

Unintentional Fall-Related Injuries and Deaths Among Seniors in British Columbia: Trends, Patterns and Future Projections, 1987-2012

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CHAPTER

1

INTRODUCTION



INTRODUCTION

F all-related injuries and deaths in older adults are a major public health problem in most contemporary western societies with aging populations (Carter, Kannus & Khan, 2001; Tinetti & Speechley, 1989). Approximately 30% of individuals over 65 years of age fall at least once a year (Campbell, Borrie, & Spears, 1989), and about half of these do so recurrently (Tinetti & Speechley, 1989). Given these statistics, and the changing age structure of the Canadian population, many concerns have been raised surrounding the prospective burden of such injuries on society, including demands on the health care system and the quality of life among the aged and their caregivers.

In Canada, falls are responsible for about two-thirds of all injury-related discharges from hospital, and more than 70% of injury-related days of hospital care (Raina et al., 1997). Falls among the elderly can result in serious fractures and long periods of recovery (Wilkins, 1989; Raina et al., 1997). In particular, over 90% of hip fractures result from falls (Grisso et al., 1991), and in individuals who sustain hip fractures, the outcome is fatal in 12% to 20% of cases (Riggs & Melton, 1986). This is a concern, considering that the number of hip fractures in Canada are expected to increase dramatically from 23,375 in 1993 to over 88,000 cases by the year 2041, as the Canadian population ages (Papadimitropoulos, Coyte, Josse, & Greenwood, 1997).

Not only do falls lead to physical problems among older adults, but they also have undesirable consequences on their lifestyle and economic productivity. It is estimated that almost half of older adults who fall are unable to get up without help (Tinetti, Lui, & Claus, 1993), and the fear of falling again may lead them to reduce their activity (Nevitt, Cummings, & Hudes,

1991). Economic costs for fall-related injuries in 1994 among Canadians 65 years and over were estimated at \$2.8 billion (Asche, Gallagher, & Coyte, 1997). This amount includes direct costs such as institutional expenditures and professional services, and indirect costs such as lost productivity due to premature mortality and disability. These costs do not include the cost of medications for fall-related injuries, research, negligence claims, or the work of non-professional caregivers.

Similar accounts of the economic costs of falls are reported in other industrialized countries. In 1996, the estimated total of direct hospital costs arising from hip fractures due to falls in the U.K. were 530 million Euros (European Commission, 1999), and in the U.S. the annual costs associated with fall-related fractures were estimated at \$10 billion (Carter et al., 2001).

In British Columbia, from 1987 to 1998, falls and motor vehicle traffic injuries were the leading causes of death by injury among adults 65 years and over (Soubhi, Lisonkova, Rajabali, Tufts, & Raina, 2001). During this 12-year period, rates of falls as a cause of death were steadily maintained at high levels among the 75 years old and over group. Falls were also the first leading cause of hospitalization due to injury among the 35 years old and over group. Analysis of the trends over the 12-year period revealed that among the 65 years old and over group, the rate of falls remained stable across the years. These facts highlight the implications for BC in terms of health care expenditures and personal costs. In fact, falls in the elderly were estimated to cost BC \$180 million in direct costs in 1998 alone (Cloutier & Albert, 2001).

PURPOSE OF THIS REPORT

This report develops a population-based profile of unintentional fatal and non-fatal falls among older adults and seniors in BC, based on mortality and hospitalization data for a 12-year period from 1987 to 1998. This study assesses the burden of injuries and deaths due to falls, and examines some of the available evidence related to risk factors and risk conditions surrounding falls among the elderly. Assessment of the burden of injuries and deaths is conducted by

examining rates and variations in deaths and hospitalizations due to falls over the study period by age, gender, leading causes, year, geographical region, nature of injury, and place of occurrence of injury events in BC. Comparisons are also drawn between deaths and hospitalizations due to falls and other selected external causes of injury. Finally, future projections are conducted based on current trends in hospitalizations.

METHODOLOGY

Two data sets were used for the purpose of the present study: the BC Vital Statistics mortality data, and the BC hospital separation data. More detail with respect to analysis for each of the data sets is included below.

MORTALITY DUE TO FALLS

The present report is based on 3,183 deaths due to unintentional falls among older adults aged 65 years and over, that were known residents of BC from 1987 to 1998. Data on numerators as well as population denominators were provided by the BC Vital Statistics Agency. The population data contained four variables; year, Local Health Area (LHA), gender, and age (in five-year age groups). A fifth variable was created from the LHA for Health Region (HR) according to the 1995 conversion table established by the BC Ministry of Health (See *Appendix A-1*). Mortality data were then merged with the population data by matching the files with respect to year, gender, age group, and HR.

A fall is defined in the International Classification of Diseases, Ninth Revision (ICD-9 Codes,) (WHO, 1977), as “an unexpected event wherein a person fell to the ground from the same or upper level, and includes

falls on stairs and falls onto furniture” (ICD-9 CM, 1989). The external causes of the falls are reported by ICD-9 subcodes as E-codes (E880-E888). These subcodes exclude falls from burning buildings, into fire, into water or machinery, onto pointed or sharp objects, or from transport vehicles. To avoid low numbers and zero-cells in the analysis, falls from chair or bed were grouped with falls from one level to another. A detailed listing of external causes of falls is presented in *Appendix A-2*.

Analyses

Incidence rates were calculated per 100,000 person-years for age, gender, year, injury category (*Appendix A-2*), and HR. Comparisons were also drawn between deaths due to falls and deaths due to other selected external causes of injury. Ranking of the leading causes was based on the incidence rates and their confidence intervals. To account for differences in age structures across regions, rates were standardized using indirect standardization, with the average provincial age-specific rates for the study period as the standard. Indirect standardization was used to calculate Standardized Mortality Ratios (SMR).

SAS Version 9 for Windows was used to calculate the age-specific and age-standardized rates, as well as the

SMR. For each of these rates and ratios, 95% Confidence Intervals (95% CI) were calculated. The SMR is a preferred measure for comparing mortality data that are based on small numbers of cases, or for comparing mortality data by geographical area (Breslow & Day, 1987). The SMR is the ratio of observed to the expected number of deaths, based on provincial age-specific mortality rates. It is often expressed as a percentage or deviation from the value 1, with 1 being the provincial value. For example, in our analysis, an SMR of 1.20 means an excess of injury mortality of 20 percent relative to the province, while an SMR of 0.60 means that, compared to the province, the given area had 40 percent less injury mortality.

