5	1,857.0	1,650.5	1,932.0	2,697.0
1993	1,658.5	1,309.5	1,724.5	1,560.0	1,500.0	1,610.5	1,641.5	1,948.5	1,962.0	1,794.0	1,614.0	1,905.5	2,667.5
1994	1,662.5	1,319.5	1,682.5	1,527.5	1,513.0	1,612.5	1,647.0	1,947.0	1,963.0	1,802.0	1,625.5	1,727.5	2,737.5

Source: *Catalogue 84-210*
† *Data for 1974 to 1990 exclude Newfoundland.*
‡ *Numerator includes births to women under age 15 and over age 49.*

Data Releases

Marriages and divorces, 1995

In 1995, for the second year in a row, the number of marriages rose, while the number of divorces fell. A total of 160,256 couples were married in 1995, up a marginal 0.2% from 1994. The number of divorces declined 1.6% to 77,636.

Despite the slight increase in numbers, the 1995 marriage rate was 5.4 marriages per 1,000 population, down from 5.5 in 1994 and from 7.0 in 1988. Canada's marriage rate has not increased since 1988.

The divorce rate per 1,000 population fell to 2.6 in 1995, down from 2.7 in 1994 and 3.0 in 1988.

Canada's 1995 marriage rate was higher than that of France (4.4), for example, but much lower than that of the United States (8.9). The 1995 divorce rate was lower than in the United States (4.0), but well above that in Japan (1.6).

Couples continue to delay marriage until later in life. In 1995, men's average age of first marriage was 29.0 years, while women were 27.1. Divorced men who remarried were an average 42.5 years old, and divorced women, 38.9. For widowers, the average age at remarriage was 61.3, and for widows, 55.0.

Men who divorced in 1995 were an average 40.5 years old, while women were 37.8. Both ages were up slightly from the year before. The marriages that ended in divorce in 1995 had lasted an average of 12.7 years.

The difference in marital patterns between Quebec and the rest of Canada continued to widen in 1995. In contrast to the rest of Canada, the number of marriages in Quebec fell 2.8%, and the number of divorces increased 10.5%. Quebec's marriage rate was less than half that in the rest of Canada. And despite its relatively small married population, Quebec had one of the country's highest divorce rates.

If it were not for immigration, Canada's married population would be declining. (Canada had a net gain of 78,000 married persons from immigration in 1995.) Indeed, the 160,268 marriages that occurred in 1995 were not enough to offset the 173,000 marriages that were ended either by divorce (77,636) or the death of a spouse (95,000). Moreover, because of the aging of the population, the number of marriages ended by the death of a spouse will increase in the future. If the numbers of marriages and divorces stay at their current level, Canada's married population will start to decline despite immigration.

Marriages, 1995 (paper version: 84-212-XPB, $30; microfiche version: 84-212-XMB, $25) and *Divorces, 1995* (paper version: 84-213-XPB, $30; microfiche version: 84-213-XMB, $25) are now available. See **How to Order.**

For further information, contact François Nault (613-951-1764) or Client Custom Services (613-951-1746), Health Statistics Division.

Cancer, 1993

A total of 116,603 new cases of invasive cancer were diagnosed in 1993, a 3% increase over 112,783 cases in 1992.

Cancer incidence data for 1993 are now available. These include data on new cases diagnosed in Canada in 1993, as reported by all provincial and territorial cancer registries.

For further information, contact Judy Lee (613-951-1775) or Client Custom Services (613-951-1746), Health Statistics Division.

Postcensal Population Estimates

Each issue of *Health Reports* includes annual population estimates. July 1, 1996 preliminary estimates are shown on the following page.

Preliminary postcensal population estimates, by sex and age group, Canada, provinces and territories, July 1, 1996

