Healthy living among seniors

- *The majority of Canadian seniors were in good health in 2003. Most were independent, free of functional disabilities and had positive perceptions of their mental and physical health.*
- *Exercising frequently, drinking moderately, eating fruit and vegetables often, having a normal BMI, as well as having low stress levels and feeling connected to their communities, all played important roles in seniors' overall good health.*
- *Healthy behaviour during the senior years not only helps maintain good health, but also increases the likelihood of recovering after a period of poor health.*

Abstract

Objectives

This article investigates good health among Canadian seniors in relation to health behaviours and psychosocial factors.

Data sources

Data are from the 2003 Canadian Community Health Survey and the 1994/95 through 2002/03 National Population Health Survey, household components.

Analytical techniques

Multiple logistic regression modeling was used to study associations between being in good health and behavioural risk and psychosocial factors in 2003. Proportional hazards modelling and logistic regression were used to examine health-related characteristics and psychosocial factors in relation to maintaining and recovering health.

Main results

Seniors who exercised frequently, had a body mass index in the normal range, were high consumers of fruit and vegetables and moderate consumers of alcohol were more likely to be in good health. Low levels of stress and feeling connected to the community were also associated with good health. Healthy behaviours were related to maintaining good health over time, as well as increased likelihood of recovery. These findings persisted when controlling for socio-demographic factors and chronic conditions.

Keywords

health behaviour, stress, independent living, aging, longitudinal studies, health survey

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During the 20th century, life expectancy at birth in Canada increased dramatically, from less than 50 years at the beginning of the century,[1] to close to 80 years by the end.[2] In 1901, a 65-year-old could have expected to live an additional 11 years; by 2001, this had increased to 19 years. Now that Canadians are living more years as seniors, the quality of life for this age group is of increasing concern.

As people grow old, chronic conditions become more prevalent. For some, functional decline and reduced perceptions of health are to be expected. But poor health in the senior years is not always inevitable, and modifying certain risk factors may not only prolong life, but may also allow seniors to live more years in good health.[3-10]

Data sources and limitations

Data sources

Canadian Community Health Survey: The cross-sectional analysis of factors associated with seniors' overall good health is based on data from cycle 2.1 of the Canadian Community Health Survey (CCHS). The CCHS collects cross-sectional information about the health of Canadians every two years. The survey covers the household population aged 12 or older in the provinces and territories, except residents of institutions, regular members of the Canadian Armed Forces and residents of Indian reserves, Canadian Forces bases, and some remote areas. Cycle 2.1 began in January 2003 and ended in December that year. Most interviews were conducted by telephone. The response rate was 80.6%, yielding a sample of 135,573 respondents.

Many of the variables used to define good health were part of the Health Utility Index (HUI). In 2003, the HUI was designated a "sub-sample" module of the CCHS, meaning that it was administered to a randomly selected subset of respondents. However, Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick and Québec opted to have this module administered to all respondents in their provinces. Data from these respondents and from the subset in the remaining provinces and territories were used for this analysis. A total of 13,998 respondents aged 65 or older were used in the cross-sectional analyses for this article. A description of the CCHS methodology is available in a published report.[11]

National Population Health Survey: The longitudinal analyses of factors associated with maintaining and recovering good health are based on data from five cycles (1994/95 through 2002/03) of the National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of Canadians every two years. It covers household and institutional residents in all provinces, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS data in this article pertain to household residents aged 65 or older in the 10 provinces.

In 1994/95, 20,095 respondents were selected for the longitudinal panel. Of these, 17,276 agreed to participate, for a response rate of 86.0%. The response rates for subsequent cycles, based on these individuals, were: 92.8% for cycle 2 (1996/97); 88.2% for cycle 3 (1998/99); 84.8% for cycle 4 (2000/01); and 80.6% for cycle 5 (2002/03). More detailed descriptions of the NPHS design, sample and interview procedures can be found in published reports.[12,13]

This analysis uses the cycle 5 (2002/03) longitudinal "square" file, which contains records for all responding members of the original panel, whether or not information about them was obtained in all subsequent cycles.

Limitations

Although the conceptual analytical framework used to examine factors associated with good health was intended to be comprehensive, key variables may have been omitted, either because of methodological problems or because they were not collected by the CCHS or the NPHS. For example, responses to questions on family medical history could not be used because they were asked only in cycle 3 of the NPHS (1998/99) and therefore pertained only to respondents who had survived to that cycle.

Because of sample size constraints, the response categories for many of the independent variables used in the multivariate models were collapsed for the longitudinal analyses. For example, only two categories were used for alcohol consumption: weekly/occasional drinkers and non-drinkers. Such collapsing of categories may have weakened associations with maintaining/recovering health or, in some cases, made it impossible to determine if associations existed. For example, it was not possible to test for negative associations between heavy drinking and maintaining/recovering health, an association that was significant in the cross-sectional analysis.

To maximize sample size and increase precision, the sample used for longitudinal analysis comprised all NPHS cycle 1 respondents, regardless of their response status in subsequent cycles. The survey weights were based on response status in cycle 1 and were not inflated to account for subsequent non-response. This may have biased the estimates if the characteristics of continuers in the longitudinal panel differed from those of non-respondents.

The survey data were self- or proxy-reported, and the degree to which they are biased because of reporting error is unknown. Respondents may not have given accurate replies to questions about issues such as smoking, alcohol consumption and weight. As well, several studies have shown that body mass index (BMI) based on self-reported height and weight can be unreliable,[14-16] particularly among the elderly. Inaccurate self-reporting of height is common among the elderly, who frequently experience loss of height as they age.

