

Social support and mortality in seniors

Kathryn Wilkins

Abstract

Objectives

This article investigates the effect of social support on mortality among Canadian seniors.

Data source

The analysis is based on longitudinal household data from the National Population Health Survey (NPHS) for 2,422 people aged 65 or older in 1994/95. Vital status and date of death were established using data collected in 2000/01.

Analytical techniques

Multivariate proportional hazards models were used to study associations between four indicators of social support (marital status; social contacts; participation in organizations; and perceived emotional support) in 1994/95 and death by 2000/01. Separate analyses were performed for men and women.

Main results

When the influence of age, socio-economic status, stress, health-related behaviours and physical/mental health status was taken into account, no association between social support and mortality emerged for women, but such a relationship was evident for men. Married men had a 40% lower hazard of death, compared with their non-married counterparts. Participation in organizations also conferred a reduced likelihood of dying for men.

Key words

marital status, death, longitudinal studies, health surveys

Author

Kathryn Wilkins (613-951-1769; kathryn.wilkins@statcan.ca) is with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

As baby boomers approach retirement, the proportion of seniors in the Canadian population is about to increase dramatically. Projections indicate that by 2016, one in six people will be aged 65 or older; in 2001, the ratio was one in eight.¹ Substantial gains in seniors' life expectancy are contributing to this growth. Men aged 65 in 1996 could expect to live another 16 years, and women, nearly 20 more.²

Aside from physical health and socio-economic status, other factors influence how long seniors will survive into old age. Over the past two decades, evidence has accumulated indicating that people with weak social ties are at greater risk of death, even when age, physical limitation and illness, and socio-economic status are taken into account.³⁻¹⁶

The consistency of the relationship between social support and mortality by sex is less clear.¹⁷ Although more evidence supports such a relationship for men than for women, most studies have not examined the sexes separately.

This article, based on longitudinal data from the National Population Health Survey (NPHS), investigates the association between social support

Data source

This article focuses on men and women aged 65 or older who were residents of private households in the ten provinces in 1994/95. The data are from the longitudinal component of the National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both longitudinal and cross-sectional components.

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

Among individuals in the longitudinal component of the NPHS, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for the household in cycle 1 and was usually the person who provided information about all household members for the General file in subsequent cycles.

In 1994/95, the NPHS collected information from a sample of 20,725 households. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents. Beginning with cycle 4 in 2000/01, the NPHS became strictly longitudinal. Of the original panel of 17,276 respondents, 957 had died and 135 had been institutionalized; 13,559 were interviewed, for a response rate of 84.8% in cycle 4. More detailed descriptions of the NPHS design, sample and interview procedures can be found in published reports.^{18,19}

In this analysis, frequencies and bivariate tabulations were carried out using the sample of people who in 1994/95 resided in households and were aged 65 or older, and for whom data for the cycles 1 and 4 surveys were available: 954 men and 1,468 women (Appendix Tables A and B). Multivariate analysis was based on data from the respondents for whom no responses were missing on the variables used in any of the multivariate models: 804 men and 1,303 women.

and mortality in the Canadian senior population (see *Data source, Analytical techniques, Definitions and Limitations*). Specifically, the analysis tests the hypothesis that social support is predictive of survival in people aged 65 or older who live in private households. Because of differences in men's and women's social relationships, each sex is analyzed separately (see *Gender differences in social support*).

The analysis is based on Sugisawa's theoretical framework,²⁰ which consolidates the work of other researchers. The framework, which proposes that social relationships influence the risk of dying through physical health and health behaviour, comprises three sets of variables: socio-demographic characteristics and social relationships; physical health and health-related behaviours (mediating variables); and death, the dependent variable. This analysis focuses on the social support aspects—marital status, contacts with family, friends and neighbours, participation in organizations and

Gender differences in social support

In 1994/95, among the household population aged 65 or older, men were much more likely than women to be married. However, the level of perceived emotional support did not differ by sex, possibly because women participated in social organizations and pursued social contacts outside the home more often than did men. Previous research suggests that social support increases for women after the death of their spouse,²¹ and that women generally have a wider range of sources of emotional support than do men, who tend to rely on their spouse for most of their social support.^{22,23}

Social support, by sex, household population aged 65 or older, Canada excluding territories, 1994/95

	Men	Women
Married (%)	76*	45
Participation in organizations (mean)	3.0*	3.7
Social contacts (mean)	4.1*	4.3
Emotional support (mean)	3.6	3.7

Data source: 1994/95 National Population Health Survey, cross-sectional sample, Health file
 * Significantly different from estimate for women ($p < 0.05$)

perceived emotional support among Canadian seniors (see *Measures of social support*). The influence of mastery (a psychological resource) is also considered, as it is thought to affect social participation and perceived social support, and has been reported to have a protective effect against death.^{4,24}

Men die sooner

Among people who were aged 65 or older in 1994/95 when they were interviewed for the NPHS, the likelihood of death before 2000/01 was substantially higher for men than for women (Table 1). Even though the average age of elderly

respondents in 1994/95 did not differ by sex (data not shown), women survived an average of about 3 months (96 days) longer in the follow-up period.