Trends analyses were conducted using a Chi-square test for trends (Snedecor & Cochran, 1980). This test appraises the linear component of the relationship between injury rates and the scores allocated to the categories of time (calendar years)¹.

Statistical significance of rate ratios was based on 95 percent confidence intervals. A confidence interval that does not include 1 is significant at $p < 0.05$. Finally, comparison of rates and rate ratios was based on the degree of overlap of their confidence intervals (significant at $p < 0.05$ if there was no overlap).

Cautions and Caveats

Accuracy and consistency of mortality data cannot be totally assumed because physicians and other health professionals responsible for diagnosing and coding the cause of death differ in their skills and practices. There may be variations in death certification and coding practices which are difficult to control for. Confidence Intervals (95% CI) were calculated for all estimates of injury mortality rates, thereby providing an indication of their stability.

FALL-RELATED HOSPITAL SEPARATIONS

The BC Ministry of Health's Regional Performance Analysis Branch provided separation data for all injury-related hospitalizations in the province of BC for the fiscal years 1987 to 1998. The data for this study included external causes of injury based on the International Classification of Diseases (ICD-9) by Local Health Areas (LHA), age (five-year age groups) and gender. E-codes included four-digit subcategories that allowed a more precise categorization of causes of injury than was possible with the mortality data. To avoid low numbers and zero cells in the analysis, E-codes E880.0, E880.1 and E880.9 were grouped under category E880, as they all related to falls from stairs. Similarly, E-codes E881.0 and E881.1 were grouped as E881 (falls from ladder or scaffolding). E-codes E883.0, E883.1 and E883.9 were combined into one category, E883, indicating falls into water or storm drains. Very rare types of falls with E-code E884.0 were regrouped with E884.9, indicating other falls from one level to another. All the data files were provided on CD-ROM, and integrated into the Accident Reporting System (LARS) Version 3.00, which was designed and revised (03/07/2000) by the Information Management Group, of the BC Ministry of Health.

Analyses

The analyses were conducted on 100,513 hospital separations due to unintentional falls among individuals 65 years old and over that were known residents of BC from 1987 to 1998. All the analyses related to place of occurrence included cases from 1989 to 1998. Place of occurrence was not reported prior to 1989. The analyses followed a similar approach to the one used for the analysis of mortality data.

¹A regression coefficient is estimated which represents the mean change in rate when there is a unit change in time (calendar year).

Future Projections

Trend projections for falls were conducted using a methodology suggested by Kannus et al. (1999). Rates of fall-related hospitalizations observed in each age group over the study period, were used to predict the age-specific incidences and absolute numbers in the population up to the year 2012. The prediction was based on a linear trend continuation method. Within each age group and gender, the predicted number of fall-related injuries was obtained by multiplying the projected hospital separation rates by the estimates of the number of inhabitants provided by BC's population projections (BC Stats, 2000). As all downward trends eventually become negative, all negative values in the present analyses were set to zero.

Projection analyses were conducted in two ways. The first set of analyses included regional variations in the rates of hospital separations due to falls in general, and those due to falls in the home. To avoid zero cells and unstable rates, age groups were combined into two categories: 65 to 79 years old, and 80 and over years old. Data results are presented by geographical groupings of the health regions into: 1) Eastern health regions (East Kootenay, West Kootenay, North Okanagan, South Okanagan); 2) Central health regions (Thompson, Fraser Valley, South Fraser Valley, Simon Fraser, Coast Garibaldi, Central Vancouver Island); 3) Northern health regions (Upper Island, Cariboo, North West, Peace Liard, Northern Interior); and 4) Southern health regions (Vancouver, Burnaby, North Shore, Richmond, Capital). To help examine the projected differences (level of heterogeneity) within the regional groupings and across the province, results were presented as trends and projections up to 2012 for each regional grouping, as well as rate ratios that used the provincial average projected rate as a reference.

The second set of analyses examined selected types of injuries resulting from falls including fractures of the upper and lower limbs, and intracranial injuries. In these analyses, the age group 35-44 years old was selected as a reference group to examine whether the predicted changes were specific for the elderly population or just more general time trends in all adult age groups.

Cautions and Caveats

The same cautions and caveats related to the ascertainment of cases can be applied to hospital separations as applied to mortality data. Furthermore, hospitalization data can vary over time and between areas for factors not related to health, such as accessibility of treatment, medical and administrative decisions that bear on the number and length of hospital stay (Chevalier, Choiniere, Ferland, Pageau, & Sauvageau, 1995; Walsh & Jarvis, 1992). Also, due to changes in editing practices by the Canadian Institute for Health Information (CIHI), the original source for the hospital morbidity data, errors in the injury data have resulted. Morphology codes were edited incorrectly prior to 1999-2000 and as a result appear as injury codes, causing an overstatement of injuries as reported in BCIRS by approximately 2% in all years. Finally, future projections are based on the assumption of a linear continuation of the current trends, which may not be a tenable assumption.

CHAPTER

2

MORTALITY



FALL-RELATED DEATHS

MORTALITY DUE TO FALLS BY AGE AND GENDER

The age-specific mortality rates per 100,000 person-years, as well as the total number of deaths from 1987 to 1998 are presented in *Table 2.1*. During the study period, the mortality rates among seniors 65 years old and over were 51.3 (95% CI: 42-61) and 52.2 (95% CI: 44-61) deaths per 100,000 for males and females, respectively. As judged by the confidence intervals [*Appendix A-3*], there was no statistically significant difference between males and females. A Chi-square test for trends revealed, for both males and females, significantly higher rates of

deaths among older age groups than younger age groups ($\chi^2=2134.9, p=.0001$ for males and $\chi^2=3293.0, p=.0001$ for females). Compared to other external causes of death, falls were responsible for a higher proportion of deaths among females than among males (40% of the deaths among males and 50% of the deaths among females; $\chi^2=71.6, p=.001$). (*Figure 2.1*)

LEADING CAUSES OF INJURY MORTALITY

The number of deaths and the mortality rates due to falls among different age groups and gender are displayed in *Tables 2.2a-c*. Overall, the mortality

Figure 2.1: Percentages of death due to injuries among elderly (65+), by gender and selected external causes, BC, 1987-1998