The use of BMI to classify "normal" body weights for seniors has been questioned. Some studies suggest that the normal range for seniors should begin above 18.5 and extend into the overweight range (somewhere between 25.0 and 29.9). Research has found that the health risks for seniors in the "overweight" range are not as high as they are for younger adults. While the exact point where health risks increase is not known, BMIs in the upper range of the overweight category are generally associated with higher risks for seniors.[17]

Every effort was made to collect in-depth health information directly from the randomly selected individuals, but proxy responses were accepted. This may have led to under-reporting of some characteristics and diluted associations between health and the independent variables. A person reporting on behalf of another may not be fully aware of that person's health, may not recall relevant information, or may inadvertently mislabel health problems.[18]

Understanding the factors associated with healthy aging among seniors is important for improving the quality of life, reducing health care costs and decreasing the caregiving burden to seniors' families. This is particularly relevant when the proportion of seniors is increasing more rapidly than ever before.

This analysis, which is based on 2003 data from the Canadian Community Health Survey (CCHS), estimates the percentage of seniors who were in good health (see *Data sources and limitations*). It also examines factors associated with seniors' good health, with emphasis on modifiable behavioural risk factors and psychosocial factors (see *Analytical techniques* and *Definitions*). Longitudinal data from the National Population Health Survey (NPHS) were used to study seniors who maintained their health over an eight-year period and to determine the factors that predicted this continued good health. The recovery of good health, along with the associated characteristics, was also studied. Estimates reflect the household population of men and women aged 65 or older.

What is good health?

Various definitions have been used to measure "healthy" aging. While some studies have defined "health" as the absence of disease or chronic conditions, it is more common to consider health in terms of an individual's functional impairment and positive health perceptions.[5,9,19-23] People with chronic conditions often adapt to them and manage to live full and vital lives.

In this analysis, four criteria were required for a senior to be considered in "good health": good functional health, independence in activities of daily living, positive self-perceived general health, and positive self-perceived mental health (see *Measuring health*). This is in keeping with the World Health Organization's definition, which states that "good health is not merely the absence of illness or infirmity, but a state of complete physical, mental and social well-being."[24]

Measuring health

Four criteria were used to define *overall good health*: two are related to physical function, one refers to self-perceived mental health, and the last, to self-perceived general health (Table 1).

A disability is a partial or total reduction in the ability to perform an activity in a way or within limits considered normal. The NPHS questions on disabilities focus on eight areas: hearing, vision, speech, mobility, dexterity, cognitive abilities, pain, and emotions. All except the last were used to measure physical health in this analysis. Respondents without disabilities or with a fully corrected disability (wearing glasses, for example) met the first criterion for overall good health, *good functional health*.

Dependency is a measure of autonomy. To meet the second criterion for good health, respondents had to have reported that they did not need assistance from others with meal preparation, shopping, everyday housework, personal care, or moving about in the home; in other words, they were *independent in activities of daily living*.

For the cross-sectional analysis, mental health was based on respondents' perceptions. Those with good/very good/excellent mental health as opposed to "fair" or "poor" met the third criterion for overall good health. The variable on *self-perceived mental health* was not available in the NPHS; therefore, for the longitudinal analysis, mental health was assessed by considering the probability of having had a major depressive episode in the previous year.[25] Respondents whose replies to a series of questions put their probability of having had such an episode in the last year preceding any NPHS cycle at 0.05 or less (an indicator of good mental health) met the third criterion.

Respondents who had *good/very good/excellent self-perceived general health* met the final criterion for overall good health.

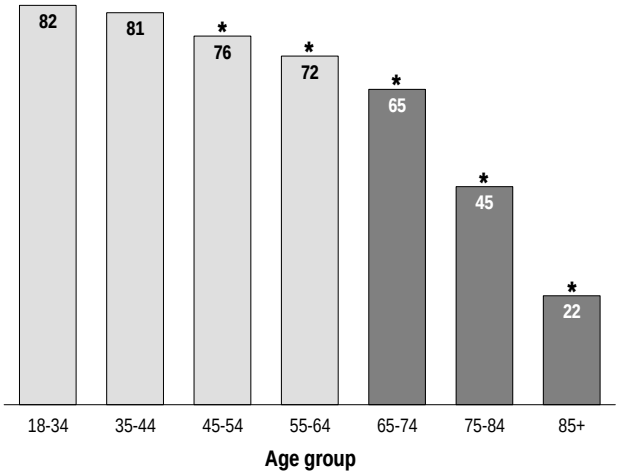
For the cross-sectional analysis, to be considered in overall good health, respondents had to be free of all problems related to these four criteria. That means they did not have a disability or dependency and reported that both their mental and general health were good, very good or excellent. If no answer had been provided for one of these measures, but the three other responses suggested the respondents were in good health, they were considered to be so. If answers were missing for two or more measures, the records for those respondents were excluded.

For the longitudinal analysis, two additional criteria were used to define overall good health. Respondents who had died or had moved to a health care institution were considered to have lost their good health or, in the analysis of recovery, not regained their good health. Of the seniors who were in good health in 1994/95, 21% had died by 2002/03 and a further 3% had moved to institutions. Of those who died, 9% had been institutionalized before death.

Majority of seniors in good health

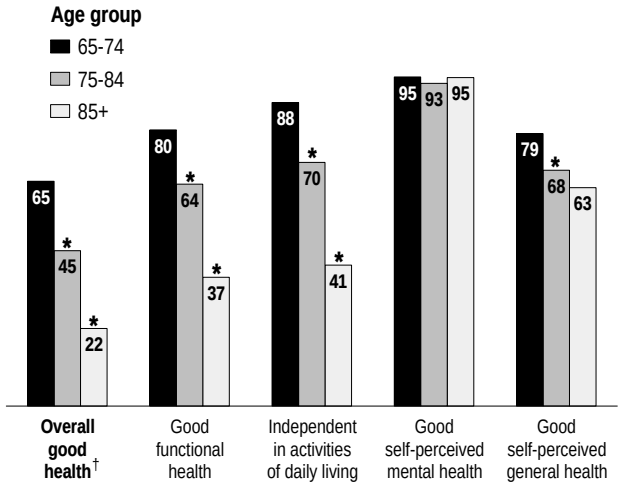
Although the percentage of people in good health drops considerably starting at age 65 (Chart 1), a substantial proportion of seniors (55%) were in good health in 2003 (Table 1). Men were more likely (59%) than women (52%) to have overall good health.