Table 1
Percentage who died by 2000/01 and mean survival time, by sex, household population aged 65 or older in 1994/95, Canada excluding territories

	Men	Women
Died (%)	32*	21
Mean number of days survived	1,906*	2,003

Data source: 1994/95 and 2000/01 National Population Health Survey, longitudinal sample, Health file

* Significantly different from estimate for women ($p < 0.05$)

Measures of social support

Two categories were established for *marital status*. People who reported that they were now married, living common-law or living with a partner were classified as married; reports of single (never married), widowed, separated or divorced were grouped as not married.

To determine *participation in organizations*, respondents were asked:

- How often did you participate in meetings or activities sponsored by these groups (voluntary organizations or associations such as school groups, church social groups, community centres, ethnic associations or social, civic or fraternal clubs) in the past 12 months?
- Other than on special occasions (such as weddings, funerals or baptisms), how often did you attend religious services or religious meetings in the past 12 months?

The response range was 0 to 8, with a higher score indicating greater participation. In bivariate analysis, a score of 0 was defined as a low participation; 25% of respondents in the weighted distribution fell into this category. Scores of 1 through 8 were considered to reflect high participation. In multivariate analysis, the score was used as a continuous variable.

Social contacts was based on responses to the following item: The next few questions are about your contact in the past 12 months with persons who do not live with you—in person, by phone or by mail. If you have more than one person in a category, for example, several sisters, think of the one with whom you have the most contact. How often did you have contact with: your parents or parents-in-law; your grandparents; your daughters or daughters-in-law; your

sons or sons-in-law; your brothers or sisters; other relatives (including in-laws); your close friends; your neighbours? Response categories were: don't have any; every day; at least once a week; 2 or 3 times a month; once a month; a few times a year; once a year; never. The number of contacts were summed and then divided by the number of existing network sectors (for example, grandparents and siblings would each be counted as a sector) who could be counted, up to a maximum of 8. The response range was 0 to 6, with a higher number indicating more contacts. In bivariate analysis, infrequent contact was defined by scores of 0 through 3, which accounted for 20% of respondents in the weighted distribution. Frequent contact was defined as a score of 4 through 8. In multivariate analysis, the score was used as a continuous variable.

Perceived emotional support was measured by summing the responses to four questions: Do you have someone:

- you can confide in, or talk to about your private feelings or concerns?
- you can really count on to help you out in a crisis situation?
- you can really count on to give you advice when you are making important personal decisions?
- who makes you feel loved and cared for?

Each "no" response was scored 0; each "yes," 1. The scores were summed and had a response range of 0 to 4, with a higher score indicating greater emotional support. For bivariate analysis, emotional support was categorized as low or high, with scores of 0 through 3 defined as low (23% of the weighted distribution), and a score of 4, high. In multivariate analysis, the score was used as a continuous variable.

Analytical techniques

A total of 2,740 household residents interviewed in 1994/95 for the National Population Health Survey (NPHS) were aged 65 or older. Of these respondents, 318 were excluded from this analysis: 55 because of an incomplete cycle 1 interview, and the remaining 263 because of incomplete information or non-response to the cycle 4 interview in 2000/01. Of the remaining sample of 2,422 respondents, 1,745 were still alive and living in households or institutions by the time of the cycle 4 interview; 677 (334 men and 343 women) were reported to be deceased in cycle 4 and had resided in households or institutions at the time of their death.

Date of death was not available for 118 of the 677 respondents reported deceased because linkage to Statistics Canada's Canadian Mortality Database, routinely attempted on the records of all NPHS respondents who are reported to have died, could not be successfully completed. For most (90) of them, contact with an NPHS interviewer had occurred in cycle 3 (1998/99), and death had been reported in cycle 4 (2000/01). In these cases, linkage was not possible because the death records were not yet included in the Mortality Database. For the remaining 28 respondents whose deaths had occurred earlier, failure to link with the Mortality Database resulted from discrepancies in data, missing information on maiden name, and/or delays in receiving the death record at Statistics Canada.

For the 118 respondents reported deceased but with no date of death, a date was generated so that they could be included in the analysis. The year of death was calculated as the most recent year in which the respondent's "alive" vital status had been reported by an NPHS interviewer, plus one. For example, a person last interviewed in 1998/99 who was reported deceased in the cycle 4 interview was assigned 1999 as the year of death. January 1 was used for month and day of death.

Bivariate tabulations were used to examine the distribution of independent variables for men and women in cycle 1, and for people who died and those who survived. Differences in proportions of the independent variables were assessed between survivors and decedents; significance was designated as $p < 0.05$.

