

Loss and recovery of independence among seniors

Laurent Martel, Alain Bélanger and Jean-Marie Berthelot

Abstract

Objectives

This article identifies risk factors associated with the loss and recovery of independence among the household population aged 65 or older.

Data sources

The data are from the longitudinal component of the first two cycles (1994/95 and 1996/97) of Statistics Canada's National Population Health Survey (NPHS). Supplementary information is from the cross-sectional component of the 1998/99 NPHS.

Analytical techniques

Cross-tabulations were used to estimate the proportions of seniors who lost or regained independence between 1994/95 and 1996/97. Logistic regression models were used to explore associations between loss or recovery of independence and demographic, behavioural and socio-economic variables, as well as chronic conditions.

Main results

Age, sex and the effects of stroke were significantly related to the loss and recovery of independence among seniors. Bronchitis/emphysema, diabetes, heart disease, weight, physical activity, education and household income were associated with the loss of independence, but not its recovery. Dependent seniors with back problems, urinary incontinence, or who smoked had low odds of regaining independence.

Key words

independent living, activities of daily living, instrumental activities of daily living, limitation of activity

Authors

Laurent Martel (613-951-2352; laurent.martel@statcan.ca) and Alain Bélanger (613-951-2326; alain.belanger@statcan.ca) are with the Demography Division, and Jean-Marie Berthelot (613-951-3760; jean-marie.berthelot@statcan.ca) is with the Health Analysis and Measurement Group at Statistics Canada, Ottawa, Ontario K1A 0T6.

Statistics Canada's most recent projections indicate that the proportion of seniors in the population will double by 2031.¹ There are nearly 4 million people aged 65 or older in Canada today, but in 30 years, according to the medium-growth scenario, there will be 8.7 million—2.3 million of whom will be at least 80 years old. Age is strongly associated with the onset of chronic conditions, activity limitations, disabilities, and institutionalization. Therefore, it is expected that this growth in the elderly population will exert increasing pressure on the health care system.²

Policies designed to meet the challenges of an aging population (for instance, prolonging independence) must be based on understanding of the disability process in old age. Most of the abundant literature on the subject deals with the prevalence of disability and the factors associated with it.³ But the prevalence of disability results from events—entries into and exits from disability-related states—that occurred in the past, while the explanatory variables used in many studies were measured at the same time as the outcome.

Methods

Data source

The National Population Health Survey (NPHS), which began in 1994/95, collects detailed information about the health of Canadians every two years. Only persons living on Indian reserves, on Canadian Forces bases, and in some remote areas are excluded. The NPHS has cross-sectional and longitudinal components.

NPHS data are stored in two files. The General file contains socio-demographic and some health information obtained for each member of participating households. The Health file contains in-depth health information, which was collected for one randomly selected household member, as well as the information in the General file pertaining to that individual.

Of the 17,626 randomly selected respondents in 1994/95, 14,786 were eligible members of the longitudinal panel, along with 468 persons for whom general information was collected. An additional 2,022 of the 2,383 randomly selected respondents younger than 12 were eligible for the longitudinal panel. Thus, 17,276 respondents were eligible for re-interview in 1996/97. A response rate of 93.6% was achieved. Of the 16,168 participants in 1996/97, full information (that is, general and in-depth health information for the two cycles or an outcome of death or institutionalization) was available for 15,670. More detailed descriptions of the NPHS design, sample, and interview procedures can be found in published reports.^{4,5}

The longitudinal sample analyzed for this article consists of 2,546 respondents aged 65 or older living in private households in 1994/95. Of these respondents, 2,028 were independent in 1994/95, and 518 were dependent.

The independent group (those "at risk" of becoming dependent) in this analysis was identified by subtracting the 88 deaths that occurred between 1994/95 and 1996/97. (The group at risk of losing their independence was, therefore, conditional upon survival between the two NPHS cycles.) Another 19 cases were excluded because of missing values for variables used to define the functional health states. This left 1,921 respondents at risk of loss of independence over the two-year period.

The dependent group, who potentially could recover their independence, was identified by subtracting the 113 deaths that occurred by 1996/97 and 6 cases for which there were missing values from the 518 dependent seniors residing in private households in 1994/95. This yielded 399 respondents in private households who could potentially recover their independence (Appendix Table A).

Residents of long-term health care institutions at both dates were, by definition, dependent and were not included in the analysis. As well, the very few (n=5) seniors who moved from health care institutions to private households between 1994/95 and 1996/97 were regarded as still being dependent and were excluded from the analysis, because detailed information on them is not available (Appendix, Chart A).

The analysis is supplemented by cross-sectional data from the household component of the 1998/99 NPHS on the percentage of seniors who needed help with each of the activities on which the definition of dependence is based. The overall response rate for 1998/99 was 88.2%. The data were weighted to represent the household population in the 10 provinces. The sub-sample for this analysis consisted of 2,851 people aged 65 or older.

Analytical techniques

Respondents were asked if, because of a long-term health problem, they needed another person to help them perform activities of daily living (ADL) and instrumental activities of daily living (IADL): personal care such as washing, dressing or eating, moving about inside the house, meal preparation, shopping for groceries or other necessities, everyday housework, and heavy household chores. Respondents who were "independent" did not report needing help with any of these activities or needed help with heavy household chores only. The "dependent" category comprised people who needed help with at least one of these tasks (except heavy housework).

Between 1994/95 and 1996/97, there were 283 transitions of seniors between independence and dependence and 138 transitions in the other direction (Appendix, Chart A). People admitted to a long-term health care institution between 1994/95 and 1996/97 were considered to have experienced a loss of independence; specifically, the 28 respondents who were independent in 1994/95 but who were residing in a long-term health care facility in 1996/97 were added to the 255 persons living in private households who were independent in 1994/95 and had become dependent by 1996/97. The 29 household residents who were dependent in 1994/95 and were residing in a health care facility two years later were considered to be dependent at both dates.

Cross-tabulations based on the longitudinal file were used to estimate the proportions of household-dwelling seniors who became dependent or independent between 1994/95 and 1996/97, by sex, age, living arrangements, chronic conditions, body mass index, physical activity, smoking status, alcohol consumption, education, household income, and urban/rural residence. Logistic regression models were used to explore the relationship between the loss or recovery of independence and the chosen set of demographic, socio-economic and behavioural factors, as well as chronic conditions (see *Definitions*). Using the same independent variables, separate regressions were fitted to assess the effect of each factor on the loss or recovery of independence. Thus, the results of the two regressions can be compared.