Chart 1
Percentage of people in good health, by age group, household population aged 18 or older, Canada, 2003



***Data source**: 2003 Canadian Community Health Survey*
** Significantly lower than estimate for previous age group (p < 0.05)*

Chart 2
Percentage of people in good health, by age group, household population aged 65 or older, Canada, 2003



***Data source**: 2003 Canadian Community Health Survey*
† Problem-free for all four components
** Significantly lower than estimate for previous age group (p < 0.05)*

Over 7 in 10 seniors had good functional health, were independent in activities of daily living, and had positive perceptions of their general health. A large majority (95%) had a positive view of their mental health.

The percentage of seniors in good functional health declined sharply with age (Table 1, Chart 2). Among 65- to 74-year-olds, 80% either had no disabilities or had corrected disabilities (see *Measuring health*). By 85 or older, however, only 37% were in this situation.

Table 1
Percentage of household population aged 65 or older with good health, by component of good health and by sex and age group, Canada, 2003

	All seniors	Sex		Age group		
		Men	Women	65-74	75-84	85+
Overall good health†	**55**	**59**	**52***	**65**	**45***	**22***
Good functional health	71	76	68*	80	64*	37*
No/Corrected disability in:						
Vision	96	97	95*	98	95*	86*
Hearing	96	96	97*	98	95*	90*
Speech	99	98	99	99	98*	97
Mobility	88	91	85*	95	82*	60*
Dexterity	99	99	99	100	99*	99
Cognition	89	90	89	93	87*	74*
Pain-free	88	91	86*	90	87*	80*
Independent in activities of daily living	78	86	72*	88	70*	41*
Good/Very good/Excellent self-perceived mental health	95	94	95	95	93*	95
Good/Very good/Excellent self-perceived general health	74	74	74	79	68*	63

***Data source:** 2003 Canadian Community Health Survey*
† Problem-free for all four components
** For sex, significantly different from estimate for men; for age group, significantly lower than estimate for previous age group (p < 0.05)*

Declines by age were most evident for mobility and cognition. There was also a sharp decrease in the percentage of seniors who were independent in activities of daily living: from 88% for the 65-to-74 age group down to 41% for those 85 or older. Perceptions of good general health also decreased with age, but to a lesser degree. The proportion of seniors reporting positive mental health was quite similar regardless of age.

Tied to lifestyle

Not surprisingly, the percentage of seniors reporting overall good health decreased with the number of diagnosed chronic conditions reported (Table 2). But more importantly, being in good health was associated with several behavioural risk and psychosocial factors.

The association between being in good health and the frequency of leisure-time physical activity was particularly strong. Among seniors who were active three or more times a week, 67% were in good health. As their activity level declined, so did seniors' health. Those who exercised infrequently were far less likely to be in good health (36%). This association, which has been found in other cross-sectional and longitudinal studies,[5,7,19-22,26,27] persisted when socio-demographic factors and the number of chronic conditions were taken into account. It has been

Table 2
Percentages and adjusted odds ratios of having good health, by selected characteristics, household population aged 65 or older, Canada, 2003

	%	Adjusted odds ratio	95% confidence interval
Total	**54.9**		
Number of chronic conditions			
None†	80.3	1.0	...
1	66.6*	0.6*	0.5, 0.7
2	46.6*	0.3*	0.2, 0.3
3	33.8*	0.2*	0.1, 0.2
4 or more	18.6*	0.1*	0.1, 0.1
Behavioural risk factors			
Leisure-time physical activity			
Frequent (at least 3 times/week)	66.9*	2.2*	1.8, 2.6
Occasional (1-2 times/week)	63.0*	2.1*	1.6, 2.7
Infrequent† (<1/week)	36.2	1.0	...
Alcohol use			
Heavy weekly drinker	42.6*	0.3*	0.2, 0.5
Weekly/Occasional drinker†	61.5	1.0	...
Former regular drinker	41.3*	0.6*	0.4, 0.8
Former drinker (not regular)	42.3*	0.7*	0.6, 0.8
Never drank	43.8*	0.6*	0.5, 0.8
Body mass index (BMI)			
Underweight (≤ 18.5)	37.4*	0.7	0.4, 1.0
Normal weight† (18.5-24.9)	55.4	1.0	...
Overweight (25.0-29.9)	59.1	1.1	0.9, 1.4
Obese (≥ 30)	46.4*	0.8*	0.6, 1.0
Daily fruit/vegetable consumption (times per day)			
Less than 3	51.6*	0.8	0.7, 1.0
3-5	56.4*	0.9	0.7, 1.0
5+†	61.8	1.0	...
Smoking status			
Current daily smoker	55.0	1.0	0.8, 1.2
Quit in past 15 years	50.6*	0.9	0.7, 1.1
Never smoked/Quit 15+ years ago†	56.0	1.0	...
Psychosocial			
Life stress			
Not at all/Not very stressful	62.4*	1.5*	1.3, 1.8
A bit stressful†	49.8	1.0	...
Quite/Extremely stressful	31.7*	0.5*	0.4, 0.7
Sense of community belonging			
Very/Somewhat strong	61.6*	1.5*	1.2, 1.8
Somewhat/Very weak†	48.9	1.0	...
Socio-demographic			
Sex			
Men	58.9*	1.0	0.8, 1.1
Women†	51.8		
Age (continuous)	...	0.94*	0.92,0.95
65-74	64.9*	...	...
75-84	44.9*	...	...
85+†	22.4	...	...
Living arrangement			
With spouse†	59.7	1.0	...
Alone	49.9*	1.0	0.8, 1.2
With others (not spouse)	39.5*	0.8	0.6, 1.1
Residence			
Rural	54.3	1.2	1.0, 1.4
Urban†	57.6	1.0	...
Education			
Less than secondary graduation†	46.8	1.0	...
Secondary graduation or more	62.8*	1.5*	1.2, 1.7
Household income			
Low/Lower-middle†	40.5	1.0	...
Middle	51.6*	1.2	0.9, 1.5
Upper-middle/High	61.9*	1.4*	1.1, 1.9