Multivariate proportional hazards analysis was used to assess the association between social support and time to death. The proportional hazards coefficient estimates the effect on survival time of each covariate entered in the model. For respondents who died during the follow-up period, the duration of survival was measured as the number of days from the date of the cycle 1 interview until the date of death at some time before the cycle 4 interview. For people who completed the cycle 4 interview, the duration of survival was defined as the difference in days between the cycles 1 and 4 interviews; after the cycle 4 interview, the survival time was considered censored.

This analysis used a series of proportional hazards models into which the independent variables reflecting social support together

with age, and then groups of other control variables, were cumulatively entered. Change that occurs in the hazards ratios for control variables known to be linked to mortality (for example, level of education) can be observed as additional variables are added to the model. Separate analyses were conducted for men and women. Selection of variables was based on the literature, which delineates distinct components of social relationships (social networks, social involvement, and emotional support),^{25,26} as well as on availability in the NPHS. Because all the control variables included in this analysis have been shown to be predictive of mortality, most were retained in successive models regardless of whether they were significant. The exception was household income, which was first included in a model with level of education, but dropped from successive models because of the possibility of multicollinearity.

Preliminary proportional hazards analyses were carried out to test for interaction effects between psychological distress and each social support variable (marital status, social contacts, participation in organizations, and perceived emotional support). The continuous variables included in the interaction terms (psychological distress, social contacts, participation in organizations, and perceived emotional support) were first centered by calculating the weighted mean of each variable and subtracting it from the value of the variable. Each interaction term was included separately in the full multivariate model; none was significantly associated with mortality, suggesting that social support did not buffer the effect of psychological distress (data not shown).

Preliminary proportional hazards models were also produced to examine the relationship between age and survival, using a term for age-squared. With the age-squared term in the model, the association between time of death and age-squared was not significant, suggesting that the relationship was not exponential (data not shown).

Model 1 includes age and the four factors reflecting social support; for Model 2, variables indicating socio-economic status (education and household income) were added. A variable measuring mastery, which indicates a sense of control over one's life, was incorporated in Model 3. For Model 4, health-related behaviours—smoking status and leisure-time physical activity level—were added. Model 5 includes a variable reflecting psychological distress. Model 6, the full model, was constructed by adding variables reflecting physical health: selected chronic conditions, functional impairment (need for help with the activities of daily living), and health status as measured by the Health Utilities Index.

The data were weighted to reflect the age and sex distribution of the household population aged 65 or older in 1994. To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.²⁷⁻²⁹

Table 2
Percentage who died by 2000/01, by sex and selected characteristics, household population aged 65 or older in 1994/95, Canada excluding territories

	Men	Women
	%	
Total	32.3 [†]	21.3
Age group		
65-74	22.6*	10.7*
75-84	45.1*	34.9*
85+ [‡]	64.2	48.0
Social support		
Marital status		
Married	27.1*	17.6*
Not married [‡]	48.3	24.4
Participation in organizations		
Infrequent	33.1	32.6*
Frequent [‡]	28.5	17.0
Social contacts		
Infrequent	27.5	24.1
Frequent [‡]	30.5	19.7
Emotional support		
Low	30.6	21.5
High [‡]	29.6	20.1
Socio-economic status		
Household income		
Lower	48.5*	25.5*
Higher [‡]	29.7	19.7
Education		
Less than secondary graduation	38.5*	24.1*
Secondary graduation or more [‡]	24.3	18.1
Mastery		
Low	37.7*	29.4*
High [‡]	26.4	17.4
Health-related behaviour		
Leisure time		
Moderately active/Active [‡]	22.6	13.6
Inactive	34.6*	22.8*
Smoking		
Daily/Occasional	34.9	25.4
Former smoker	32.2	23.3
Never smoked [‡]	30.2	19.4
Health status		
Psychological distress		
High	33.6*	23.7*
Low [‡]	24.6	11.5
Cancer		
Yes	66.2*	39.0*
No [‡]	30.3	20.3
Diabetes		
Yes	41.1	41.4*
No [‡]	31.0	19.3
Heart disease		
Yes	53.6*	32.8*
No [‡]	27.4	19.2
Respiratory disease		
Yes	54.0*	41.3*
No [‡]	30.3	20.1
Effects of stroke		
Yes	67.9*	43.7*
No [‡]	30.6	20.5
Functional dependency		
Yes	81.3*	58.1*
No [‡]	29.3	19.0
Health Utility Index 3		
High	50.6*	36.4*
Low [‡]	26.4	15.5

Data source: 1994/95 and 2000/01 National Population Health Survey, longitudinal sample, Health file

[†] Significantly different from estimate for women ($p < 0.05$)

[‡] Reference category

* Significantly different from sex-specific estimate for reference category ($p < 0.05$)

Social support related to survival for men

The percentage of seniors who died differed significantly by marital status. For both sexes, the proportion who died was higher among those who were not married than among those who were married (Table 2). As well, women with infrequent participation in organizations were more likely to die sooner than women who participated more often.