Estimates were weighted to represent Canada's senior population in 1994/95. To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.⁶⁻⁸

However, results from some American surveys—notably the Longitudinal Survey on Aging, the National Long-term Care Survey, and the Health and Retirement Survey—have shown the dynamic nature of functional health. For example, some individuals, even quite elderly ones, recover their independence after an episode of dependence.⁹⁻¹⁸

In 1994/95, Statistics Canada launched the National Population Health Survey (NPHS), which includes a longitudinal panel. Because it can be used to trace transitions between functional health states, and also because it contains information on a wide range of health-related characteristics, this survey opened the door to studies of factors that predispose people to lose or recover functional health.^{19,20} An analysis based on flows between functional states in a longitudinal perspective permits the measurement of health determinants before transitions, as well as an examination of factors associated with the loss and recovery of independence. With longitudinal data from the NPHS, this article identifies some of the statistically significant risk factors associated with the loss and recovery of independence among the elderly in Canada between 1994/95 and 1996/97 (see *Methods*, *Definitions* and *Limitations*).

The ability to detect transitions between independence and dependence may vary with the duration of the period under examination.²¹ It has been estimated that episodes of dependence last an average of 18 months for a moderate impairment and 23 months for a severe impairment.²² If functional status at the beginning and end of a long period (for example, four or more years) is compared, many intermediate transitions between independence and dependence might be missed. Consequently, only the first two NPHS cycles, 1994/95 and 1996/97, are used in this analysis. Moreover, using the first two cycles is judicious, since the longitudinal panel was representative of the Canadian population only in 1994/95. As a result, this article differs from a previous analysis of functional transitions based on the NPHS.²⁰

Conceptual framework

Given the many determinants of functional health,

developing a conceptual framework to analyze the loss and recovery of independence among seniors is a major challenge. Nevertheless, understanding of the processes has grown substantially over the past three decades. The framework proposed for this analysis draws on the works of Anderson et al.,²³ Evans and Stoddard²⁴ and Verbrugge and Jetté,²⁵ and also takes into account the population-health approach developed by Health Canada.³ Five major categories of factors thought to affect functional health are examined: demographic variables, chronic conditions, behavioural factors, socio-economic variables, and area of residence.

Three demographic variables are included in this analysis: sex, age and living arrangements. Studies of transitions between functional states stress the close link between age and loss of independence.^{12,15,16}

Results of cross-sectional studies have shown a higher prevalence of disabilities among women than men, primarily because of women's greater propensity to develop disabling chronic diseases. However, the association between sex and independence is less consistent: some research has found an association;^{12,17,20,26} other studies, controlling for death and institutionalization, have not.^{15,16,27}

Living arrangements are closely correlated with marital status, which has been shown to be significantly associated with institutionalization.^{28,29} However, while some researchers found no association between loss of independence and marital status,²⁶ others found that married people were most likely to recover their independence after an episode of dependence,¹² which implies that a spouse may be instrumental in this process. Also, unmarried people were at a greater risk than married people of losing their independence.

As might be expected, some chronic diseases can affect independence. They may, in fact, be more important than age, suggesting that independence is primarily a matter of health, not age.¹⁵ This analysis controls for: asthma, arthritis, back problems, bronchitis/emphysema, diabetes, heart disease, cancer, stroke, urinary incontinence, and glaucoma/cataracts.

Four lifestyle-related factors are considered: weight as measured by body mass index (BMI), physical activity, smoking, and alcohol consumption. Body mass index (BMI) was included in the model because of the harmful health effects of overweight and obesity.^{3,30-35} Although links between obesity and independence remain largely unexplored,

obesity among older people has recently been shown to be associated with activity limitations, especially in terms of mobility and chronic diseases.³³

Physical activity is associated with both physical and mental health.^{19,40} It is also known that inactivity is a significant risk factor for coronary heart disease and other serious health problems.³

Definitions

Respondents to the National Population Health Survey were asked if, because of a long-term health problem, they needed another person to help them perform certain tasks, based on instrumental activities of daily living (IADL)³⁶ and activities of daily living (ADL)³⁷: "Because of any condition or health problem, do you need the help of another person in: a) preparing meals? b) shopping for groceries or other necessities? c) doing normal everyday household work? d) doing heavy household chores such as washing walls or yardwork? e) personal care such as washing, dressing or eating? f) moving about inside the house?" To be included in the *independent* category, a respondent had to have no dependency or to report being dependent only for heavy household chores. Respondents were classified as *dependent* if they needed help in preparing meals and/or shopping and/or daily household tasks and/or getting around the house and/or personal care.

Five *age groups* (as of 1994/95) were used in this analysis: 65 to 69, 70 to 74, 75 to 79, 80 to 84, and 85 or older.

Living arrangements were defined to reflect three situations: living with spouse, regardless of whether other people also lived in the household; living alone; and living with others, but not a spouse.

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 that have been diagnosed by a health professional." A checklist of conditions was read; the following were considered in this analysis: asthma, arthritis or rheumatism, back problems (excluding arthritis), bronchitis/emphysema, diabetes, heart disease, cancer, the effects of stroke, urinary incontinence, and glaucoma/cataracts.

Body mass index (BMI), which was calculated by dividing weight in kilograms by the square of height in metres, was grouped into four categories for this analysis: underweight (a BMI of 18.5 or less), acceptable weight (more than 18.5 and less than 25), overweight/obese (25 or more), and missing. The "missing" category was necessary to retain as many cases as possible in the multivariate analysis. The BMI ranges are those of the World Health Organization³⁸ and differ from the Canadian standards.³⁹

Physical activity refers to activity during leisure time. Frequency

of physical activity was based on the number of times in the previous three months that respondents had participated in a physical activity for at least 15 minutes. Respondents were classified as active (at least four times per month) and inactive (less than four times per month).

Smoking was derived from responses to the following questions: "At what age did you stop smoking (cigarettes) daily?", "At the present time, do you smoke cigarettes daily, occasionally or not at all?" and "Have you ever smoked cigarettes at all?" For this analysis, respondents were divided into two categories: smoker (daily smoker, occasional but former daily smoker, and former daily smoker who had quit within the year) and non-smoker (always occasional smoker, former daily smoker who had quit for at least a year, former occasional smoker, and never smoked).

To establish *alcohol consumption* in 1994/95, respondents were asked, "During the past 12 months, how often did you drink alcoholic beverages?" Individuals were classified into two groups: regular drinker (at least 14 drinks a week) and occasional or non-drinker (fewer than 14 drinks a week or does not drink).

Respondents were grouped into two *education* categories based on the highest level attained as of 1994/95: less than postsecondary graduation and postsecondary graduation or more.

Household income was defined based on the number of people in the household and total household income from all sources in the 12 months before the 1994/95 interview.

Household income group	People in household	Total household income
Low	1 or 2	Less than \$15,000
	3 or 4	Less than \$20,000
	5 or more	Less than \$30,000
Medium/High	1 or 2	\$15,000 or more
	3 or 4	\$20,000 or more
	5 or more	\$30,000 or more

Residence was defined as rural or urban. Urban refers to a continuously inhabited area of at least 1,000 inhabitants and a population density of at least 400 per square kilometre.