Data source: *2003 Canadian Community Health Survey*
Notes: *Because of rounding, some odds ratios with 1.0 as upper confidence limit are statistically significant. To maximize sample size, "missing" categories were included for several variables, but the odds ratios are not shown.*
† Reference category
**Significantly different from estimate for reference category (p < 0.05)*
··· Not applicable

suggested that regular physical activity such as walking or gardening is the most important thing seniors can do to maintain mobility and prevent disability.[7,27]

While heavy drinking is known to adversely affect health, moderate alcohol consumption may have some beneficial effects.[28-30] Moderate drinking seems to have a favourable effect on lipid production, thereby reducing the risk of heart disease.[31-35] A recent study found that negative ratings of health were most common among heavy drinkers and abstainers and least common among moderate drinkers.[36] Results from the CCHS mirror these findings. Of the seniors who were weekly or occasional drinkers in 2003, 62% were in good health. Heavy weekly drinkers were far less likely (43%) to be in good health. The same was true for abstainers, whether they were former regular drinkers, former occasional drinkers, or lifetime abstainers.

Excess body weight increases the likelihood of having a number of chronic conditions, including high blood pressure, diabetes and heart disease.[37] Of the seniors whose weight was in the normal BMI range, 55% were in good health, compared with 46% of those who were obese. This may reflect the functional impairment associated with obesity. Seniors who were underweight were also less likely to be in good health (37%). However, this association did not persist in the multivariate model, probably because underweight reflects frailty associated with age and multiple chronic conditions.

Seniors who were overweight, but not obese, were as likely to be in good health as those with BMIs in the normal range. Research suggests that the usual BMI standards may not be as applicable to seniors and that a higher cut-off for the overweight category may be more appropriate (see *Limitations*).[17]

Nutrition and smoking are modifiable behaviours related to cardiovascular disease and cancer. Evidence suggests that healthy eating and refraining from smoking can prevent functional decline and lead to improved health among the elderly.[26,38] CCHS data also reveal links between nutrition and good health. Of the seniors who consumed fruit and vegetables at least five times a day, 62% were in good health, compared with 52% of those who ate these foods less than three times a day. Seniors who had quit smoking over the past 15 years were less likely to be in good health than those who had never smoked or those who had quit for 15 years or more. Somewhat surprisingly, though, the percentage of current smokers in good health was similar to those who had never smoked or who had quit at least 15 years ago. This may, however, be due to survival rates among smokers. Smokers have higher mortality rates,[39] and those who smoke are less likely to reach age 65. Longitudinal results in this study revealed that seniors who currently smoked were less likely to maintain their health (see "Maintaining health"). The time when people are the most likely to quit smoking is soon after the diagnosis of a chronic condition[40]; that is, they change their behaviour after losing their health.

Psychosocial factors

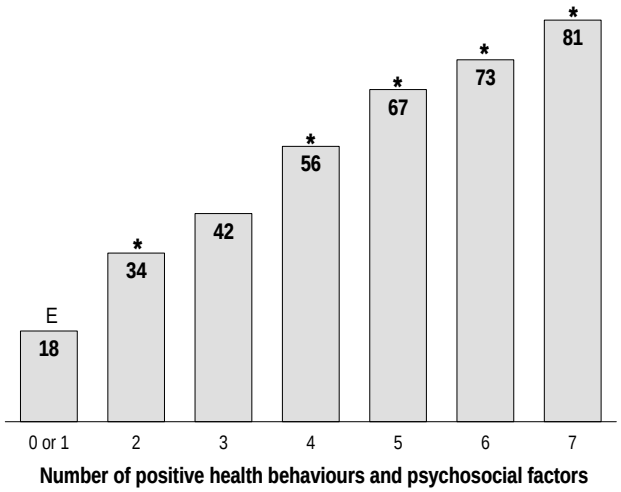
Seniors who perceived low levels of stress in their lives were approximately twice as likely to be in good health as those who had high stress levels (62% versus 32%). As well, seniors who reported a strong sense of community belonging were more likely to be in good health (62%) than were those who felt less connected (49%). Research suggests that social relationships and affiliation have powerful effects on physical and mental health.[41] It has been suggested that interaction between community members may promote health in a number of ways, such as promoting healthy behaviours and reducing stress levels.[41,42]

The more, the better

Healthy behaviours and psychosocial well-being often co-exist and there is some evidence of a cumulative effect; that is, those with the fewest risk factors in these areas will be the most healthy.[6,38] Findings from the CCHS reveal a clear gradient based on the seven factors considered: frequent or occasional exercise, weekly or occasional alcohol consumption, being in

Chart 3

Percentage in good health, by number of positive behavioural and psychosocial factors, household population aged 65 or older, Canada, 2003



***Data source**: 2003 Canadian Community Health Survey*
** Significantly higher than estimate for previous group (p < 0.05)*
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Table 3
Adjusted odds ratios† for being in good health, by number of positive behavioural and psychosocial factors, household population aged 65 or older, Canada, 2003

	Adjusted odds ratio	95% confidence interval
Number of positive health behaviours and psychosocial factors		
0 or 1‡	1.0	...
2	2.3*	1.3, 4.0
3	3.1*	1.9, 5.1
4	5.0*	3.0, 8.1
5	7.3*	4.5, 11.8
6	8.8*	5.4, 14.2
7	13.3*	7.2, 24.6

Data source: *2003 Canadian Community Health Survey*
† Adjusted for socio-demographic factors and number of chronic conditions
‡ Reference category
**Significantly different from estimate for reference category ($p < 0.05$)*
... Not applicable

the "normal" BMI category, consuming fruit and vegetables five or more times a day, never smoking or having quit for at least 15 years, perceiving low stress, and feeling strongly connected to the community. As the number of positive behaviours and psychosocial factors increased, so did the likelihood that a senior would have overall good health (Chart 3). Of the seniors who were positive in all seven factors, 8 in 10 were in good health, compared with less than 2 in 10 of those who were positive on none or only one of the factors. This gradient remained when examined in a multivariate model controlling for socio-demographic factors and chronic conditions (Table 3).