With adjustment for age and other potential influences (socio-economic status, mastery, health-related behaviours, and mental and physical health status), the protective effect of being married remained for men, but not women (Tables 3 and 4). Married men had a 40% lower hazard of death, compared with men who were not married. As well, for men, even when the other factors were taken into account, participation in organizations remained positively associated with survival (Table 3, Model 6). For women, the association between participation in organizations and survival was attenuated slightly and lost statistical significance ($p = 0.06$) when smoking, level of leisure-time physical activity and psychological distress were considered (Table 4, Models 4 and 5), and disappeared with the addition of variables for physical health (Table 4, Model 6).

The finding that being married confers a protective effect against mortality for men, but not women, is consistent with results of an earlier report based on Canadian mortality data, as well as studies elsewhere that have controlled for other influences.^{5,30-33} Other reports have also noted a benefit only to men when social support was more broadly defined to include social networks, social ties, frequency of contacts and involvement in associations.^{5,34}

Education a factor for men

Seniors who died tended to have lower socio-economic status than their counterparts who survived. The likelihood of dying was significantly higher among people who had not finished high school and among those who lived in lower income households, compared with more highly educated and more affluent individuals (Table 2). This difference did not reflect generally lower education

among the oldest seniors, who would, of course, be the most likely to die. At age 80 or older, the proportion who had not graduated from high school was not statistically greater than that for 65- to 79-year-olds (data not shown), suggesting that factors apart from age accounted for the association between death and lower educational attainment.

When other potential influences were taken into account, education was linked with mortality in men, although its level of significance changed as control variables were added to the models (Table 3). No similar finding emerged for women (Table 4).

As expected, differences in some health-related behaviours distinguished seniors who had died by

Table 3
Adjusted proportional hazard ratios for death by 2000/01, by selected characteristics, male household population aged 65 or older in 1994/95, Canada excluding territories

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval
Age†	1.1*	1.1, 1.1	1.1*	1.0, 1.1	1.1*	1.1, 1.1	1.1*	1.0, 1.1	1.1*	1.1, 1.1	1.1*	1.0, 1.1
Social support												
<i>Marital status</i>												
Married	0.6*	0.4, 0.8	0.6*	0.5, 0.9	0.6*	0.4, 0.8	0.6*	0.4, 0.9	0.6*	0.4, 0.9	0.6*	0.4, 0.8
Not married‡	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...
<i>Participation in organizations†</i>												
Social contacts†	0.9*	0.8, 1.0	0.9*	0.9, 1.0	0.9*	0.9, 1.0	0.9*	0.9, 1.0	0.9*	0.9, 1.0	0.9*	0.9, 1.0
Emotional support†	1.1	0.9, 1.3	1.0	0.9, 1.2	1.1	0.9, 1.2	1.1	0.9, 1.3	1.1	0.9, 1.3	1.1	0.9, 1.4
Socio-economic status												
<i>Household income</i>												
Lower			1.4	0.9, 2.0								
Higher†			1.0	...								
<i>Education</i>												
Less than secondary graduation†			1.0	...	1.0	...	1.0	...	1.0	...	1.0	...
Secondary graduation or more			0.7*	0.5, 1.0	0.7*	0.5, 1.0	0.7	0.5, 1.1	0.8	0.5, 1.1	0.7*	0.5, 1.0
Mastery†					1.0	0.9, 1.0	1.0	0.9, 1.0	1.0	0.9, 1.0	1.0	1.0, 1.0
Health-related behaviour												
<i>Leisure time</i>												
Moderately active/Active							0.7	0.5, 1.1	0.8	0.5, 1.1	0.8	0.5, 1.2
Inactive‡							1.0	...	1.0	...	1.0	...
<i>Smoking</i>												
Daily/Occasional†							1.0	...	1.0	...	1.0	...
Former smoker							1.1	0.7, 1.6	1.2	0.8, 1.8	1.2	0.7, 2.0
Never smoked							0.8	0.5, 1.4	0.9	0.5, 1.6	1.2	0.6, 2.2
Health status												
Psychological distress†									1.1*	1.0, 1.1	1.0	1.0, 1.1
Cancer§											2.9*	1.5, 5.7
Diabetes§											1.2	0.7, 2.3
Heart disease§											1.7*	1.1, 2.6
Respiratory disease§											2.1*	1.3, 3.5
Effects of stroke§											1.3	0.5, 3.3
Functional dependency§											1.2	0.4, 3.1
Health Utility Index 3†											0.7	0.4, 1.6

Data source: 1994/95 and 2000/01 National Population Health Survey, longitudinal sample, Health file
 Notes: All models are based on sample of 804 men for whom there were no missing values on any variable included. Because of rounding, some confidence intervals with 1.0 as lower/upper limit are significant.
 † Treated as continuous variable
 ‡ Reference category
 § Reference category is absence of condition.
 * $p < 0.05$