Unlike its association with mortality, the impact of smoking on the loss of independence has received little attention, although some studies have shown that smoking not only reduces life expectancy, but also increases the burden of disability.^{41,42}

Alcohol consumption has not been given special attention as a risk factor for changes in functional health status. However, moderate alcohol consumption has been shown to have beneficial health effects, especially with respect to the heart.^{43,44}

The model includes two socio-economic variables: education and household income. Less-educated and lower-income individuals are generally in worse health and are more likely to die prematurely than better-educated and more affluent people.³ Education, in particular, is related to lifestyles that may prevent or delay the onset of disease or disability.⁴⁵ As well, people with less education have been found to be more at risk of losing their independence.¹²

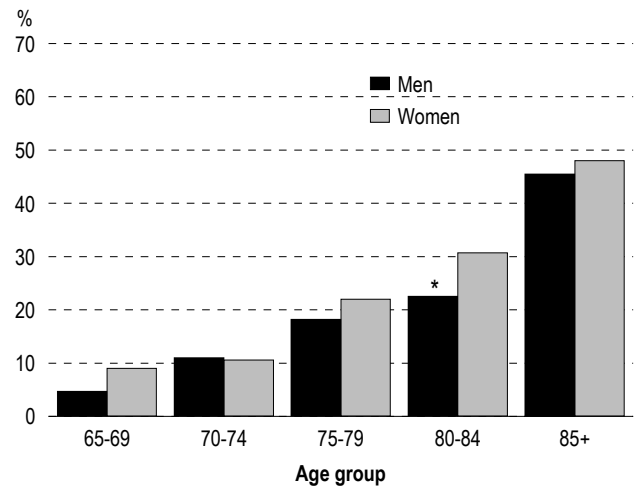
Finally, the model uses area of residence as a proxy for access to health care. Seniors in rural areas are distinguished from those in urban areas on the assumption that the latter have greater access to health services, and that this might be related to their ability to live independently.

Independence declines with age

Of the 2.5 million seniors who were independent and living in private households in 1994/95, 14% (an estimated 348,800 individuals) were found to be dependent in 1996/97. That is, by 1996/97, they needed the help of another person in performing at least one of the following activities: meal preparation, shopping for necessities, everyday housework, personal care (washing, dressing, bathing), and moving about inside their home (see *Needing help in 1998/99*). During the same period, 32% of seniors who had been dependent in 1994/95 recovered their independence, totalling an estimated 140,900 individuals.

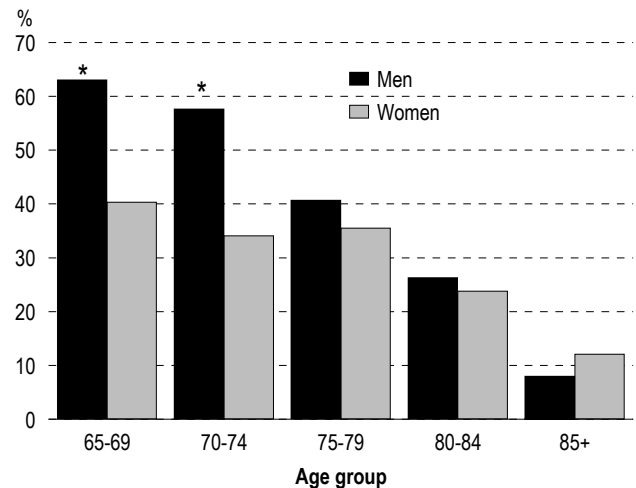
For both sexes, in fact, the likelihood of becoming dependent tended to rise with age (Chart 1, Table 1). Close to half of independent seniors aged 85 or older in 1994/95 were dependent two years later. By contrast, just 7% of independent people aged

Chart 1
Percentage of seniors who were independent in 1994/95 but dependent in 1996/97, by sex and age group, household population† aged 65 or older, Canada excluding territories



Data source: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file
Note: For both sexes, the percentages who were independent in 1994/95 but dependent in 1996/97 were significantly higher at ages 75 to 79, 80 to 84 and 85 or older than at ages 65 to 69 ($p \leq 0.05$).
 † Includes individuals who were independent in 1994/95, but were residing in a health care institution in 1996/97.
 * Significantly lower than value for women ($p \leq 0.05$)

Chart 2
Percentage of seniors who were dependent in 1994/95 but independent in 1996/97, by sex and age group, household population aged 65 or older, Canada excluding territories



Data source: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file
Note: For both sexes, the percentages who were dependent in 1994/95 but independent in 1996/97 were significantly higher at ages 65 to 69 than at 85 or older ($p \leq 0.05$).
 * Significantly higher than value for women ($p \leq 0.05$)

65 to 69 in 1994/95 were found to be dependent in 1996/97.

The probability of regaining independence after it was lost tended to decrease with age. As well, among dependent seniors younger than 75 in 1994/95, men were significantly more likely than women to regain their independence (Chart 2). By age 75, however, differences between the sexes in the percentages recovering their independence faded.

These descriptive figures suggest an association between age and the loss or recovery of independence. But a number of other characteristics that tend to be common at older ages may actually be the deciding factors in these transitions. For instance, at older ages, the likelihood of living alone is greater. As well, the prevalence of chronic disease tends to increase with age. And having a chronic disease may preclude physical activity, which could affect weight. To identify characteristics that are

Needing help in 1998/99

According to the National Population Health Survey, most of the 3.5 million seniors living in private households in 1998/99 were independent; only a minority needed help with their daily activities. The likelihood of requiring assistance varied with the activity, and generally rose with advancing age.

The tasks with which seniors, especially women, were most likely to need help involved heavy housework. Overall, 28% of elderly men and 43% of elderly women required assistance with these activities. For both sexes, the percentages tended to rise with age, so that at 85 or older, 49% of men and 78% of women needed help with heavy chores. In all age groups, a higher percentage of women than men required such help.

Senior women were also more likely than senior men to require help with everyday housework: 18% versus 13%. However, the disparity reflected the situation among people in their seventies. By ages 80 to 84, there was no significant difference.

The pattern was similar for shopping for necessities. Whereas 16% of senior women needed such assistance, the percentage for senior men was 12%. This overall gap was largely attributable to people in their late seventies. By age 85, 48% of both men and women required help with shopping.

Just 8% of senior women and 11% of men needed help preparing meals. The percentages tended to rise with age, but differences between men and women were not statistically significant.