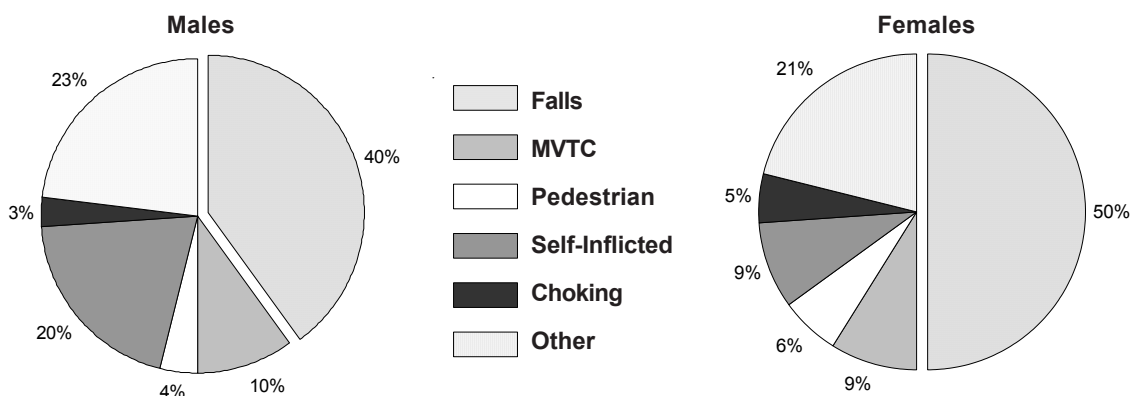


Table 2.1: Age-Specific Mortality Rates per 100,000 Person-Years and Number of Deaths Due to Falls, B.C., 1987-1998

Age group	Male		Female	
	Total # of Deaths 1987-1998	Rate	Total # of Deaths 1987-1998	Rate
65-69	96	10.49	57	5.61
70-74	148	20.44	92	10.17
75-79	214	41.81	208	29.31
80-85	290	95.29	335	70.16
85+	608	320.29	1135	288.35
65+	1356	51.26	1827	52.18

Table 2.2a: Age-Specific Mortality Rates, 1987-98, BC, per 100,000, by Category of Falls and Gender, Ages 65-74

Falls from/on:	Male			Female			Total		
	Number of Deaths	Rate	Rank*	Number of Deaths	Rate	Rank*	Number of Deaths	Rate	Rank*
Stairs (E880)	35	2.14	1	17	0.89	1	52	1.46	1
Ladder (E881)	14	0.85	3	1	0.05	1	15	0.42	1
Building (E882)	11	0.67		0			11	0.31	
Hole (E883)	2	0.12	2	2	0.10	2	4	0.11	1
Chair or Bed/One Level to Another (E884)	23	1.40		5	0.26		28	0.79	
Same Level (E885)	5	0.31		13	0.68		18	0.51	
Collision/Push (E886)	1	0.06		0			1	0.03	
Fracture Unspecified (E887)	25	1.53		37	1.93		62	1.74	
Other and Unspecified (E888)	128	7.81		74	3.85		202	5.67	
All Falls	244	14.88		149	7.76		393	11.04	

Table 2.2b: Age-Specific Mortality Rates, 1987-98, BC, per 100,000, by Category of Falls and Gender, Ages 75-84

Falls from/on:	Male			Female			Total		
	Number of Deaths	Rate	Rank*	Number of Deaths	Rate	Rank*	Number of Deaths	Rate	Rank*
Stairs (E880)	32	3.92	1	26	2.19	1	58	2.90	1
Ladder (E881)	8	0.98	1	0		1	8	0.40	1
Building (E882)	4	0.49		4	0.34		8	0.40	
Hole (E883)	1	0.12		0			1	0.05	
Chair or Bed/One Level to Another (E884)	37	4.53		27	2.27		64	3.20	
Same Level (E885)	26	3.19	2	14	1.18	2	40	2.00	1
Fracture Unspecified (E887)	136	16.66	2	199	16.76	2	335	16.72	1
Other and Unspecified (E888)	260	31.86		273	23.00		533	26.61	
All Falls	504	61.75		543	45.74		1047	52.27	

Table 2.2c: Age-Specific Mortality Rates, 1987-98, BC, per 100,000, by Category of Falls and Gender, Ages 85+

Falls from/on:	Male			Female			Total		
	Number of Deaths	Rate	Rank*	Number of Deaths	Rate	Rank*	Number of Deaths	Rate	Rank*
Stairs (E880)	24	12.64	1	21	5.34	2	45	7.71	2
Ladder (E881)	1	0.53	1	0		2	1	0.17	2
Building (E882)	4	2.11		2	0.51		6	1.03	
Hole (E883)	0			1	0.25		1	0.17	
Chair or Bed/One Level to Another (E884)	45	23.71		72	18.29		117	20.05	
Same Level (E885)	26	13.70	1	47	11.94	1	73	12.51	1
Fracture Unspecified (E887)	199	104.83	1	429	108.99	1	628	107.64	2
Other and Unspecified (E888)	309	162.78		563	143.03		872	149.46	
All Falls	608	320.29		1135	288.35		1743	298.74	

*Ranking of the leading categories was based on the rates and their 95% confidence intervals among the specified categories. CI overlapped categories received the same ranking.

rates were significantly higher among males than females, except among the elderly (85 years old and over), where there were no significant differences between genders.

Age group 65-74

Among the 65-74 year olds, falls from stairs were the leading cause of deaths due to falls for both males (95% CI: 1.94-2.35) and females (95% CI: 0.77-1.02). Among the 65- to 74-year-old males, the second leading cause included the combined category of falls from chair or bed/one level to another (95% CI: 1.25-1.58), while the third leading cause was falls from ladder or scaffolding (95% CI: 0.73-0.99). Among the 65-74 year-old females, falls on same level were also a leading cause of death (95% CI: 0.58-0.79), while falls from chair or bed/one level to another represented the second leading cause of death (95% CI: 0.20-0.33). (Table 2.2a)

Age group 75-84

Among males aged 75-84 years, the leading causes of death included the combined category of falls from chair or bed/one level to another (95% CI: 4.13-4.97) and falls from stairs (95% CI: 3.55-4.33). The second leading cause of death was falls on same level (95% CI: 2.85-3.56). Among females aged 75-84 years, the first and second leading causes were the same as those for males (95% CI: 2.04-2.53; 1.96-2.45 and 1.01-1.37 respectively). (Table 2.2b)