2000/01 from those who survived. For example, among those who were inactive in their leisure time, a higher proportion died, compared with those who were more active (Table 2). This is consistent with previous reports showing a protective association between physical activity and mortality.^{3,35,36}

Psychological distress

The likelihood of death was significantly higher among people reporting high psychological distress in 1994/95 (Table 2). When age, mastery and health-related behaviours were controlled, a positive association between psychological distress and

Table 4
Adjusted proportional hazard ratios for death by 2000/01, by selected characteristics, female household population aged 65 or older in 1994/95, Canada excluding territories

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval	Proportional hazard ratio	95% confidence interval
Age†	1.1*	1.1, 1.1	1.1*	1.1, 1.1	1.1*	1.1, 1.1	1.1*	1.1, 1.1	1.1*	1.1, 1.1	1.1*	1.1, 1.1
Social support												
<i>Marital status</i>												
Married	1.2	0.8, 1.8	1.3	0.8, 1.9	1.2	0.8, 1.8	1.2	0.8, 1.8	1.2	0.8, 1.8	1.2	0.8, 1.8
Not married‡	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...
<i>Participation in organizations§</i>	0.9*	0.9, 1.0	0.9*	0.9, 1.0	0.9*	0.9, 1.0	0.9	0.9, 1.0	0.9	0.9, 1.0	1.0	0.9, 1.0
<i>Social contacts†</i>	1.1	0.9, 1.3	1.1	0.9, 1.3	1.1	0.9, 1.3	1.1	0.9, 1.3	1.1	0.9, 1.3	1.1	0.9, 1.3
<i>Emotional support†</i>	0.9	0.7, 1.1	0.9	0.7, 1.1	0.9	0.7, 1.1	0.9	0.7, 1.1	1.0	0.8, 1.3	1.0	0.8, 1.3
Socio-economic status												
<i>Household income</i>												
Lower			1.1	0.8, 1.6								
Higher‡			1.0	...								
<i>Education</i>												
Less than secondary graduation†			1.0	...	1.0	...	1.0	...	1.0	...	1.0	...
Secondary graduation or higher			0.9	0.6, 1.2	0.9	0.7, 1.2	0.9	0.7, 1.2	0.9	0.7, 1.3	0.9	0.6, 1.3
Mastery†					0.9*	0.9, 1.0	0.9*	0.9, 1.0	1.0	0.9, 1.0	1.0	0.9, 1.0
Health-related behaviour												
<i>Leisure time</i>												
Moderately active/Active							0.7	0.5, 1.2	0.7	0.4, 1.2	0.8	0.5, 1.3
Inactive‡							1.0	...	1.0	...	1.0	...
<i>Smoking</i>												
Daily/Occasional†							1.0	...	1.0	...	1.0	...
Former smoker							1.0	0.6, 1.7	1.2	0.7, 2.2	1.1	0.6, 2.1
Never smoked							0.6	0.4, 1.0	0.7	0.4, 1.3	0.7	0.4, 1.3
Health status												
Psychological distress†									1.1*	1.0, 1.1	1.1*	1.0, 1.1
Cancer§											2.2*	1.2, 4.0
Diabetes§											1.5	0.9, 2.4
Heart disease§											1.4	0.9, 2.1
Respiratory disease§											1.5	0.8, 2.8
Effects of stroke§											1.4	0.7, 2.9
Functional dependency§											1.2	0.6, 2.4
Health Utility Index 3†											0.6	0.3, 1.2

Data source: 1994/95 and 2000/01 National Population Health Survey, longitudinal sample, Health file
Notes: All models are based on a sample of 1,303 women for whom there were no missing values on any variable included. Because of rounding, some confidence intervals with 1.0 as upper/lower limit are significant.
 † Treated as continuous variable
 ‡ Reference category
 § Reference category is absence of condition.
 ... Not applicable
 * $p < 0.05$

Definitions

Vital status (dead or alive at the time of the 2000/01 interview) defines the dependent variable in bivariate analysis. It was also used with duration of survival in proportional hazards modelling.

Duration of survival is calculated from the date of the National Population Health Survey (NPHS) cycle 1 interview in 1994/95. A date of death was generated for those for whom the date was unavailable (see *Analytical techniques*). Duration of survival ranged from 4 days to 2,590 days.

In bivariate analysis, *age* was defined categorically: 65 to 74, 75 to 84, and 85 or older. In multivariate analysis, age was used as a continuous variable, based on years of age as reported in cycle 1. A multiplicative term for age (age-squared) was also defined.

Two *household income* groups, based on household size and total household income from all sources in the 12 months before the 1994/95 interview, were derived:

Household income group	People in household	Total household income
Lower	1 or 2	Less than \$15,000
	3 or 4	Less than \$20,000
	5 or more	Less than \$30,000
Higher	1 or 2	\$15,000 or more
	3 or 4	\$20,000 or more
	5 or more	\$30,000 or more

Education was categorized as less than high school graduation, or high school graduation or more.