Relatively few seniors in private households needed help with personal care (washing, dressing, bathing) or moving about inside their homes. Overall, about 6% of seniors in households required help with personal care, and 6% of men and 3% of women needed help moving about at home. These low percentages reflect the fact that elderly people requiring such basic care generally live in institutions.²⁹ The need for such aid tended to become more common at older ages, and differences between the sexes were generally not statistically significant.

Percentage of population needing help with selected activities, by sex and age group, household population aged 65 or older, Canada excluding territories, 1998/99

	Heavy housework		Everyday housework		Shopping for necessities		Meal preparation		Personal care		Moving about at home	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
	%		%		%		%		%		%	
Total 65+	27.8	43.3*	13.1	18.2*	11.9	16.4*	11.0	7.5	6.0	6.2	5.5^{E1}	3.3
65-69	18.2	25.9*	5.9 ^{E2}	6.7 ^{E1}	6.7 ^{E1}	4.6 ^{E2}	5.4 ^{E2}	F	F	F	4.2 ^{E2}	F
70-74	23.3	39.1*	7.2 ^{E1}	15.9* ^{E1}	6.7 ^{E2}	10.9 ^{E1}	5.4 ^{E2}	3.5 ^{E2}	5.1 ^{E2}	F	4.6 ^{E2}	F
75-79	30.9	48.3*	9.7 ^{E1}	20.6* ^{E1}	7.2 ^{E2}	17.4*	9.7 ^{E2}	9.2 ^{E1}	F	9.0* ^{E1}	F	5.1 ^{E1}
80-84	45.5	62.6*	27.9 ^{E1}	30.3 ^{E1}	24.9 ^{E1}	34.6	22.2 ^{E1}	14.5 ^{E1}	12.7 ^{E2}	12.6 ^{E1}	11.7 ^{E2}	6.1 ^{E2}
85+	49.2 ^{E1}	77.5*	53.0	42.8	47.8 ^{E1}	47.6	43.7 ^{E1}	25.3 ^{E1}	F	19.3 ^{E1}	F	9.4 ^{E2}

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

^{E1} Coefficient of variation between 16.6% and 25.0%

^{E2} Coefficient of variation between 25.1% and 33.3%

F Coefficient of variation greater than 33.3%

* Significantly different from value for men ($p \leq 0.05$)

Table 1

Percentages and adjusted odds ratios for loss and recovery of independence between 1994/95 and 1996/97, by selected characteristics, household population aged 65 or older, Canada excluding territories

	Loss of independence			Recovery of independence		
	%	Adjusted odds ratio	95% confidence interval	%	Adjusted odds ratio	95% confidence interval
Total 65+	13.9	32.1
Sex						
Men	11.7	0.66*	0.45, 0.98	37.7 ^{E1}	2.71*	1.25, 5.90
Women†	15.7	1.00	...	30.3	1.00	...
Age group						
65-69†	7.1 ^{E1}	1.00	...	49.2	1.00	...
70-74	9.9	1.39	0.80, 2.41	40.1 ^{E1}	0.65	0.24, 1.73
75-79	20.4*	3.13*	1.94, 5.05	35.1 ^{E1}	0.52	0.20, 1.34
80-84	27.2*	4.60*	2.73, 7.75	24.7 ^{E2}	0.19*	0.06, 0.58
85+	46.9 ^{E1}	13.89*	5.31, 36.36	F	0.08*	0.02, 0.28
Living arrangements						
With spouse†	11.6	1.00	...	33.1	1.00	...
Alone	18.1*	0.99	0.68, 1.42	36.9	2.56*	1.20, 5.43
With others, no spouse	14.7 ^{E2}	0.67	0.33, 1.34	F	1.30	0.48, 3.50
Chronic condition‡						
Asthma	15.0 ^{E2}	0.96	0.38, 2.45	F	0.58	0.19, 1.75
Arthritis	16.7	1.15	0.80, 1.64	31.1	0.79	0.42, 1.48
Back problems (excluding arthritis)	15.5 ^{E1}	1.32	0.83, 2.11	23.2 ^{E1}	0.41*	0.21, 0.80
Bronchitis/Emphysema	25.0 ^{E1}	2.68*	1.31, 5.48	26.8 ^{E2}	0.54	0.14, 2.11
Diabetes	21.2 ^{E1}	1.92*	1.08, 3.40	28.1 ^{E2}	0.81	0.34, 1.94
Heart disease	24.4*	2.10*	1.26, 3.50	30.7 ^{E1}	1.07	0.55, 2.08
Cancer	F	0.82	0.25, 2.69	42.4 ^{E2}	1.50	0.42, 5.36
Effects of stroke	47.8 ^{E1}	5.68*	2.11, 15.28	F	0.30*	0.12, 0.75
Urinary incontinence	F	1.49	0.61, 3.69	F	0.15*	0.04, 0.55
Glaucoma/Cataracts	18.4	0.93	0.57, 1.50	24.8 ^{E1}	0.84	0.42, 1.70
Body mass index						
Underweight	35.2 ^{E1}	2.93*	1.22, 7.04	F	0.45	0.09, 2.25
Acceptable†	11.6	1.00	...	32.0	1.00	...
Overweight /Obese	14.4	1.52*	1.02, 2.26	34.5	1.09	0.57, 2.10
Missing§	F	1.39	0.33, 5.92	F	1.02	0.14, 7.45
Physical activity						
Active†	9.9	1.00	...	42.2	1.00	...
Inactive	23.2*	1.97*	1.32, 2.94	32.8	0.63	0.32, 1.23
Missing§	19.3 ^{E2}	2.72*	1.21, 6.12	F	0.15*	0.03, 0.86
Smoking						
Smoker	15.9 ^{E1}	1.70	0.99, 2.93	F	0.33*	0.12, 0.92
Non-smoker†	13.6	1.00	...	33.4	1.00	...
Alcohol consumption						
Regular drinker	F	0.58	0.15, 2.18	F	0.89	0.12, 6.35
Occasional/Non-drinker†	14.2	1.00	...	32.1	1.00	...
Education						
Less than postsecondary graduation†	15.1	1.00	...	30.5	1.00	...
Postsecondary graduation	8.2*	0.55*	0.32, 0.94	39.6 ^{E1}	1.27	0.48, 3.40
Household income						
Low	21.6*	1.78*	1.19, 2.67	27.9 ^{E1}	0.58	0.29, 1.18
Medium/High†	11.5	1.00	...	35.5	1.00	...
Missing§	15.3	1.48	0.67, 3.29	F	0.39	0.07, 2.13
Area of residence						
Urban†	14.0	1.00	...	30.0	1.00	...
Rural	13.6	0.96	0.64, 1.44	42.2 ^{E1}	1.44	0.73, 2.86

Data source: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file

Notes: The model for loss of independence is based on 1,921 respondents aged 65 or older who were independent and living in private households in 1994/95 and who were still alive in 1996/97; the model for recovery of independence is based on 399 respondents aged 65 or older who were dependent and living in private households in 1994/95 and still alive in 1996/97.