Psychosocial well-being and healthy behaviours

On several behavioural and psychosocial factors, seniors compared favourably with young and middle-aged adults. Seniors were almost twice as likely (58%) as adults aged 18 to 64 (30%) to perceive low stress (Table 4). Low stress levels among the elderly have been observed in other studies, and it has been suggested that experience and maturity make elderly people less likely to perceive events as stressful.[43] Close to 70% of seniors reported a strong sense of community belonging, significantly higher than the rate for those aged 18 to 64. Among seniors, however, rates for stress and community belonging did not differ by age.

More than three-quarters (78%) of seniors were non-smokers, meaning that they had never smoked or that they had quit at least 15 years ago. Among younger adults, the figure was 61%. Most of those aged 85 or older (93%) were non-smokers. This may reflect a survival effect; that is, smokers are less likely to live to age 85 and beyond. Close to half of seniors (48%) consumed fruit and vegetables at least five times a day, compared with 40% for those aged 18 to 64.

Seniors, however, were less likely than younger adults to have a normal body weight, to be weekly or occasional drinkers and to engage in frequent or occasional leisure-time physical activity. The percentage of seniors who were frequently or occasionally active decreased from 79% at ages 65 to 74 to 42% for the 85-or-older group. A similar decline was evident for weekly or occasional alcohol consumption: 69% versus 51% for the same age groups. These declines likely reflect deteriorating

Table 4
Percentage with positive behavioural and psychosocial factors, by age group, household population aged 18 or older, Canada, 2003

	Age group				
	18-64	65+	65-74	75-84	85+
	%			%	
Frequent/Occasional leisure-time physical activity	83*	71	79*	63*	42*
Weekly/Occasional drinker	77*	66	69*	64	51*
Normal BMI category	48*	45	40*	49*	62*
Fruit and vegetables 5 or more times per day	40*	48	47	49	49
Never smoked or quit for at least 15 years	61*	78	73*	83*	93*
Low stress	30*	58	58	60	57
Strong sense of community belonging	62*	69	69	69	67

Data source: *2003 Canadian Community Health Survey*
** Significantly different from estimate for 65-or-older age group ($p < 0.05$)*

Analytical techniques

Cross-sectional analysis: The percentage of seniors in good health was estimated based on data from the 2003 Canadian Community Health Survey. The data were weighted to represent the population of the provinces and territories in 2003. For the provinces and territories for which sub-sampling occurred (see *Data sources and limitations*), a special weight was used.

Cross-tabulations were used to examine associations between being in good health (see *Measuring health*) and health behaviours and psychosocial factors. A multiple logistic regression model was used to determine if the observed associations persisted when controlling for socio-demographic characteristics and chronic conditions. A total of 13,998 respondents aged 65 or older were used in this cross-sectional analysis.

Longitudinal analysis, maintaining health: Cox proportional hazards modelling was used to study health behaviours and psychosocial factors in relation to maintaining health over time. Longitudinal data from the 1994/95 through 2002/03 NPHS were used in this analysis.

The Cox model incorporates a measure of duration (the number of years respondents maintained their good health) and allows for the possibility that, for some, loss of good health did not occur over the study period (some respondents were still in good health in 2002/03). As well, it minimizes the bias associated with attrition.

Seniors living in the 10 provinces who were in good health in 1994/95 were selected for this analysis; the sample numbered 1,309. For respondents about whom data were not available in one cycle, either because they refused to participate or because they could not be traced, health status was imputed as "good" if it had been good in the preceding cycle and was good in the subsequent cycle. After this imputation, 235 records (18%) were censored because of non-response in at least one cycle (57 were censored at cycle 2, 54 at cycle 3, 55 at cycle 4, and 69 at cycle 5).

Associations between health behaviours and psychosocial factors in 1994/95 and maintaining good health over the next eight years were examined, controlling for socio-economic factors and chronic conditions (also measured in 1994/95). All analyses were weighted using the longitudinal weights constructed to represent the total household population of the provinces in 1994/95. Seniors who were living in institutions in 1994/95 were not included in the study.

Longitudinal analysis, recovering health: Factors associated with recovering health were also based on longitudinal data from the NPHS. The technique used for this analysis was pooling of repeated observations combined with logistic regression analysis. Four cohorts of pooled observations were used. The baseline years for these four cohorts were 1994/95, 1996/97, 1998/99 and 2000/01. For each baseline year, all seniors living in households who were not in good health were selected. Seniors were defined as recovering their health if they were in good health at the follow-up interview two years later. As well as those who were still in poor health, seniors who had died by the next cycle or who were residing in institutions were classified as not recovering their health.

It is possible that some seniors could have recovered their health more than once over the study period; e.g., the same individual could have been in poor health in 1994/95 and recovered by 1996/97, then lost health by 1998/99, but regained it by 2000/01.