Mastery measures the extent to which individuals believe that their life chances are under their control. Respondents were asked to react to seven items, which were ranked on a five-point scale ranging from "strongly agree" (score 0) to "strongly disagree" (score 4):

- You have little control over the things that happen to you.
- There is really no way you can solve some of the problems you have.
- There is little you can do to change many of the important things in your life.
- You often feel helpless in dealing with problems of life.
- Sometimes you feel that you are being pushed around in life.
- What happens to you in the future mostly depends on you (reverse scored).
- You can do just about anything you really set your mind to (reverse scored).

The responses were summed; possible scores ranged from 0 to 28, with a higher score indicating a higher sense of mastery. For bivariate analysis, the total score was categorized into two groups: low (scores 0 through 16, which fell in the lower quartile of the weighted distribution), and high (over 16). In multivariate analysis, mastery was treated as a continuous variable. Cronbach's alpha for this scale was 0.76.³⁷

Level of *leisure-time physical activity* was based on total accumulated energy expenditure, or EE. EE was calculated from the reported frequency and duration of a respondent's leisure-time physical activities in the three months before the cycle 1 interview and the metabolic energy demand of each activity.^{38,39} Leisure time was classified as being moderately active/active (1.5 or more

kilocalories per kilogram per day) or inactive (less than 1.5). An example of moderately active leisure time would be walking for an hour four times a week. Leisure-time physical activity that consisted only of gardening or yardwork for an hour a week would be categorized as inactive.

Smoking status was determined by asking respondents if they smoked cigarettes daily, occasionally, or not at all. Three groups were established: daily/occasional smoker, former smoker and never smoked.

The measure of *psychological distress* was based on responses to the following questions: During the past month, about how often did you feel:

- so sad that nothing could cheer you up?
- nervous?
- restless or fidgety?
- hopeless?
- worthless?
- that everything was an effort?

Each question was answered on a five-point scale, ranging from "none of the time" (score 0) to "all of the time" (4). Responses were scored and summed. Total scores could range from 0 to 24, with a higher score indicating greater distress. In bivariate analysis, the score was categorized in two groups, with 0, which covered 32% of responses in the weighted distribution, indicating low distress, and 1 through 24, high distress. In multivariate analysis, the score was used as a continuous variable. Cronbach's alpha for this scale was 0.77.⁴⁰

Respondents were asked if they had any of a number of "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." Interviewers read a list of *chronic conditions*, the following of which were considered in this analysis: cancer, diabetes, heart disease, chronic bronchitis or emphysema (respiratory disease), and effects of stroke. Conditions reported in 1994/95 were considered to be present (see *Limitations*).

Functional dependency was based on need for assistance with activities of daily living. Respondents were asked if, because of any condition or health problem, they needed help with personal care (such as washing, dressing or eating) or moving about inside the house. A "yes" response to either was considered to indicate functional dependency.

The *Health Utilities Index* (HUI3) is a summary measure that incorporates functional health and societal preferences of health states.^{41,42} Based on responses to 30 questions about eight aspects of functional health (vision, hearing, speech, mobility, dexterity, emotions, cognition, and pain and discomfort) together with a valuation component, an overall score, or index, is produced for each individual. Perfect health is rated 1.000, and death, 0.000; negative scores reflect health states considered worse than death. Possible response values of the HUI3 range from -0.360 to 1.000. For bivariate analysis, HUI3 scores in the lower quartile of the weighted distribution (from -0.324 to 0.664) were categorized as a high level of limitation, and scores above 0.664, a low level. In multivariate analysis, the HUI3 score was used as a continuous variable.

mortality emerged for men (Table 3, Model 5), but it disappeared with the addition of chronic diseases (Table 3, Model 6). For women, the relationship between distress and mortality persisted, even when controlling for chronic diseases (Table 4, Model 6). These findings suggest that the origins and impact of psychological distress differ by sex. For men,

psychological distress may simply reflect the difficulties and suffering caused by ill health, factors that affect mortality. By contrast, for women, psychological distress is apparently independent of other indicators of poor physical health, and its effect on mortality is as important.

Limitations

This analysis focuses on quantitative rather than qualitative measures of social support. Social interactions or marriages that are discordant or stressful may give rise to adverse health effects,^{25,43,44} which would likely dilute any positive association between social support and survival. Although a few National Population Health Survey (NPHS) questions address negative stressors that may stem from a marital or common-law relationship, the low frequency with which such problems were reported precluded using the data in this analysis.

Information is not available from the NPHS on some of the “upstream” factors that are thought to influence how or if people form social networks—culture, the larger economic context, and political and social change, for example.^{3,45}

Although this analysis focuses on the influence of social support on mortality, physical health may, in turn, affect social support. For example, illness may reduce participation in organizations, but increase social contacts. Because the measures of social support were taken only from information provided in cycle 1, it was not possible to study reciprocal effects that may have occurred between social support and illness.