† Reference category

‡ Reference category is no chronic condition.

§ Included in model to retain a large number of observations for which these variables were missing.

^{E1} Coefficient of variation between 16.6% and 25.0%

^{E2} Coefficient of variation between 25.1% and 33.3%

F Coefficient of variation greater than 33.3%

* Significantly different from reference category ($p \leq 0.05$)

... Not applicable

significantly associated with transitions into and out of independent living, a multivariate analysis was conducted.

Age and sex “double-jeopardy” risk factors

Even when other factors—living arrangements, chronic conditions, weight, physical activity, smoking, drinking, education, household income, and area of residence—were taken into account, advancing age increased the odds of losing independence and reduced the odds of recovering it. In other words, age was a “double-jeopardy” risk factor. For example, individuals aged 85 or older in 1994/95 had 14 times the odds of experiencing a loss of independence by 1996/97, compared with 65- to 69-year-olds. And once people aged 85 or older became dependent, their odds of recovering were significantly lower than those of 65- to 69-year-olds.

Sex, too, was a “double-jeopardy” risk factor. Elderly men had lower odds than did elderly women of losing their independence. And if they experienced an episode of dependence, men had significantly higher odds of recovering. To some degree, this may reflect traditional gender roles related to the activities that define independence.

Living arrangements

When the other factors, including age and sex, were taken into consideration, living arrangements were significant only for the recovery of independence, specifically for seniors who lived alone. The odds that people who lived alone and were dependent in 1994/95 would recover their independence by 1996/97 were higher than the odds for people living with a spouse. A more detailed analysis (data not shown) found that the nature of the assistance that had been needed by dependent people who lived alone was generally less basic (for instance, shopping) than the assistance required by dependent people who lived with a spouse (for instance, personal care).

Chronic conditions major factor

Some chronic conditions posed more of a threat to independence than did others. Close to half (48%)

of independent seniors who were affected by stroke had become dependent by 1996/97. And in fact, when the effects of the other variables were controlled, stroke was the only chronic condition that was a “double-jeopardy” risk factor, associated with high odds of losing independence and low odds of recovering it. This is hardly surprising, since the consequences of a stroke can be especially disabling: partial or total paralysis, sensory or muscle tone loss, nerve damage, speech difficulties, confusion, and memory loss.

Seniors with bronchitis/emphysema, diabetes or heart disease had high odds of becoming dependent. However, having these conditions did not significantly reduce the odds of recovering independence. By contrast, individuals with back problems and urinary incontinence did not have high odds of losing their independence, but they had significantly low odds of recovering once they had become dependent.

Several conditions were not significantly associated with losing or recovering independence at older ages: asthma, arthritis, and cancer. For asthma and arthritis, this might seem surprising, although the relatively short period examined (two years) may not be long enough to observe a substantial deterioration in functional health related to these diseases. It is noteworthy that cancer, a major risk factor for loss of life, was not significantly related to loss of independence. This may be because people who died of cancer between 1994/95 and 1996/97 were, by definition, excluded from the analysis, although they would have been the cancer patients most at risk of losing their independence.

Co-morbidity (having more than one chronic condition) was tested, but was not significant for the loss or recovery of independence (data not shown). This suggests that it is not so much the number, but rather the type, of chronic conditions that imperils independent living.

To assess the importance of chronic diseases, as well as behavioural and socio-economic factors, on the loss and recovery of independence, three models were produced (data not shown). One at a time, each group of variables was removed. Chronic

conditions proved to have the strongest association with both the loss and recovery of independence. But behavioural factors were also significant in the loss of independence, illustrating that habits and lifestyle developed during youth and adulthood can have an impact on functional health in old age.

Health-related behaviours

Just 12% of seniors whose weight was in the acceptable range in 1994/95 had become dependent by 1996/97. However, 35% of underweight seniors lost their independence. When the effects of other

variables (some closely related to BMI such as physical activity and smoking) were taken into account, both too much and too little weight were significantly related to seniors' loss of independence. The odds that elderly people who were independent in 1994/95 would be dependent in 1996/97 were significantly high for those who were overweight/obese or underweight, compared with those in the acceptable weight range. Being underweight may be a marker of frailty related to an unreported or undiagnosed disease, which may, in turn, explain the significant association.

Limitations

Some people selected for the National Population Health Survey (NPHS) longitudinal panel in 1994/95 did not respond in 1996/97. Some were lost to follow-up; others no longer wanted to participate. Because loss to follow-up represented less than 2% of all respondents in the longitudinal panel (a proportion considered very low),⁴⁶ and because most of these missing respondents were young, it was not an important source of bias in this analysis. Non-response is a greater concern, and adjustments to survey weights were applied to responses in both cycles to compensate.^{4,47} Nonetheless, it is possible that some bias remains.

Every effort was made to collect in-depth health information directly from the randomly selected individuals. However, proxy responses were accepted and accounted for 21.4% of household records in this analysis. This might lead to under-reporting of some characteristics and dilute associations between the loss or recovery of independence and specific variables. For instance, a person reporting on behalf of another may not be fully aware of that person's health situation, may not recall relevant health information, or may mislabel health problems.^{48,49} However, an analysis of proxy reporting in the NPHS showed that for more serious conditions such as diabetes, heart disease and stroke, the odds that they will be reported do not differ significantly between proxy and self-reporters.⁵⁰

The relatively few respondents aged 65 or older in the longitudinal file limited opportunities for analysis. Selection of variables for inclusion in the model meant balancing the desirability of accounting for as many factors in the conceptual framework as possible against limits imposed by the data. For example, the conceptual framework originally included social support and mental health. When the models were run including those variables, neither was significant. Similarly, loss of independence among the elderly can often result

from a fall leading to hip fractures or other injuries, especially at very advanced ages. About 7% of independent seniors in 1994/95 were victims of injuries leading to activity limitations, and approximately 2% suffered fractures. This variable, too, was initially included in the multivariate models, but the associations were not significant, possibly because of the small number of cases.

The relatively small sample size also meant that transitions between only two functional health states could be investigated: independent and dependent in activities of daily living. Furthermore, the "dependent" population is heterogeneous. The range of activities for which they required assistance ranged from shopping only to personal care such as dressing and bathing. Although a breakdown of the dependent population into more homogeneous categories would have been desirable, it was not possible.

A small sample size also meant that the coefficients of variation associated with some variable categories were large, and consequently, estimates could not be shown.