Sample sizes for longitudinal analysis on recovering health, by two-cycle interval, household population aged 65 or older, National Population Health Survey, 1994/95 to 2002/03

	Number of Seniors not in good health (baseline)	Number of Seniors who recovered good health (follow-up)
	1,315 (1994/95)	332 (1996/97)
	1,094 (1996/97)	193 (1998/99)
	1,096 (1998/99)	200 (2000/01)
	1,052 (2000/01)	166 (2002/03)
Total	**4,557**	**891**

Multiple regression analysis was used on this set of pooled observations to examine recovery in a two-year period in relation to health behaviours and psychosocial factors at the baseline year, controlling for socio-demographic characteristics and chronic conditions. All analyses were weighted using the longitudinal weights constructed to represent the total household population of the provinces in 1994/95. Some variables used in the regression were not collected in every NPHS cycle: sense of coherence, financial stress and family health stress. Sense of coherence was not asked in cycles 2 and 4, so the cycle 2 variable was imputed with the cycle 1 value, and the cycle 4 variable, with cycle 3. Information on stress was not collected in cycles 2 and 3. Because stress is a less stable construct, it was not imputed from previous cycles. A "missing" category was used for the stress variables for these cycles.

An additional 297 seniors who were not in good health at baseline were excluded because their health status in the follow-up period was not known.

All analyses (cross-sectional and longitudinal) were conducted on both sexes combined. Tests for interaction effects between sex and each health behaviour and psychosocial factor were carried out. The only significant interaction was for being a smoker and maintaining health. For women, being a smoker was negatively associated with maintaining health; for men, the association was not significant. This suggests that, for the most part, the magnitude of the associations between health behaviours and psychosocial factors and good health is similar for men and women.

To account for the survey design effects of the CCHS and the NPHS, coefficients of variation and p-values were estimated and significance tests were performed using the bootstrap technique.[44-46] The significance level was set at $p < 0.05$.

Definitions

Unless otherwise stated, definitions apply to both the Canadian Community Health Survey (CCHS) and the National Population Health Survey (NPHS) variables.

To determine the presence of *chronic conditions*, respondents were asked if they had "any long-term health conditions that have lasted or are expected to last six months or more and that have been diagnosed by a health professional." The following conditions were considered in this analysis: asthma, arthritis, back problems, bronchitis/emphysema/chronic obstructive pulmonary disease, diabetes, heart disease, cancer, the effects of a stroke, Alzheimer's disease, incontinence and glaucoma/cataracts.

Three categories of *leisure-time physical activity* were defined, based on how often the respondent was active for at least 15 minutes a day: frequent—at least three times a week; occasional—once or twice a week; and infrequent—less than once a week.

Alcohol use represents the following types of drinkers: heavy—five or more drinks on one occasion on a weekly basis; weekly/occasional—drank weekly or occasionally, but were not heavy drinkers; former regular—did not currently drink, but regularly consumed 12 or more drinks per week at some time in the past; former (not regular); and never drank (i.e., lifetime abstainers).

Weight was defined in terms of *body mass index (BMI)*, which is obtained by dividing weight in kilograms by the square of height in metres. Based on the guidelines from Health Canada, aligned with the World Health Organization standard,[17,47] BMI was grouped into four categories: underweight (BMI less than 18.5); normal (18.5 to 24.9); overweight (25.0 to 29.9); and obese (30 or more).

Fruit and vegetable consumption was based on how often respondents said they ate these foods during the day: less than three, three or four, and five or more times. This variable was not measured in the NPHS until 2002/03 (cycle 5).

Smoking status comprises respondents who: were current daily smokers; had quit daily smoking within the past 15 years; and had quit at least 15 years ago or had never smoked every day. (The risk of mortality for former smokers who have been abstinent for 15 years approaches that of people who never smoked.[39])

Because of sample size constraints in the NPHS, response categories for the behavioural risk factors were collapsed for the longitudinal analysis.

Psychosocial factors were selected based on availability in the CCHS and NPHS, which differs slightly. Self-perceived *life stress* and *sense of community belonging* were used for the analysis of CCHS cross-sectional data. Three categories were used for life stress, based on how stressful respondents said they found most days: not at all/not very stressful, at bit stressful, and quite a bit/extremely stressful. Sense of community belonging was categorized in terms of respondents' sense of belonging to their local community: very/somewhat strong or somewhat/very weak.

Sense of coherence and *stress* were used for the longitudinal analysis. The sense of coherence scale was used to classify respondents' perceptions of life events; specifically, did they see events as understandable, controllable and meaningful.[48] Those with a strong sense of coherence (a value of 70 or more) were distinguished from others. Various sources of stress were measured in the NPHS, and the ones considered most relevant to seniors[49] were used: *family health stress* (having a partner, parent or child in bad health who may die or having a family member with a drug or alcohol problem); and *financial stress* (not having enough money to buy the things you need).

In addition to sex and age, a number of other socio-demographic determinants were considered.

Living arrangement reflects whether respondents lived with their spouse (with or without other people in the household), alone, or with others (excluding their spouse).

Residence distinguishes respondents living in rural areas from those in urban areas (at least 1,000 inhabitants and a population density of at least 400 per square kilometre). This variable is also a proxy for differential health care access, based on the assumption that access might be more difficult in rural areas.

Education distinguishes respondents who had graduated from secondary school from those who had not.

Household income was based on the number of people in the household and total household income from all sources in the 12 months before the interview.

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

For the analysis of NPHS data, income was not included in the multivariate models. Financial stress was included; it was highly correlated with income, and considered more relevant for classifying the socio-economic status of seniors.

health among the very old. The percentage with normal body weight, though, rose as seniors aged, from 40% for those aged 65 to 74 to 62% at age 85 or older. But again, this may reflect weight loss associated with frailty and declining health among the oldest group.