The data file used for the analysis contains full responses on all variables in cycle 1 and vital status for the same respondents in cycle 4. Use of this file maximizes the number of records, but also limits the predictive value of the independent variables, which are based only on data collected in cycle 1. For example, a person who reported being married in cycle 1 may have subsequently lost his or her spouse, but in order to include all deaths that occurred after the cycle 1 interview, changes in marital status or the other social support factors were not considered. Similarly, people diagnosed with chronic conditions after the cycle 1 interview were categorized as not having the conditions. As a result, the observed associations with death may be weaker than they would have been had changes in the independent variables been considered.

Of the initial sample of 2,740 people aged 65 or older in cycle 1, 318 (12%) were excluded from the bivariate analysis because of incomplete information for either cycle 1 or cycle 4. An additional 315 were dropped from multivariate analysis because of missing values on variables included in the models. Selection bias may have affected the results if those who were dropped differed from the remaining sample in mortality, level of social support, or both. For example, if the respondents lost to follow-up generally had less social support and also experienced a higher rate of death than those who continued, the association between these factors would have been stronger if the analysis had included these people.

Missing information necessitated generating a date of death for 17% of records, which reduced the accuracy of the calculation of days of survival. To address the issue of missing date of death, the data were also analyzed using logistic regression. This analysis was based on the proportion of people surviving the interval between surveys, rather than the duration of survival—the basis of the proportional hazards regression analysis. The results of the logistic regression analysis were highly consistent with those of the proportional hazards regressions; that is, using either approach, the same variables were significantly predictive of death (data not shown).

Small cell sizes for the education and household income variables precluded defining more than two categories. A finer breakdown of these variables might have revealed gradients in their association with death.

Information was not available for objective measures of health (for example, blood pressure, blood chemistry, severity of disease, or diet) that may influence survival, or for many other factors (for example, personal and genetic) that affect the way people perceive and/or receive social support or resist disease and death.⁴⁶

NPHS data are self- or proxy-reported, and the degree to which they are biased because of reporting error is unknown. Reports of chronic or other conditions were not validated against clinical records.

Physical health: relationships differ by sex

As expected, the likelihood of death was greater for seniors with chronic diseases, functional dependency or impaired physical function (as measured by the Health Utilities Index), compared with those without these conditions (Table 2). Previous research, indicating that decreased self-care capacity is a precursor of death,^{36,47} is consistent with the finding that dependency on others for activities of daily living was also much more common among people who died.

Even when the effects of other influences were controlled, men who reported in 1994/95 that they had been diagnosed with cancer, heart disease or respiratory disease had higher hazard ratios for death by 2000/01 than did men without these diagnoses (Table 3). For women, when the other factors were taken into account, cancer was the only physical health variable linked to mortality (Table 4). The lack of relationships between mortality and other chronic conditions (diabetes, effects of stroke, and functional dependency, for example) was likely caused by insufficient statistical power resulting from the relatively low prevalence of such conditions.

Concluding remarks

The findings of this analysis, based on data from a panel of senior household residents who were followed over approximately six years, partly support the hypothesis that individual components of social support are linked to survival. The results extend previous observations of the role of social support in relation to death. Among men aged 65 or older, but not among their female counterparts, being married and participating in organizations were each independently predictive of survival.

One of the strengths of this analysis of the National Population Health Survey data is that the number of deaths of men and women during the follow-up period was roughly the same. Therefore, the disparity in the results by sex is not caused by insufficient statistical power, an explanation that has been offered for similar findings.¹³ The basis for the difference may be more fundamental: for example, psychological research suggests that the neuroendocrine response to social interaction differs

between men and women, with men registering a strong response and women none at all.⁴⁸ Women, it is suggested, may be more vulnerable than men to negative aspects of social interactions and may also be more likely to assume the caring tasks in a relationship.⁴⁹ Consequently, social interaction may subject women more than men to harmful health effects.¹³ The contrasting results emphasize the importance of performing separate analyses by sex, and suggest that the role of social support in relation to mortality is distinct in each gender.

This analysis provides important information about the impact of social support on the risk of dying among seniors. Although the physiological mechanisms of the relationship between social support and death are not well understood, the findings suggest that older men living in households may benefit from interventions that promote social contact. ●

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Appendix

Table A

Distribution of selected characteristics, male household population aged 65 or older in 1994/95, Canada excluding territories