Respondents may give socially desirable answers 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,^{34,35,51} particularly among the elderly. Advancing age leads to a decline in body mass owing to the loss of muscle and bone mass.^{30,52,53} Inaccurate self-reporting of height is also common among the elderly, who frequently experience loss of height as they age.^{54,55}

The NPHS does not provide an indication of the severity of chronic conditions. Thus, while the results of this analysis show that dependence was not significantly related to having been diagnosed with, for example, arthritis, in severe cases, there might be some association.

Physical activity was also important. Compared with elderly people who were active, a higher percentage of those who were inactive lost their independence. When the effects of the other factors were controlled, inactivity increased the odds of a loss of independence, but was not associated with its recovery. However, the “missing-value” category for physical activity was significantly related to both the loss and recovery of independence. This may be explained by the age/sex profile of these non-respondents, a large majority of whom were aged 80 or older and reported poor health.

Even when the other variables were taken into consideration, daily or occasional smokers who were dependent had reduced odds of recovering, compared with individuals who did not smoke. Alcohol consumption, by contrast, was not significantly related to either loss or recovery of independence among the elderly.

Education, income and residence

Comparatively high percentages of elderly people in low-income households or with less than high school graduation became dependent between 1994/95 and 1996/97. When other variables were taken into account, the odds of becoming dependent were still high for elderly people who were not postsecondary graduates, compared with individuals who had more formal education. Low household income, too, was associated with becoming dependent. Neither education nor income was significantly related to the recovery of independence. A more detailed breakdown of the education and income categories (data not shown) indicated that education's positive effect existed only for the most highly educated seniors, and that the negative effect of low income prevailed only at very low income levels.

The high odds of a loss of independence among low-income seniors may partly reflect a perceptual difference between individuals with adequate means and those with inadequate means.⁵⁶ Seniors who can afford to pay for help with the tasks on which the definition of independence is based, and who have long had such help, may not regard this as being dependent. They might also be unaware that they

would be unable to perform these activities if they lacked the resources to pay for the service.

It might be hypothesized that health care and support services designed to foster independence would be less accessible in rural than in urban settings. However, the odds that seniors living in rural areas would lose or recover their independence did not differ significantly from the odds for urban residents.

Concluding remarks

According to longitudinal data from the National Population Health Survey, transitions between states of functional health are not invariably one-way for elderly people: a substantial number regain their independence after an episode of dependence. Thus, functional health is a dynamic process and is not uni-directional. The loss or recovery of independence is associated with a variety of demographic, health, lifestyle, and socio-economic characteristics.

Although age was not the only factor related to transitions between independence and dependence among seniors between 1994/95 and 1996/97, it was very important, ranking among a small number of “double-jeopardy” risk factors. That is, all else being equal, aging was associated with high odds of losing independence and low odds of regaining it.

Sex, too, was a “double-jeopardy” risk factor. Elderly women had higher odds than did elderly men of losing their independence and lower odds of recovering it after an episode of dependency. These results point to a paradox: men are at greater risk of dying at all ages, but at less risk of becoming dependent. This association may be related to gender roles, since independence is measured largely in terms of the ability to perform domestic tasks. Housework and shopping for necessities more often fall to women,⁵⁷ so men may be less exposed to the risk of losing independence defined in this way.

Stroke was the only chronic condition among those examined that presented a “double risk” to independent living. But to properly assess its impact, the prevalence of stroke should also be considered. Stroke affected relatively few seniors in 1994/95: less than 2% who were independent and 11% who

were dependent (Appendix Table A). By contrast, heart disease and diabetes, both of which were significantly related to the loss of independence, were reported by 13% and 9%, respectively, of independent seniors, and by 30% and 16% of those who were dependent. And back problems, which were associated with low odds of recovering independence, were reported by 35% of dependent seniors. Consequently, from a population-health perspective, the impact of heart disease, diabetes and back problems on seniors' independence can be greater than that of stroke.

Given the role of chronic conditions in the loss and recovery of independence, recent trends in some of these conditions provide clues about dependency among tomorrow's elderly. Cohorts born before 1950 are more likely than younger cohorts to have cardiovascular disease, arthritis and emphysema.⁵⁸ Heart disease has been found to be more prevalent among older cohorts, but diabetes is more common among those born after 1947.⁴⁰ These findings demonstrate the importance of longitudinal analysis, which makes it possible to treat population aging as a process in which successive cohorts reshape the profile of the elderly population.

Smoking had a significant association with dependence: smokers had lower odds of recovering their independence once they had lost it, compared with non-smokers. This finding, consistent with other studies,^{41,42} indicates that smoking cessation may not only save lives, but also reduces the burden of dependency in old age.

Two other behavioural factors—physical activity and weight (BMI)—were significantly associated with a loss of independence, suggesting some scope for developing health policies and programs designed to encourage healthy lifestyles.

Low education and low income were both associated with loss of independence. The steady increase in educational attainment among successive cohorts, and the concomitant rise in household income, especially among women,⁴⁰ might have a favourable impact on independence among the elderly in the future.

A more complete understanding of the dynamics of functional health and of the factors associated with it should enable policy-makers to better grasp the range of choices available to them. Programs designed to encourage healthy lifestyles and prevent disabling diseases such as stroke, diabetes and heart disease might be conducive to successful aging. ●

References

- 1 Statistics Canada. *Population projections for Canada, provinces and territories, 2000-2026* (Catalogue 91-520-XBP) Ottawa: Minister of Industry, 2001.
- 2 Contandriopoulos M-A. Quel avenir pour le système de soins canadien? *Isuma* 2000; 1(1): 39-43.
- 3 Health Canada. Federal, Provincial and Territorial Advisory Committee on Population Health. *Toward a Healthy Future. Second Report on the Health of Canadians*. Ottawa: Minister of Public Works and Government Services, 1999.
- 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 Swain L, Catlin G, Beudet M. The National Population Health Survey—Its longitudinal nature. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 69-82.
- 6 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18(2): 209-17.
- 7 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 281-310.
- 8 Yeo D, Mantel H, Liu TP. Bootstrap variance estimation for the National Population Health Survey. *American Statistical Association: Proceedings of the Survey Research Methods Section*. Baltimore: August 1999.
- 9 Manton KG. A longitudinal study of functional change and mortality in the U.S. *Journal of Gerontology* 1988; 43: 5153-61.
- 10 Branch LG, Ku L. Transition probabilities to dependency, institutionalization and death among the elderly over a decade. *Journal of Ageing and Health* 1989; 1: 370-408.
- 11 Rogers RG, Rogers A, Bélanger A. Active life among elderly in the United-States: Multistate life table estimates and population projections. *The Milbank Quarterly* 1989; 67 (3-4): 370-411.
- 12 Rogers RG, Rogers A, Bélanger A. Disability-free life among the elderly in the United States. *Journal of Ageing and Health* 1992; 4(1): 19-42.
- 13 Manton KG, Corder LS, Stallard E. Estimates of change in chronic disability and institutional incidence and prevalence rates in the U.S. elderly population from the 1982, 1984 and 1989 National Long Term Care Survey. *Journal of Gerontology* 1993; 48(4): S153-66.