Age group 85+

Among males aged 85 years and over, the first three leading causes were the same as those identified among younger age groups: falls from chair or bed/one level to another (95% CI: 17.7-31.7), falls on same level

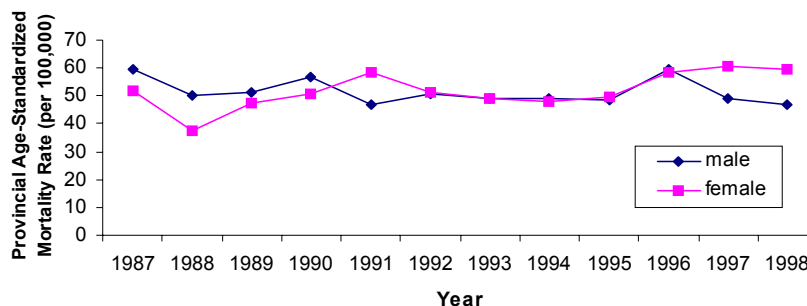
(95% CI: 9.3-20.1), and falls from stairs (95% CI: 8.5-18.8). Among females aged 85 years and over, similar to males, the leading causes were falls from chair or bed/one level to another (95% CI: 14.52-23.05) and falls on same level (95% CI: 8.97-15.89), followed by falls from stairs (95% CI: 3.48-8.18). (Table 2.2c) [Appendices A-4a-c]

TIME TRENDS

The provincial age-standardized mortality rates by year and gender are presented for the 65 years and over age group in Figure 2.2. [Appendix A-5]

Mortality rates among males were relatively stable across the calendar years, with no significant trend. By contrast, there was a significant increasing trend among females ($\chi^2=11.4$, $p=.001$). A closer examination of the rates by age group revealed no significant trends among males in any of the age groups. However, there was an increasing and significant trend among females 75-79 years old ($\chi^2=4.5$, $p=.03$).

Figure 2.2: Trends for Age-Standardized Mortality Rates, Falls, 1987-1998, BC, by Gender, Ages 65+



Trends in the Age-Specific Mortality Rates by Leading Categories of Falls and Gender

Age group 65-74

Males

Trends among 65- to 74-year-old males for the three leading categories of death due to falls are presented

in *Figure 2.3*. None of the trends were significant. Mortality rates remained low, fluctuating around 2 per 100,000 for falls from stairs and approximately 1.5 for falls from chair or bed/one level to another. There was a non-significant decrease in mortality due to falls from ladder or scaffolding between the periods 1987-89 and 1990-92, and then a leveling off with mortality being under 1 per 100,000. [*Appendix A-6a*]

Females

Mortality due to the three leading categories of falls among 65-74 year-old females can be seen in *Figure 2.4*. None of the trends were significant. Mortality rates were fluctuating between 1.6 and 0.4 per 100,000 for falls from stairs and between 1.33 and 0.4 for falls on same level throughout the study period. Mortality due to falls from chair or bed/one level to another remained under 1 per 100,000 from 1987 to 1998. [*Appendix A-6a*]

Age group 75-84

Males and Females

Similar patterns were observed among 75- to 84-year-old males and females. The rates fluctuated for falls from chair or bed/one level to another and for falls from stairs (*Figures 2.5, 2.6*). However, none of the trends were significant. Similarly, none of the trends in the rates among females were significant. [*Appendix A-6b*]

Age Group 85+

Mortality due to the leading categories of falls among elderly (85 years old and over) are shown in *Figure 2.7* for males and *Figure 2.8* for females. The trends

Figure 2.3: Trends for Age-Specific Mortality Rates, 1987-1998, BC, Males, Ages 65-74

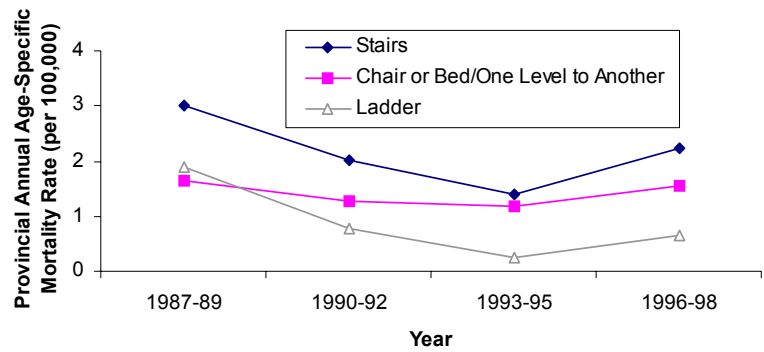


Figure 2.4: Trends for Age-Specific Mortality Rates, 1987-1998, BC, Females, Ages 65-74

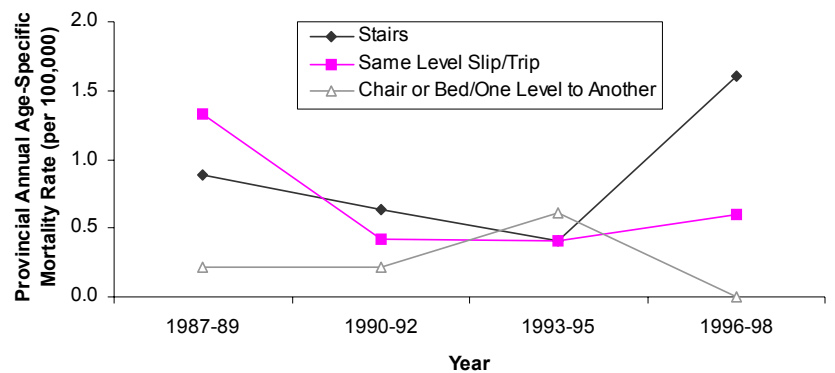
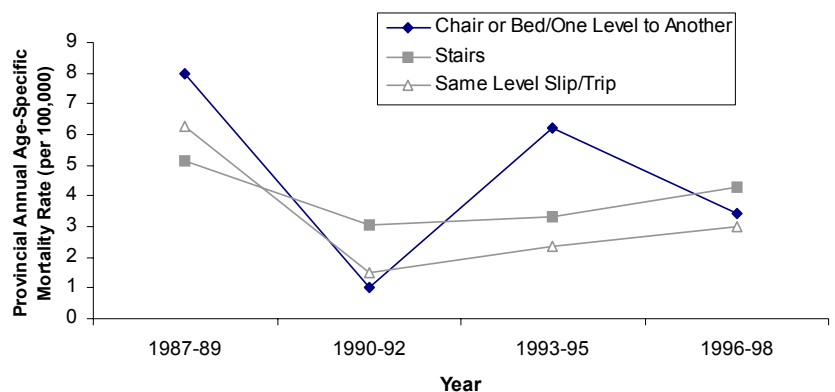


Figure 2.5: Trends for Age-Specific Mortality Rates, 1987-1998, BC, Males, Ages 75-84



were similar for both genders and the mortality rates were approximately ten times higher in comparison with the preceding age groups 65-74 and 75-84.