	Sample size	Estimated population			Sample size	Estimated population	
		'000	%			'000	%
Total	954	1,381	100.0				
Age group				Smoking			
65-74	587	880	63.8	Daily/Occasional	171	238	17.3
75-84	307	392	28.4	Former smoker	597	854	61.8
85+	60	109	7.9	Never smoked	186	289	20.9
				Missing	0	0	0
Vital status, 2000/01				Psychological distress			
Alive	620	936	67.8	Low	383	492	35.6
Dead	334	445	32.3	High	577	714	51.7
				Missing	114	174	12.6
Marital status				Cancer			
Married	626	1,046	75.7	Yes	52	75 ^{E1}	5.4 ^{E1}
Not married	328	335	24.3	No	901	1,306	94.6
				Missing	1	F	F
Participation in organizations				Diabetes			
Infrequent	275	350	25.3	Yes	114	170	12.3
Frequent	692	867	62.8	No	839	1,211	87.7
Missing	107	164	11.9	Missing	1	F	F
Social contacts				Heart disease			
Infrequent	198	273	19.8	Yes	181	258	18.7
Frequent	770	944	68.4	No	772	1,123	81.3
Missing	106	164	11.9	Missing	1	F	F
Emotional support				Respiratory disease			
Low	269	322	23.3	Yes	78	113	8.2
High	696	892	64.6	No	875	1,268	91.8
Missing	109	167	12.1	Missing	1	F	F
Household income				Effects of stroke			
Lower	231	237	17.2	Yes	38	62 ^{E1}	4.5 ^{E1}
Higher	681	1,708	78.1	No	915	1,319	95.5
Missing	42	66 ^{E1}	4.8 ^{E1}	Missing	1	F	F
Education				Functional dependency			
Less than secondary graduation	559	729	52.8	Yes	52	79 ^{E1}	5.7 ^{E1}
Secondary graduation or more	390	638	46.2	No	902	1,302	94.3
Missing	5	F	F				
Mastery				Health Utility Index 3			
Low	245	295	21.4	Low	788	1046	75.8
High	707	903	65.4	High	254	316	22.9
Missing	122	183	13.3	Missing	32	F	F
Leisure time							
Inactive	553	722	52.3				
Moderately active/Active	326	507	36.7				
Missing	75	151	11.0				

Data source: 1994/95 and 2000/01 National Population Health Survey, longitudinal sample, Health file

Note: Because of rounding, detail may not add to totals.

E1 Coefficient of variation between 16.6% and 25.0%

F Coefficient of variation greater than 33.3%

... Not applicable

Table B
Distribution of selected characteristics, female household population aged 65 or older in 1994/95, Canada excluding territories

	Sample size		Estimated population			Sample size		Estimated population	
			'000	%				'000	%
Total	1,468	1,824	100.0						
Age group					Smoking				
65-74	805	1,102	60.4		Daily/Occasional	193	236	12.9	
75-84	522	580	31.8		Former smoker	455	581	31.8	
85+	141	143	7.8		Never smoked	818	999	54.8	
					Missing		F	F	
Vital status, 2000/01					Psychological distress				
Alive	1,125	1,435	78.7		Low	439	439	24.0	
Dead	343	389	21.3		High	1,126	1,272	69.7	
					Missing	101	113 ^{E1}	6.2 ^{E1}	
Marital status					Cancer				
Married	481	819	44.9		Yes	84	97	5.3	
Not married	987	1,005	55.1		No	1,380	1,723	94.5	
					Missing	4	F	F	
Participation in organizations					Diabetes				
Infrequent	324	385	21.1		Yes	137	169	9.2	
Frequent	1,246	1,334	73.1		No	1,327	1,651	90.5	
Missing	96	106 ^{E1}	5.8 ^{E1}		Missing	4	F	F	
Social contacts					Heart disease				
Infrequent	220	303	16.6		Yes	242	287	15.7	
Frequent	1,347	1,412	77.4		No	1,222	1,533	84.0	
Missing	99	109 ^{E1}	6.0 ^{E1}		Missing	4	F	F	
Emotional support					Respiratory disease				
Low	298	357	19.6		Yes	85	105	5.8	
High	1,269	1,361	74.6		No	1,379	1,715	94.0	
Missing	99	105 ^{E1}	5.8 ^{E1}		Missing	4	F	F	
Household income					Effects of stroke				
Lower	576	539	29.6		Yes	55	66 ^{E1}	3.6 ^{E1}	
Higher	815	1,177	64.5		No	1,409	1,755	96.2	
Missing	77	107	5.9		Missing	4	F	F	
Education					Functional dependency				
Less than secondary graduation	814	986	54.1		Yes	85	107	5.9	
Secondary graduation or more	652	835	45.8		No	1,383	1,717	94.1	
Missing	2	F	F						
Mastery					Health Utility Index 3				
Low	422	446	24.4		Low	1,157	1,314	72.0	
High	1,125	1,248	68.4		High	446	475	26.0	
Missing	119	130	7.1		Missing	63	35 ^{E2}	1.9 ^{E2}	
Leisure time									
Inactive	1,037	1,222	67.0						
Moderately active/Active	389	506	27.8						
Missing	42	96	5.3						

Data source: 1994/95 and 2000/01 National Population Health Survey, longitudinal sample, Health file

Note: Because of rounding, detail may not add to totals.

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%

... Not applicable