- 14 Crimmins EM, Saito Y. Getting better and getting worse. Transitions in functional status among older Americans. *Journal of Ageing and Health* 1993; 5: 3-36.
- 15 Mor V, Wilcox V, Rakowski W, et al. Functional transitions among the elderly: Patterns, predictors, and related hospital use. *American Journal of Public Health*, 1994; 84(4): 1274-80.
- 16 Runberg MA, Parzen MI, Leonard LA, et al. Functional limitation pathways and transitions in community-dwelling older persons. *Gerontologist* 1996; 36(4): 430-40.
- 17 Béland F, Zunzunegui MV. Predictors of functional status in older people living at home. *Age and Ageing* 1999; 28: 153-9.
- 18 Allaire SH, LaValley MP, Evans SR, et al. Evidence for decline in disability and improved health among persons aged 55 to 70 years : The Framingham Heart Study. *American Journal of Public Health* 1999; 89(11): 1678-83.
- 19 Chen J, Millar WJ. Health effects of physical activity. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(1): 21-30.
- 20 Shields M, Chen J. Health among older adults. *Health Reports* (Statistics Canada, Catalogue 82-003) 2000; 11(3): 47-61.
- 21 Wolf DA, Freedman V, Marcotte J, et al. Periodicity and occurrence bias in estimates of disablement transitions. Presented at REVES 12. Los Angeles: March 20-22, 2000.
- 22 Wolf DA, Laditka SB. Stochastic modeling of active life and its expectancy. Presented at REVES 9. Rome: December 11-13, 1997.
- 23 Andersen RM, McCutcheon LA, Aday LA, et al. Exploring dimensions of access to medical care. *Health Services Research* 1983; 18(1): 49-74.
- 24 Evans RG, Stoddart GL. *Producing Health, Consuming Health Care*. CHEPA Working Paper No. 90-6. Hamilton, Ontario: McMaster University, 1990.
- 25 Verbrugge L, Jetté AM. The disablement process. *Social Science and Medicine* 1994; 38(1): 1-14.
- 26 Jagger C, Spiers NA, Clarke M. Factors associated with decline in function, institutionalization and mortality of elderly people. *Age and Ageing* 1993; 22: 190-7.
- 27 Kaplan GA, Strawbridge WJ, Camacho T, et al. Factors associated with change in physical functioning in the elderly: a six-year prospective study. *Journal of Ageing and Health* 1993; 5: 140-53.
- 28 Grundy E, Glaser K. Trends in, and transitions to, institutional residence among older people in England and Wales, 1971-91. *Journal of Epidemiology and Community Health* 1997; 51: 531-40.
- 29 Trottier H, Martel L, Houle C, et al. Living at home or in an institution: What makes the difference for seniors? *Health Reports* (Statistics Canada, Catalogue 82-003) 2000; 11(4): 49-61.
- 30 Gilmore J. Body mass index and health. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 11(1): 31-43.
- 31 World Health Organisation. *Obesity: Preventing and Managing the Global Epidemic*. Geneva: World Health Organisation, 1997.
- 32 Golini A, Amendola G, Falorni C. Height, body mass index and self-perceived health. The case of the Italian population. Presented at REVES 12. Los Angeles: March 20-22, 2000.
- 33 Himes CL. Obesity, disease, and functional limitation in later life. *Demography* 2000; 37(1): 73-82.
- 34 Folsom AR, Kaye SA, Sellers TA, et al. Body fat distribution and 5-year risk of death in older women. *Journal of the American Medical Association* 1993; 269: 483-7.
- 35 Manson JE, Willett WC, Stampfer MJ, et al. Body weight and mortality among women. *New England Journal of Medicine* 1995; 333: 677-85.
- 36 Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist* 1969; 9(3): 179-86.
- 37 Katz S, Ford AB, Moskowitz RW. Studies of illness in the aged. The Index of ADL, a standardized measure of biological and psychological function. *Journal of the American Medical Association* 1963; 185(12): 914-9.
- 38 World Health Organization. *Physical Status: The Use and Interpretation of Anthropometry, Report of the WHO Expert Committee* (WHO Technical Report Series, No. 854) Geneva: World Health Organization, 1995.
- 39 National Health and Welfare. *Canadian Guidelines for Healthy Weights*. Report of an Expert Group convened by Health Promotion Directorate, Health Services and Promotion Branch. Ottawa: Minister of National Health and Welfare, 1988.
- 40 Chen J, Millar WJ. Are recent cohorts healthier than their predecessors? *Health Reports* (Statistics Canada, Catalogue 82-003) 2000; 11(4): 9-23.
- 41 Nusselder WJ, Looman CW, De Mheen PJ, et al. Smoking and the compression of morbidity. *Journal of Epidemiology and Community Health* 2000; 54(8): 566-74.
- 42 Martel L, Bélanger A, Berthelot J-M. Smoking and disability-free life expectancy in Canada. *Report on the Demographic Situation in Canada* (Statistics Canada, Catalogue 91-209) Ottawa: Minister of Industry, 2001.
- 43 Spies CD, Sander M, Stangl K, et al. Effects of alcohol on the heart. *Current Opinion in Critical Care* 2001; 7(5): 337-43.
- 44 Murray RP, Connett JE, Tyas SL, et al. Alcohol volume, drinking pattern, and cardiovascular disease morbidity and mortality: Is there a U-shaped function? *American Journal of Epidemiology* 2002; 155(3): 242-8.
- 45 Millar WJ, Stephens T. Social status and health risks in Canadian adults: 1985 and 1991. *Health Reports* (Statistics Canada, Catalogue 82-003) 1992; 5(2): 143-56.
- 46 Béland Y, Bustros J. *Aperçu global de la qualité de l'enquête nationale sur la santé de la population*. Assemblée annuelle de la SSC, Recueil de la Section des méthodes d'enquêtes, 1998.
- 47 Tambay J-L, Schioppa-Kratina I, Mayda J, et al. Treatment of nonresponse in cycle two of the National Population Health Survey. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1998; 24(2): 147-56.
- 48 Miller RE, Massagli MP, Clarridge BR. Quality of proxy vs. self reports: evidence from a health survey with repeated measures. *American Statistical Association: Proceedings of the Section on Survey Research Methods*. Washington, DC: American Statistical Association, 1986: 546-51.
- 49 National Center for Health Statistics. Reporting of hospitalization in the Health Interview Survey. *Vital and Health Statistics* 1973; 2(54): 1-24.