Maintaining health

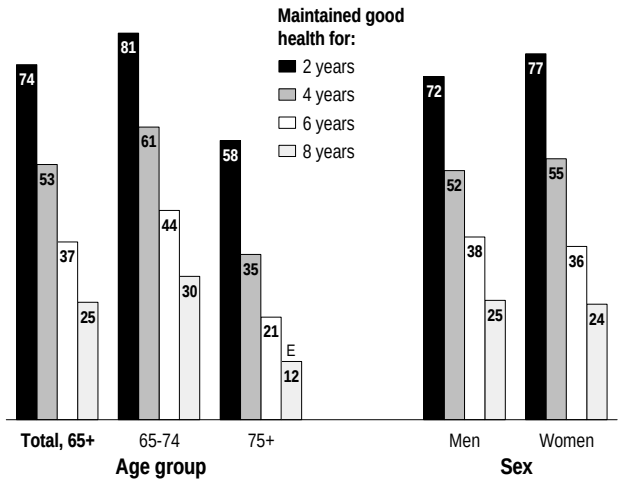
The CCHS data suggest a link between behavioural risk factors, psychosocial factors and good health. However, with cross-sectional data, it is not possible to say if healthy behaviours and psychosocial well-being allow seniors to maintain their health, or if a decline in health causes a decline in these positive factors.

For example, the association with exercise may reflect the benefits of keeping fit; that is, seniors who engage in regular physical activity are more likely to maintain their health. Alternatively, a decrease in physical activity may be the result of the onset of conditions such as arthritis, heart disease or the effects of a stroke. Longitudinal data from the NPHS can be used to shed some light on the direction of these associations (see *Analytical techniques*).

Of the seniors who were in good health in 1994/95, approximately three-quarters (74%) were still in good health at the first follow-up period two years later (Chart 4). Four years later, just over half (53%) had

Chart 4

Percentage maintaining good health for 2, 4, 6 and 8 years, by age group and sex, household population aged 65 or older in good health in 1994/95, Canada excluding territories



***Data source**: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample*
***Notes:** Rates for 75+ are significantly lower than rates for 65-74. No significant differences between rates for men and women.*
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Table 5

Adjusted proportional hazards ratios relating selected characteristics to staying healthy between 1994/95 and 2002/03, household population aged 65 or older in good health in 1994/95, Canada excluding territories

Characteristics in 1994/95	Proportional hazards ratio	95% confidence interval
Behavioural risk factors		
Leisure-time physical activity		
Frequent/Occasional	1.5*	1.1, 1.9
Infrequent†	1.0	...
Alcohol consumption		
Weekly/Occasional drinker	1.4*	1.1, 1.8
Non-drinker†	1.0	...
Body mass index		
Normal weight	1.3*	1.0, 1.6
Underweight/Overweight/Obese†	1.0	...
Smoking status		
Current smoker	0.7*	0.5, 1.0
Quit during past 15 years	0.7*	0.5, 0.9
Never smoked/Quit for 15+ years†	1.0	...
Psychosocial		
High sense of coherence		
Yes	1.4*	1.1, 1.8
No†	1.0	...
Financial stress		
Yes	0.8	0.6, 1.0
No†	1.0	...
Family health stress		
Yes	1.2	0.8, 1.6
No†	1.0	...
Socio-demographic		
Sex		
Men	1.0	0.8, 1.3
Women†	1.0	...
Age (continuous)	0.92*	0.90,0.94
Living arrangement		
With spouse†	1.0	...
Alone	1.3*	1.0, 1.6
With others (not spouse)	0.8	0.5, 1.3
Residence		
Rural	1.1	0.8, 1.4
Urban†	1.0	...
Education		
Less than secondary graduation†	1.0	...
Secondary graduation or more	1.3*	1.0, 1.6
Number of chronic conditions		
None†	1.0	...
1	0.9	0.7, 1.2
2	0.5*	0.4, 0.7
3 or more	0.5*	0.3, 0.7

***Data source:** 1994/95 to 2002/03 National Population Health Survey, longitudinal sample*
***Notes:** Because of rounding, some hazards ratios with 1.0 as lower/upper confidence limit are statistically significant. To maximize sample size, "missing" categories were included for several variables, but the hazards ratios are not shown. A variable was also included to control for the effect of passage of time (i.e., the NPHS cycle), but the hazards ratios are not shown.*
† Reference category
**Significantly different from estimate for reference category ($p < 0.05$)*
... Not applicable

retained their good health. At the end of the eight years, only 25% remained in good health. Men and women were equally likely to maintain their health and, not surprisingly, younger seniors (aged 65 to 74) were more likely to stay healthy.

A Cox proportional hazards model was used to identify factors associated with seniors' maintaining their health over the eight years (see *Analytical techniques*). Even when controlling for socio-demographic factors and chronic conditions, healthy aging over the eight-year period was related to behavioural risk and psychosocial factors in 1994/95 (Table 5). Seniors who were smokers in 1994/95 or who had quit within the previous 15 years were less likely to maintain their health over the next eight years, compared with those who had never smoked or who had been non-smokers for at least 15 years. Frequent or occasional leisure-time physical activity, having a normal body weight, and being a weekly or occasional drinker were all associated with seniors' remaining healthy. A similar analysis conducted for adults aged 45 to 65 found that these four factors were not significantly related to maintaining good health.[50] It may take a while for the negative consequences of unhealthy behaviours to be fully realized, but they eventually catch up with those who adopt them.

For the longitudinal analysis, different psychosocial factors were considered based on availability in the NPHS (see *Definitions*). Having a healthy outlook on life was associated with healthy aging. Seniors who found life meaningful, manageable and comprehensible in 1994/95 were considered to have a strong "sense of coherence." Such seniors were more likely to stay healthy over the next eight years. A negative association between financial stress in 1994/95 and staying healthy emerged, but only approached statistical significance (p = 0.07). Stress related to concerns about family health was not linked with maintaining health.