	Canada	Nfld	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta	B.C.	Yukon	N.W.T.
						'000							
Both sexes	**29,963.6**	**570.7**	**137.3**	**942.8**	**762.5**	**7,389.1**	**11,252.4**	**1,143.5**	**1,022.5**	**2,789.5**	**3,855.1**	**31.5**	**66.6**
<1	377.9	6.1	1.7	10.7	8.7	86.1	145.6	16.2	13.8	38.8	48.2	0.5	1.5
1-4	1,582.9	25.8	7.3	45.7	36.7	374.5	602.1	66.3	58.2	162.1	196.2	2.1	5.8
5-9	2,015.8	36.7	10.0	63.1	49.3	462.3	761.9	83.1	79.7	211.6	247.6	2.4	8.1
10-14	2,019.6	43.0	10.1	63.7	52.2	465.9	746.8	81.1	82.0	213.1	253.2	2.5	6.1
15-19	2,002.9	44.7	10.1	63.5	53.3	502.6	721.7	78.5	76.5	196.6	247.8	2.2	5.3
20-24	2,036.3	46.6	9.8	66.5	56.9	478.8	757.6	81.0	70.0	197.1	264.4	2.2	5.5
25-29	2,223.5	45.3	9.8	68.7	57.0	519.7	858.2	81.5	64.3	216.0	294.3	2.4	6.3
30-34	2,631.2	47.1	11.0	80.6	64.6	643.2	1,023.4	93.8	77.7	249.1	330.7	3.3	6.7
35-39	2,666.4	48.0	11.0	82.0	64.6	675.4	996.7	94.4	82.9	263.6	338.8	3.2	5.7
40-44	2,387.5	46.9	9.9	73.8	61.1	610.0	874.6	85.2	75.6	230.9	311.8	3.0	4.6
45-49	2,159.5	42.6	9.8	69.3	56.9	553.5	804.4	75.9	62.9	190.4	287.6	2.7	3.7
50-54	1,672.2	32.4	7.4	53.6	42.2	455.1	616.5	58.8	48.0	139.2	214.9	1.8	2.3
55-59	1,332.6	24.4	6.0	42.7	33.3	349.9	503.3	47.7	41.9	109.5	171.2	0.9	1.7
60-64	1,213.1	20.9	5.6	38.5	30.1	315.4	462.4	44.6	40.6	97.4	155.6	0.8	1.3
65-69	1,129.3	18.6	5.0	34.5	27.7	290.8	433.9	42.7	39.9	87.1	147.4	0.7	1.0
70-74	979.9	15.9	4.5	30.7	25.6	243.5	378.3	40.3	36.9	72.0	131.3	0.4	0.5
75-79	704.3	12.4	3.7	25.2	19.2	168.9	261.6	31.4	30.8	52.8	98.0	0.2	0.3
80-84	467.6	8.0	2.6	16.9	13.1	109.1	170.9	22.7	22.5	34.8	66.8	0.1	0.2
85-89	240.6	3.8	1.4	8.7	6.9	56.7	87.9	11.8	11.9	17.9	33.4	0.0	0.1
90+	120.5	1.6	0.8	4.5	3.2	27.6	44.6	6.4	6.5	9.3	15.9	0.0	0.1
Males	**14,845.0**	**285.2**	**67.7**	**464.3**	**377.3**	**3,642.6**	**5,560.5**	**567.4**	**507.8**	**1,404.6**	**1,916.8**	**16.1**	**34.6**
<1	194.0	3.1	0.9	5.5	4.4	44.2	74.7	8.4	7.1	20.0	24.8	0.2	0.8
1-4	811.9	13.2	3.8	23.7	18.6	191.9	308.5	33.9	29.9	83.5	100.9	1.0	3.0
5-9	1,031.3	18.8	5.1	32.4	25.3	236.5	390.0	42.8	40.6	108.3	126.0	1.3	4.1
10-14	1,031.9	21.8	5.2	32.4	26.6	237.7	382.0	41.8	41.7	109.1	129.3	1.2	3.2
15-19	1,026.3	22.5	5.0	32.1	27.3	257.3	370.8	39.7	39.7	100.7	127.4	1.1	2.6
20-24	1,033.5	23.8	5.0	33.9	28.9	243.8	383.7	41.7	35.6	100.8	132.5	1.1	2.7
25-29	1,121.5	23.1	4.9	35.1	28.9	265.0	429.0	41.5	32.0	109.5	148.0	1.2	3.2
30-34	1,334.0	23.5	5.3	40.6	32.6	328.4	518.2	47.9	38.5	127.1	166.7	1.7	3.5