50 Shields M. Proxy reporting in the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 2000; 12(1): 21-39.

51 Losonczy KG, Harris TB, Coroni-Huntley EM, et al. Does weight loss from middle age to old age explain the inverse weight mortality relation in old age? *American Journal of Epidemiology* 1995; 141: 312-21.

52 Baumgartner RN, Heymsfield SB, Roche AF. Human body composition and the epidemiology of chronic disease. *Obesity Research* 1995; 3: 73-95.

53 Hayflick L. *How and Why We Age*. New York: Ballantine, 1996.

54 Kuskowska-Wolk A, Karlsson P, Stolt M, et al. The predictive validity of body mass index on self-reported weight and height. *International Journal of Obesity* 1989; 13(4): 441-53.

55 Rowland ML. Self-reported weight and height. *American Journal of Clinical Nutrition* 1990; 52(6): 1125-33.

56 Wilkins K, Park E. Chronic conditions, physical limitations and dependency among seniors living in the community. *Health Reports* (Statistics Canada, Catalogue 82-003) 1996; 8(3): 7-15.

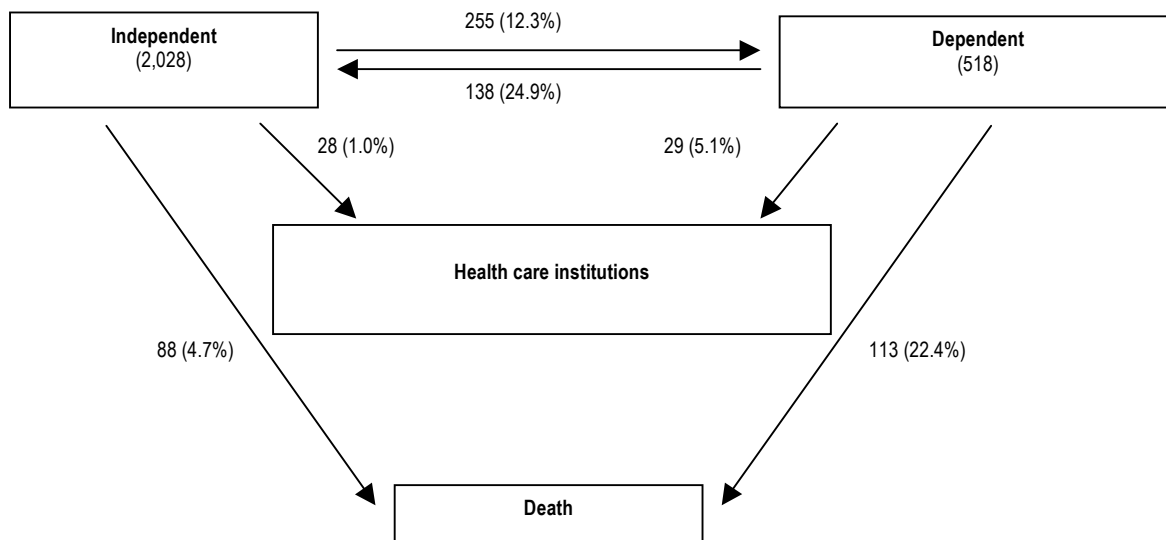
57 Marshall K. Employed parents and the division of housework. *Perspectives on Labour and Income* (Statistics Canada, Catalogue 75-001E) 1993; 5(3): 23-30.

58 Reynolds SL, Crimmins EM, Saito Y. Cohort differences in disability and disease presence. *Gerontologist* 1998; 38(5): 578-90.

Appendix

Chart A

Dynamics of dependency over two years, household population aged 65 or older, Canada excluding territories, 1994/95 to 1996/97



Data source: 1994/95 and 1996/97 National Population Health Survey, longitudinal sample, Health file
Note: Percentages in parentheses based on weighted data

Table A

Selected characteristics of independent and dependent household population aged 65 or older, Canada excluding territories, 1994/95

	<u>Independent</u>		<u>Dependent</u>		<u>Independent</u>		<u>Dependent</u>	
	Sample size		Sample size		Sample size		Sample size	
Average age (years)	72.4	1,921 [†]	77.5	399 [‡]				
	%		%		%		%	
Sex								
Men	45.2	796	25.5	89				
Women	54.8	1,125	74.5	310				
Age								
65-69	37.9	652	17.5	67				
70-74	30.7	583	21.0	86				
75-79	18.7	385	24.0	92				
80-84	8.3	214	19.4	86				
85+	4.5	87	18.2 ^{E1}	68				
Living arrangements								
With spouse	59.0	893	39.9	129				
Alone	29.5	880	43.0	238				
With others, no spouse	11.5	148	17.1 ^{E1}	32				
Chronic condition								
Asthma	4.5	86	6.9 ^{E1}	32				
Arthritis	36.0	739	66.0	274				
Back problems (excluding arthritis)	15.3	289	35.2	126				
Bronchitis/Emphysema	5.0	100	12.7 ^{E1}	50				
Diabetes	9.2	160	16.0 ^{E1}	60				
Heart disease	13.1	264	29.5	114				
Cancer	4.2	78	6.7 ^{E1}	26				
Effects of stroke	1.9 ^{E1}	36	11.1 ^{E1}	42				
Urinary incontinence	2.4 ^{E1}	45	9.9 ^{E1}	39				
Glaucoma/Cataracts	13.3	294	28.0	102				
Body mass index								
Underweight					3.2	56	4.3 ^{E2}	23
Acceptable					44.5	843	49.0	191
Overweight/Obese					51.3	1,011	45.2	181
Missing					F	11	F	4
Physical activity								
Active					68.4	1,275	28.4	119
Inactive					26.3	574	57.6	254
Missing					5.3	72	14.0 ^{E1}	26
Smoking								
Smoker					13.9	265	15.7 ^{E1}	58
Non-smoker					86.1	1,656	84.3	341
Alcohol consumption								
Regular drinker					4.1	79	F	8
Occasional/Non-drinker					95.9	1,842	97.6	391
Education								
Less than postsecondary graduation					82.3	1,603	82.0	333
Postsecondary graduation					17.7	318	18.0	66
Household income								
Low					21.8	576	36.0	181
Medium/High					72.8	1,249	60.3	202
Missing					5.4	96	3.7 ^{E2}	16
Area of residence								
Urban					82.8	1,399	82.1	283
Rural					17.2	522	17.9	116

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

Note: Percentages calculated using weighted data

[†] Figure obtained by subtracting 88 deaths and 17 cases for which values were missing from the 2,028 independent seniors observed in 1994/95.

[‡] Figure obtained by subtracting 113 deaths and 5 cases for which values were missing from the 518 dependent seniors observed in 1994/95.

E1 Coefficient of variation between 16.6% and 25.0%

E2 Coefficient of variation between 25.1% and 33.3%

F Coefficient of variation greater than 33.3%