Recovering good health

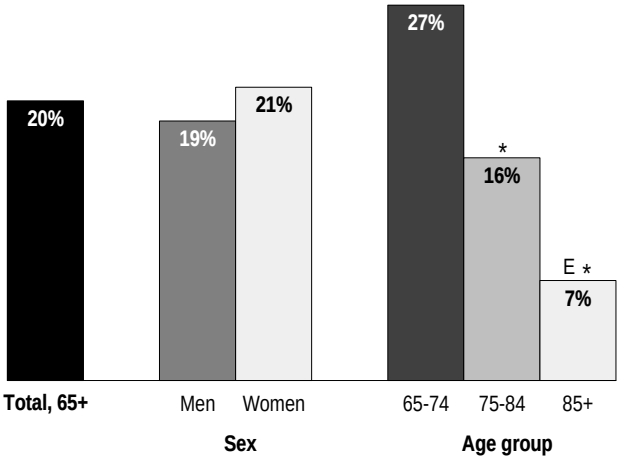
Even though loss of health among the senior population is inevitable over time, not all seniors who lose their health do so for good.[51] With data from the NPHS, two-year recovery rates were estimated by considering seniors who were not in good health in one NPHS cycle, but had regained their good health by the time they were re-interviewed two years later (see *Analytical techniques*).

Of the seniors not in good health, approximately 20% recovered over successive two-year periods between 1994/95 and 2002/03. Men and women were equally likely to bounce back. Recovery rates declined from 27% for seniors aged 65 to 74 to 7% for those 85 or older (Chart 5).

When the effects of socio-demographic and chronic conditions were taken into account, behavioural risk factors and psychosocial well-being were related to seniors recovering their health (Table 6). The findings were very similar to those for maintaining health. Frequent or occasional leisure-time physical activity, weekly or occasional alcohol consumption, having a normal body weight and being a non-smoker (never having smoked or having quit for at least 15 years) were all associated with increased odds of recovering health in a two-year period.

Similar to the results for maintaining health, a strong sense of coherence was associated with a 50% increase in the odds of recovery. Financial stress was negatively associated with recovery, but only approached significance in the multivariate model (p = 0.06). Stress associated with the health of a family member was not significantly associated with recovery.

Chart 5
Two-year recovery rates among people not in good health, by age group and sex, household population aged 65 or older, Canada excluding territories, 1994/95 to 2002/03



***Data source**: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample*
** Significantly lower than estimate for previous age group (p < 0.05)*
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Table 6
Adjusted odds ratios relating selected characteristics to recovery of health in a two-year period, household population aged 65 or older not in good health in baseline year, Canada excluding territories, 1994/95 to 2002/03

Characteristics in baseline year	Adjusted odds ratio	95% confidence interval
Behavioural risk factors		
Leisure-time physical activity		
Frequent/Occasional	1.9*	1.5, 2.4
Infrequent†	1.0	...
Alcohol consumption		
Weekly/Occasional drinker	1.4*	1.1, 1.8
Non-drinker†	1.0	...
Body mass index		
Normal weight	1.3*	1.0, 1.6
Underweight/Overweight/Obese†	1.0	...
Smoking status		
Current smoker	0.6*	0.4, 0.8
Quit during past 15 years	0.7*	0.5, 0.9
Never smoked/Quit for 15+ years†	1.0	...
Psychosocial		
High sense of coherence		
Yes	1.5*	1.2, 1.9
No	1.0	...
Financial stress		
Yes	0.6	0.4, 1.0
No	1.0	...
Family health stress		
Yes	0.8	0.5, 1.2
No	1.0	...
Socio-demographic		
Sex		
Men	0.8*	0.6, 1.0
Women†	1.0	...
Age (continuous)	0.92*	0.90,0.94
Living arrangement		
With spouse†	1.0	...
Alone	1.1	0.8, 1.4
With others (not spouse)	1.5*	1.0, 2.2
Residence		
Rural	1.1	0.8, 1.4
Urban†	1.0	...
Education		
Less than secondary graduation†	1.0	...
Secondary graduation or more	1.0	0.8, 1.3
Number of chronic conditions		
None†	1.0	...
1	0.5*	0.4, 0.6
2	0.5*	0.3, 0.6
3 or more	0.3*	0.2, 0.4
NPHS cycle		
1994/95 to 1996/97 (1 to 2)†	1.0	...
1996/97 to 1998/99 (2 to 3)	1.2	0.5, 2.8
1998/99 to 2000/01 (3 to 4)	1.2	0.5, 2.6
2000/01 to 2002/03 (4 to 5)	0.6*	0.4, 0.8

Data source: *1994/95 to 2002/03 National Population Health Survey, longitudinal sample*
Notes: *Because of rounding, some odds ratios with 1.0 as lower/upper confidence limit are statistically significant. To maximize sample size, "missing" categories were included for several variables, but the odds ratios are not shown.*
† Reference category
**Significantly different from estimate for reference category ($p < 0.05$)*
··· Not applicable

Concluding remarks

In 2003, the majority of Canadian seniors were in good health. Most were independent, free from functional disabilities and had positive perceptions of their health.

Findings from the Canadian Community Health Survey indicate that behavioural and psychosocial factors played an important role in seniors' overall good health. Those who exercised frequently, had a normal body weight, were high consumers of fruit and vegetables and moderate consumers of alcohol were more likely to be in good health, independent of socio-demographic factors and the number of diagnosed chronic conditions. Low stress levels and feeling connected to their community were also associated with seniors' good health. These factors also had a cumulative effect; that is, the proportion of seniors in good health rose as the number of these positive factors increased. These associations are particularly relevant, given that, to some extent, they reflect modifiable characteristics.

Longitudinal results revealed that healthy behaviours in the senior years are related to maintaining good health over time, as well as to a greater likelihood of recovery when health is lost. It is always possible to change or improve behaviour, and improvements may allow people to spend their senior years without being dependent on others, and with positive perceptions of their physical and mental health. Promotion of healthy behaviours may be the key to successful aging, allowing older people to enjoy retirement and take full advantage of their senior years.

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