Males

Among males, a significant downward trend ($\chi^2=9.96$, $p=.002$) was observed for falls from chair or bed/one level to another. A significant downward trend ($\chi^2=13.8$, $p=.0001$) was also observed for falls on same level/slip or trip. Finally, there was a significant decrease ($\chi^2=11.26$, $p=.001$) for falls from stairs.

(Figure 2.7) [Appendix A-6c]

Females

Among females, there was a slight but significant decrease ($\chi^2=5.71$, $p=.02$) in the rates across the four periods considered between 1987-98 to 1996-98 for falls from chair or bed/one level to another. There was also a significant downward trend ($\chi^2=15.82$, $p=.0001$) for falls on same level/slip or trip. Finally, mortality due to falls from stairs showed a slight, but non-significant, decline. (Figure 2.8) [Appendix A-6c]

Figure 2.6: Trends for Age-Specific Mortality Rates, 1987-1998, BC, Females, Ages 75-84

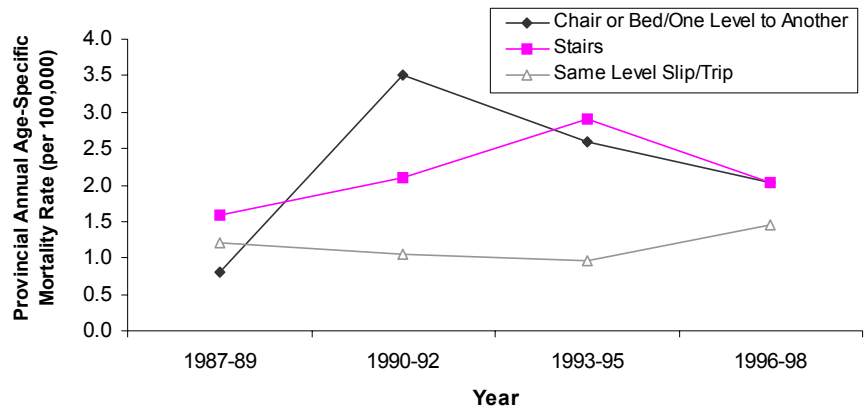


Figure 2.7: Trends for Age-Specific Mortality Rates, 1987-1998, BC, Males, Ages 85+

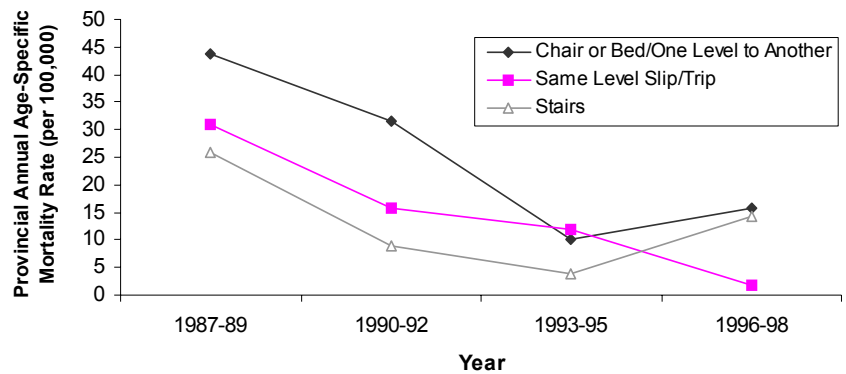
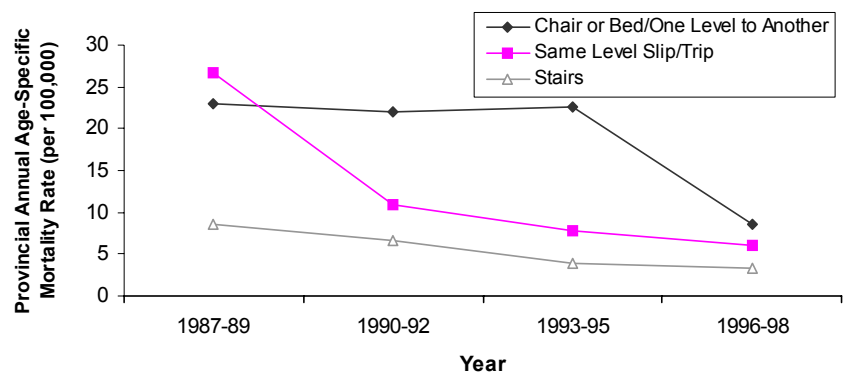


Figure 2.8: Trends for Age-Specific Mortality Rates, 1987-1998, BC, Females, Ages 85+



REGIONAL VARIATIONS IN INJURY MORTALITY DUE TO FALLS

Males Ages 65+

The overall pattern of regional variations in mortality SMR for males is shown in *Figure 2.9*. High mortality ratios were found in the Peace Liard (2.32; 95% CI: 0.6-9.02), Thompson (1.60; 95% CI: 0.6-4.27) and Cariboo (1.59; 95% CI: 0.36-7.00) health regions. The lowest SMR was found in East Kootenay (0.63; 95% CI: 0.11-3.65), followed by Vancouver (0.66; 95% CI: 0.43-1.02) and Fraser Valley (0.79; 95% CI: 0.33-1.90). However, none of the regional rates were significantly different from the provincial rate of mortality due to falls. [*Appendix A-7*]

Females Ages 65+

Among females aged 65 years and over, statistically significant SMR was found only in the Vancouver Health Region (0.53; 95% CI: 0.36-0.78), which had 47% lower mortality due to falls in comparison with the BC average of 1. Cariboo (1.80; 95% CI: 0.42-7.66) and Northern Interior (1.80; 95% CI: 0.50-6.49) had the highest ratio, followed by North Okanagan (1.63; 95% CI: 0.75-3.53). However, these were not significantly different from the provincial rate. (*Figure 2.10*) [*Appendix A-7*]

