

# Health care consequences of falls for seniors

*Kathryn Wilkins*

## **Abstract**

### **Objectives**

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

### **Data source**

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

### **Analytical techniques**

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

### **Main results**

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

### **Key words**

elderly, accidents, institutionalization, home care

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

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

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

## Methods

### Data source

This article is based on Statistics Canada's National Population Health Survey (NPHS). The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both a cross-sectional and longitudinal component. Respondents who are part of the longitudinal component will be followed for up to 20 years. The analysis in this article is based on cross-sectional data from the household component of the second (1996/97) cycle of the NPHS for the 10 provinces and longitudinal data from the first (1994/95) and second cycles.

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

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

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

For the longitudinal panel, a response rate of 93.6% was achieved in 1996/97. Of these 16,168 respondents, 15,670 provided full

information; that is, general and in-depth health information for both cycles of the survey. Of the 15,670 people providing full information, 2,546 were aged 65 or older.

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

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

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

### Analytical techniques

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

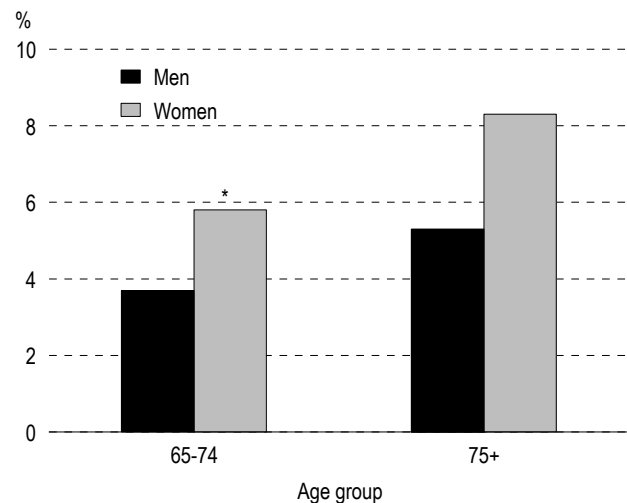
The behavioural model of health services utilization was used as the basis for selecting factors to be controlled for in multiple logistic regression.<sup>8</sup> The behavioural model describes three categories of variables related to health services use: predisposing, enabling and need. From the NPHS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

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

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

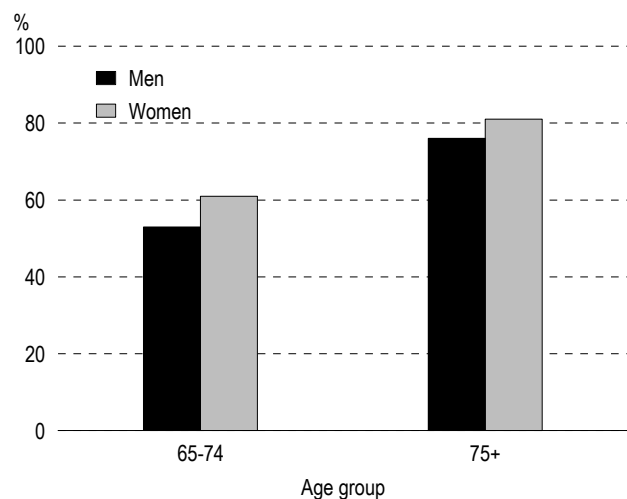
Hospitalization and death records show that falls are a major health problem for elderly people. These sources, however, reveal an incomplete

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



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

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



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

picture of the consequences of falls, in part because the data relate mostly to care or outcomes immediately after the fall. American research indicates that for elderly people, falls are strongly predictive of future needs for health care or institutionalization, even several years after the fall.<sup>12-14</sup> These findings are derived from analyses of population-based longitudinal data.

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

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

### Falls cause most injuries in seniors

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

## Deaths

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

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

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

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

† Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.

‡ Reference category, for which odds ratio is always 1.0

§ Reference category is absence of condition.

\*  $p < 0.05$

... Not applicable

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

### Women, very old more likely to fall

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

### Fracture most common injury

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

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

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

### Long-term consequences

Of those seniors who were living in households and not receiving formal home care in 1994/95, an estimated 290,000, or 11%, had "entered care" by 1996/97. That is, they had either been hospitalized for a total of 14 or more nights or had entered

formal home care in the year prior to their interview in 1996/97, or they had been placed in an institutional care facility some time following their 1994/95 interview and were still there at the time of the interviewer's subsequent contact with the household. The unadjusted odds of entry into care for people who reported having sustained an injurious fall in 1994/95 were nearly triple (2.7) the odds for people who did not report a fall (data not shown).

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

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

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

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

† Coefficient of variation between 25.1% and 33.3%

-- Amount too small to provide reliable estimate

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

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

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

-- Amount too small to provide reliable estimate

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

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

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

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

<sup>†</sup> Spent a total of 14 or more nights in hospital, received home care, or entered a long-term care facility before 1996/97 interview.

<sup>‡</sup> Because of rounding, some confidence intervals with 1.0 as the lower limit were significant.

<sup>§</sup> Reference category, for which odds ratio is always 1.0

<sup>††</sup> A variable for unavailable data on income was also entered into the model, but the odds ratio is not shown.

<sup>‡‡</sup> Reference category is absence of condition.

\*  $p < 0.05$

... Not applicable

## Effects of other factors

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

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

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

## Concluding remarks

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

straw” or precipitating event that causes family members to arrange for formal home care or institutionalization.<sup>13</sup>

The question of whether an injurious fall initiates, or merely exacerbates, a decline in health is beyond the scope of this analysis. However, these findings do show that seniors who fall can suffer serious consequences, both physically and in their need for health care services—even a considerable time after

the fall. Measures effective in preventing falls, such as balance or strengthening exercises, adjustments to medication, and alterations in the home (installing railings or grab-bars, for example), might also avert or delay the need for home care or institutional placement.<sup>20</sup> Further research to identify the characteristics of seniors who are at greatest risk of sustaining injurious falls would benefit such preventive efforts. ●

### Definitions

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

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

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

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

NPHS respondents were asked if, in the year before the 1994/95 survey, they had experienced *any injury serious enough to limit their normal activities*. Those who reported at least one such injury were asked about their most serious injury: the type (for example, a burn or broken bone), the body part injured, where the injury happened, and what caused it. Respondents were dichotomized as those who reported that a fall had caused their most serious

injury, and those who either sustained no injury or attributed their injury to a cause other than a fall.

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

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

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

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

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

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

## Limitations

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

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

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

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

severity, but each could also occur in the case of a temporary problem that could be remedied.

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

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

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



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