35-39	1,343.9	24.0	5.4	40.5	32.3	340.8	502.1	48.2	42.0	134.8	169.2	1.6	2.9
40-44	1,191.8	23.5	5.0	36.1	30.3	305.4	432.8	42.7	38.8	117.8	155.4	1.5	2.4
45-49	1,084.8	21.5	5.0	34.8	28.8	277.0	401.0	38.4	32.3	97.1	145.6	1.3	2.1
50-54	838.2	16.5	3.8	27.1	21.4	225.8	307.6	29.5	24.1	71.0	109.1	1.0	1.3
55-59	661.9	12.5	3.0	21.3	16.7	171.8	249.0	23.7	20.7	55.8	86.0	0.6	0.9
60-64	596.2	10.5	2.7	19.0	14.7	151.6	226.3	22.0	20.2	48.8	79.3	0.4	0.7
65-69	536.2	9.1	2.5	16.0	12.9	133.5	206.9	20.1	19.3	42.5	72.4	0.4	0.5
70-74	432.8	7.4	2.1	13.4	11.4	104.4	166.4	17.8	17.0	32.8	59.6	0.2	0.2
75-79	289.2	5.4	1.5	10.3	8.0	65.6	108.0	13.0	13.1	22.4	41.6	0.1	0.1
80-84	174.9	3.2	0.9	6.2	4.9	38.0	64.1	8.7	8.9	13.4	26.5	0.0	0.1
85-89	78.3	1.4	0.5	2.9	2.2	16.9	28.1	4.1	4.2	6.2	11.7	0.0	0.1
90+	32.5	0.5	0.2	1.1	0.9	6.9	11.5	1.6	2.1	2.9	4.7	0.0	0.0
Females	**15,118.6**	**285.5**	**69.6**	**478.5**	**385.2**	**3,746.6**	**5,691.9**	**576.1**	**514.7**	**1,385.0**	**1,938.3**	**15.3**	**31.9**
<1	184.0	3.0	0.8	5.2	4.3	41.9	70.9	7.9	6.7	18.9	23.4	0.2	0.7
1-4	771.0	12.6	3.5	22.0	18.0	182.6	293.7	32.4	28.4	78.6	95.2	1.1	2.8
5-9	984.5	17.9	4.9	30.7	24.0	225.8	372.0	40.2	39.1	103.4	121.6	1.1	3.9
10-14	987.7	21.1	4.9	31.3	25.6	228.2	364.8	39.3	40.3	104.0	123.9	1.2	2.9
15-19	976.5	22.2	5.1	31.4	26.0	245.3	350.9	38.8	36.8	95.9	120.4	1.1	2.7
20-24	1,002.9	22.8	4.8	32.6	28.0	234.9	373.9	39.3	34.4	96.3	132.0	1.1	2.7
25-29	1,102.1	22.2	4.9	33.6	28.1	254.7	429.2	40.0	32.3	106.5	146.3	1.2	3.0
30-34	1,297.2	23.6	5.6	40.0	32.0	314.8	505.2	46.0	39.1	122.1	164.0	1.6	3.2
35-39	1,322.5	24.1	5.6	41.5	32.3	334.6	494.6	46.2	40.8	128.9	169.6	1.7	2.7
40-44	1,195.7	23.5	4.9	37.6	30.8	304.5	441.9	42.6	36.8	113.1	156.4	1.5	2.1
45-49	1,074.7	21.1	4.8	34.5	28.1	276.5	403.5	37.5	30.6	93.3	142.0	1.3	1.6
50-54	834.0	15.9	3.6	26.5	20.8	229.4	308.9	29.2	23.9	68.2	105.8	0.8	1.0
55-59	670.7	11.9	3.0	21.5	16.6	178.1	254.3	24.0	21.2	53.8	85.2	0.4	0.7
60-64	616.9	10.3	2.9	19.5	15.4	163.8	236.1	22.6	20.4	48.6	76.3	0.4	0.7
65-69	593.1	9.5	2.5	18.5	14.8	157.3	227.0	22.6	20.6	44.6	74.9	0.3	0.5
70-74	547.1	8.5	2.4	17.3	14.2	139.1	211.8	22.5	19.9	39.2	71.7	0.2	0.2
75-79	415.1	7.0	2.2	14.9	11.2	103.2	153.6	18.4	17.7	30.4	56.4	0.1	0.1
80-84	292.7	4.9	1.7	10.7	8.1	71.1	106.8	14.1	13.6	21.4	40.3	0.1	0.1
85-89	162.3	2.4	1.0	5.8	4.6	39.8	59.8	7.7	7.7	11.7	21.7	0.0	0.0
90+	88.0	1.1	0.6	3.4	2.3	20.7	33.1	4.7	4.4	6.3	11.2	0.0	0.0