Figure 2.9: Standardized Mortality Ratio, 1987-1998, BC, by Health Region, Males, Falls, Ages 65+

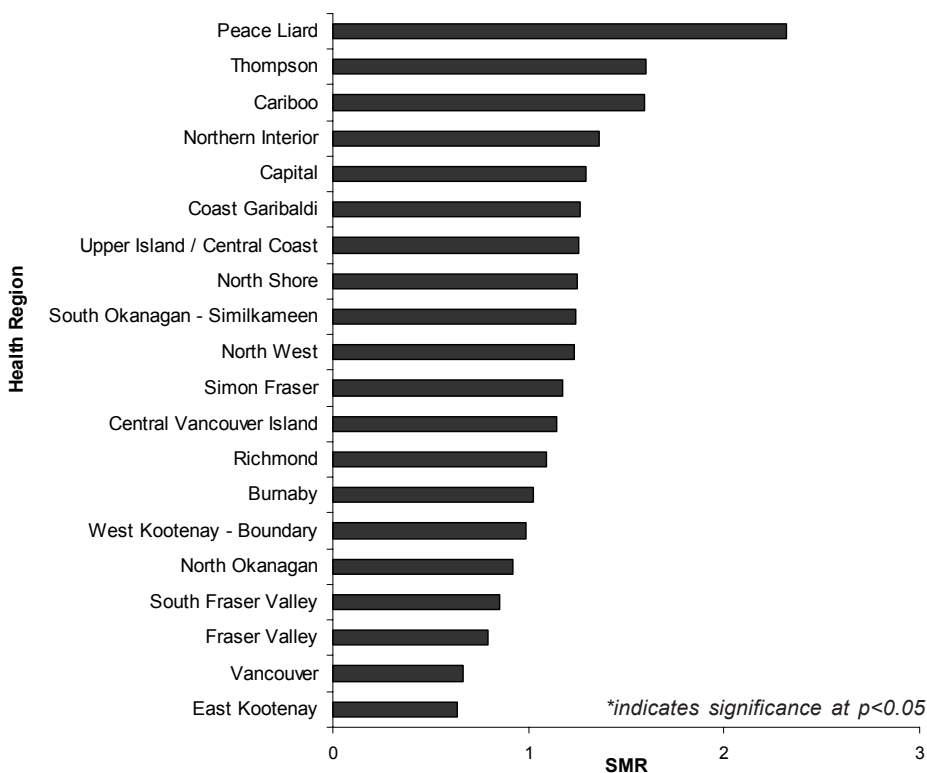


Figure 2.10: Standardized Mortality Rate Ratio, 1987-1998, BC, by Health Region, Females, Falls, Ages 65+

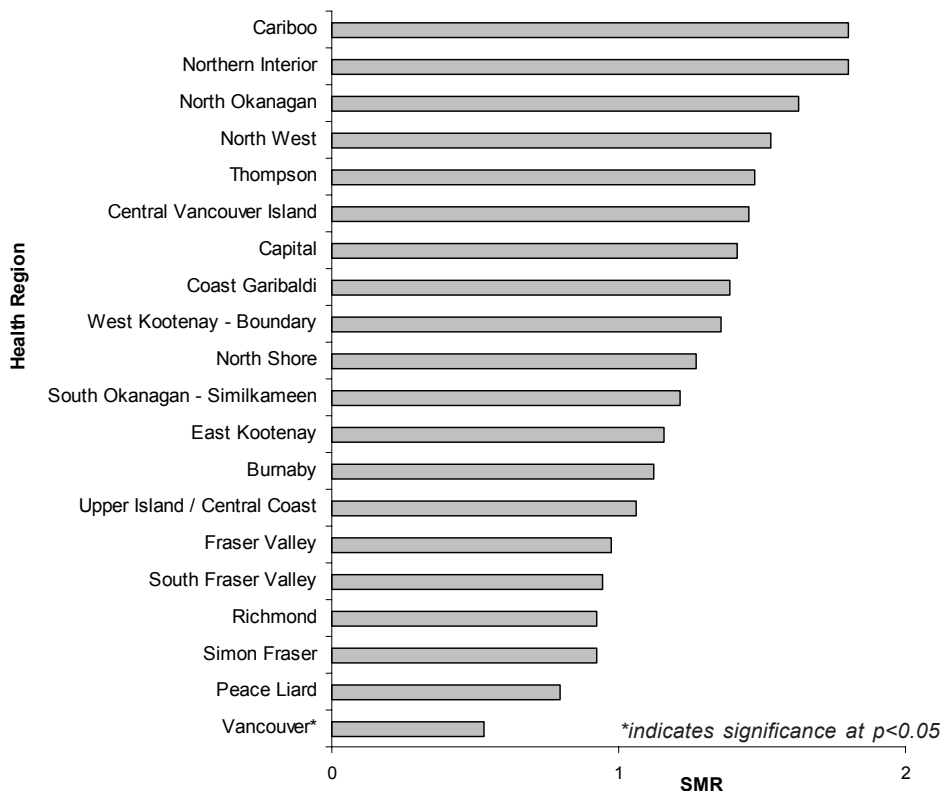


Figure 2.11: Mortality Rate Ratio, 1987-1998, BC, by Health Region, Males, Falls, Ages 65-74

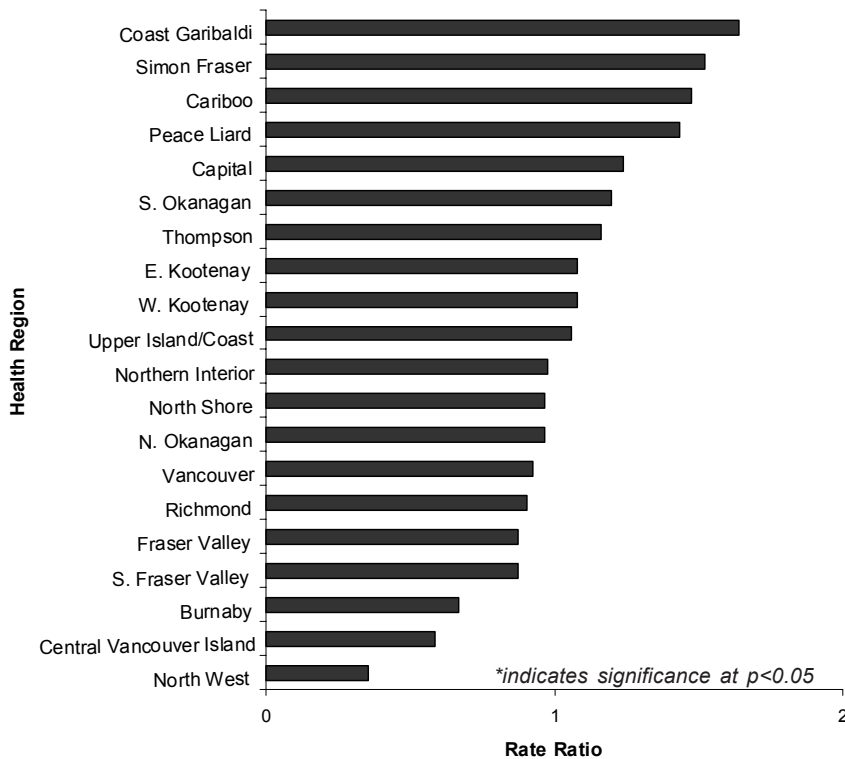
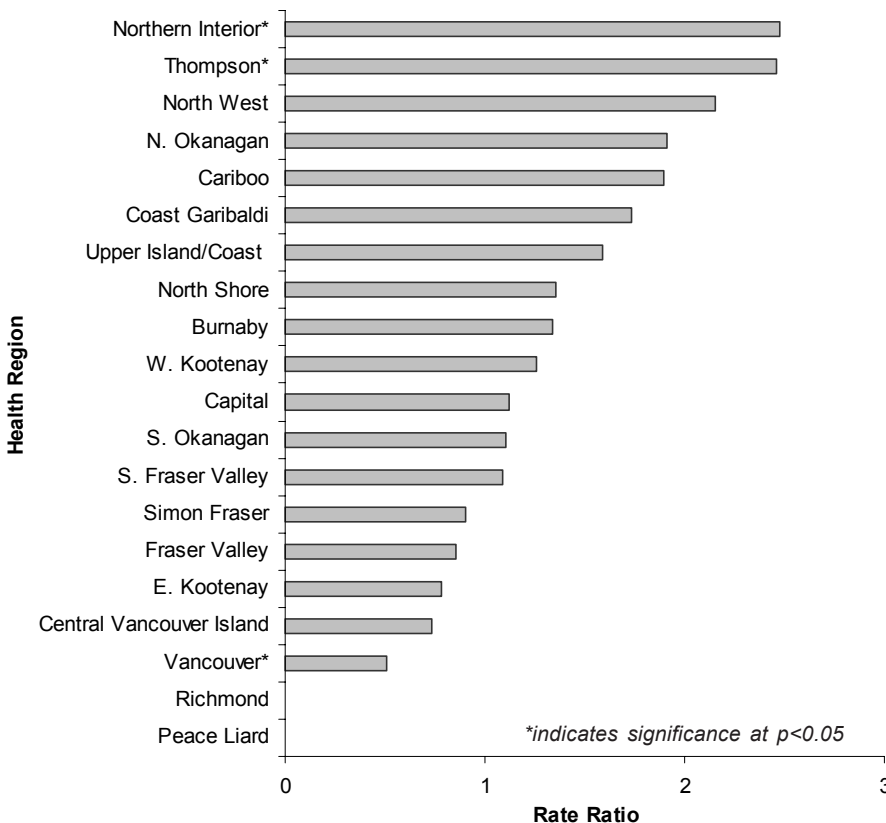


Figure 2.12: Mortality Rate Ratio, 1987-1998, BC, by Health Region, Females, Falls, Ages 65-74



Males Ages 65-74

Compared to the province, the highest ratios were found in Coast Garibaldi (1.64; 95% CI: 0.77-3.47), Simon Fraser (1.52; 95% CI: 0.94-2.46), Cariboo (1.48; 95% CI: 0.61-3.58), and Peace Liard (1.44; 95% CI: 0.46-4.49). The lowest mortality ratios were found in the North West (0.36; 95% CI: 0.05-2.54), Central Vancouver Island (0.58; 95% CI: 0.31-1.10) and Burnaby (0.67; 95% CI: 0.32-1.42). However, none of the regional rates were significantly different from the provincial rate. (Figure 2.11) [Appendix A-8a]

Females Ages 65-74

The highest mortality ratios among 65- to 74-year-old females were found in the Northern Interior (2.48; 95% CI: 1.02-6.04), followed by the Thompson Health Region (2.46; 95% CI: 1.26-4.82); both regional rates were significantly different from the provincial rate (approximately 2.5 times higher than the BC average). In Vancouver, the rate was significantly lower at approximately half of the BC average (0.51; 95% CI: 0.31-0.82). There were no reported deaths due to falls in Richmond and Peace Liard. (Figure 2.12) [Appendix A-8b]

Males Ages 75-84

The regional variations for males aged 75-84 are shown in Figure 2.13. Compared to the province, significantly high mortality ratios were found in the North West Region (2.20; 95% CI: 1.14-4.24), Northern Interior (2.03; 95% CI:

Figure 2.13: Mortality Rate Ratio, 1987-1998, BC, by Health Region, Males, Falls, Ages 75-84