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

Also from Our Analysts

In addition to *Health Reports*, research conducted by Health Statistics Division analysts is published elsewhere. This section lists the most recent of these publications. The names of our analysts are highlighted.

An analysis of expert participants' opinions before and after a consensus conference on dementia is presented in:

- Clarfield MA, Kogan S, Bergman H, Shapiro DE, **Beaudet MP**. Do consensus conferences influence their participants? *Canadian Medical Association Journal* 1996, 154(3): 331-6.

An analysis of results of a randomized trial of ibuprofin, a nonsteroidal anti-inflammatory drug, is presented in:

- Gurwitz JH, Everitt DE, Monane M, Glynn RJ, Choodnovskiy I, **Beaudet MP**, Avorn J. The impact of ibuprofen on the efficacy of antihypertensive treatment with hydro-chlorothiazide in elderly persons. *Journal of Gerontology* 1996; 51(2): M74-9.

The following six articles were part of a special issue of *Acta Oncologica* containing 15 articles from The International Union for Circumpolar Health's Working Group on Cancer. The data were compiled from cancer registries in Canada, Alaska, Denmark, and Russia.

- **Gaudette LA**, Freitag S, Dufour R, Blaikie M, **Gao R-N**, Wideman M. Cancer in Circumpolar Inuit—Background information for cancer patterns in Canadian Inuit. *Acta Oncologica* 1996; 35(5): 527-33.
- Nielsen NH, Storm HH, Christensen N, **Gaudette LA**, Lanier AP. Cancer among Circumpolar Inuit 1969-1988—Introduction and methods. *Acta Oncologica* 1996; 35(5): 539-43.
- Miller AB, **Gaudette LA**. Cancer of the respiratory system in Circumpolar Inuit. *Acta Oncologica* 1996; 35(5): 571-6.
- Miller AB, **Gaudette LA**. Breast cancer in Circumpolar Inuit. *Acta Oncologica* 1996; 35(5): 577-80.
- Miller AB, **Gaudette LA**. Cancers of skin, bone, connective tissues, brain, eye, thyroid and other specified and unspecified sites in Inuit. *Acta Oncologica* 1996; 35(5): 607-16.
- Nielsen NH, Storm HH, **Gaudette LA**, Lanier AP. Cancer in Circumpolar Inuit 1969-1988—A summary. *Acta Oncologica* 1996; 35(5): 621-8.

The following three articles analyse surgery rates, using data from Statistics Canada's Hospital Morbidity Data Base.

- Vayda E, **Gentleman JF, Walsh MN, Parsons GF** Hysterectomy rates by diagnosis: Variation among Canadian census divisions. *Journal of the Society of Obstetricians and Gynaecologists of Canada* 1996; 18(4): 315-25.
- **Gentleman JF**, Vayda E, **Parsons GF, Walsh MN** Surgical rates in subprovincial areas across Canada: Rankings of 39 procedures in order of variation. *Canadian Journal of Surgery* 1996; 39(5): 361-7.
- **Gentleman, JF**, Vayda E, **Parsons GF**. Surgical rate variation analysis. Response to "The value (and limitations) of surgical rate variation analysis," Editorial by Tandan and Langer. *Canadian Journal of Surgery* 1996; 39(5): 429-30.

The following two articles present findings from Statistics Canada's 1994-95 National Population Health Survey.

- **Hagey J, Millar WJ, Beaudet M,** Hood S. The National Population Health Survey: What have we learned? An overview of preliminary findings. In: *Towards the XXIst century: Emerging socio-demographic trends and policy issues in Canada.* Proceedings of the 1995 Symposium organized by the Federation of Canadian Demographers. 1995 Oct. 23-25; Ottawa: 103-10.
- **Millar WJ, Beaudet MP**. Health facts from the 1994 National Population Health Survey. *Canadian Social Trends* 1996 (Statistics Canada, Catalogue 11-008-XPE) 40: 24-7.

Results from a hospital-based case-control study are presented in:

- Cole CW, Hill GB, **Millar WJ,** Moher D, Laupacis A, Johnston KW. Selective screening for abdominal aortic aneurysm. *Chronic Diseases in Canada* 1996; 17(2): 51-5.

The following is an adaptation of an article in *Health Reports* 7(2): 33-43. The data are from

Statistics Canada's Canadian Vital Statistics Data Base.

- **Wilkins K**. Causes of death—How the sexes differ. *Canadian Social Trends* 1996 (Statistics Canada, Catalogue 11-008-XPE) 41: 11-8.

Using census data, the following paper summarizes a new approach to developing assumptions of future interprovincial migration and to controlling the effect of the assumptions on overall population projections:

- Wershler T, **Nault F**. Projecting interregional migration balances within a multiregional cohort-component framework. *Environment and Planning A* 1996; 28: 769-82.

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