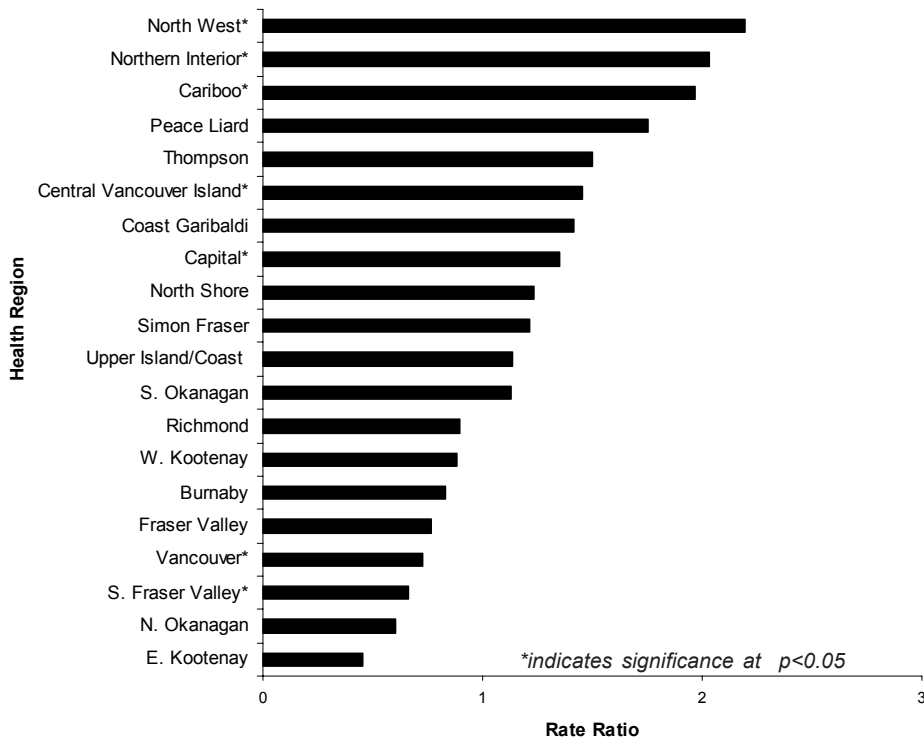
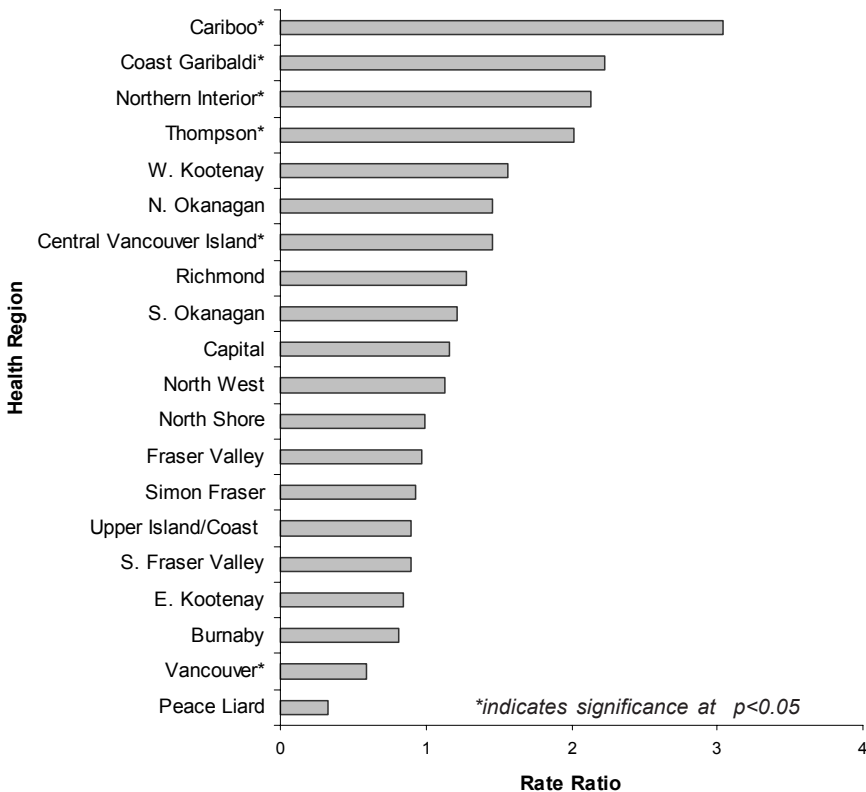


Figure 2.14: Mortality Rate Ratio, 1987-1998, BC, by Health Region, Females, Falls, Ages 75-84



1.15-3.60) and the Cariboo Health Region (1.97; 95% CI: 1.05-3.68). Significantly higher mortality was also found in Central Vancouver Island (1.46; 95% CI: 1.07-1.97) and Capital Region (1.35; 95% CI: 1.06-1.71). The lowest ratios were found in East Kootenay (0.45; 95% CI: 0.17-1.22) and North Okanagan (0.60; 95% CI: 0.32-1.13). However, only South Fraser Valley (0.66; 95% CI: 0.47-0.94) and Vancouver (0.76; 95% CI: 0.58-0.90) were significantly different from the province. [Appendix A-8a]

Females Ages 75-84

Among females aged 75-84, the highest mortality ratio was found in the Cariboo Health Region (3.04; 95% CI: 1.72-5.39), Coast Garibaldi (2.23; 95% CI: 1.36-3.67), Northern Interior (2.13; 95% CI: 1.17-3.86) and the Thompson Region (2.01; 95% CI: 1.30-3.11). All were statistically significant and had mortality rates that were two to three times higher than the BC average. In addition, rate ratios for Central Vancouver Island were significantly higher than the BC average (1.46; 95% CI: 1.06-1.99). The lowest rate ratios were found in Peace

Liard (0.33; 95% CI: 0.05-2.31) and Vancouver (0.60; 95% CI: 0.48-0.74), however, only Vancouver was significantly different from the province. (Figure 2.14) [Appendix A-8b]

Males Ages 85+

Mortality ratios for males 85 years old and over are shown in Figure 2.15. Compared to the provincial average, high and statistically significant mortality ratios were found in the Peace Liard (3.04; 95% CI: 1.85-4.99), Thompson Region (1.96; 95% CI: 1.29-2.97), South Okanagan (1.35; 95% CI: 1.05-1.74) and Capital Region (1.28; 95% CI: 1.02-1.59). The lowest mortality ratio was found in Vancouver (0.54; 95% CI: 0.43-0.67), which had a significantly lower mortality rate than the BC average. [Appendix A-8a]

Females Ages 85+

North Okanagan (1.67; 95% CI: 1.25-2.25), Central Vancouver Island (1.59; 95% CI: 1.27-2.00), Capital (1.56; 95% CI: 1.35-1.79) and North Shore (1.39; 95% CI: 1.10-1.75) showed significantly higher mortality than the BC average. Vancouver had the lowest rate ratio (0.50; 95% CI: 0.43-0.59), indicating a significantly lower mortality rate than the BC average. (Figure 2.16) [Appendix A-8b]

Figure 2.15: Mortality Rate Ratio, 1987-1998, BC, by Health Region, Males, Falls, Ages 85+

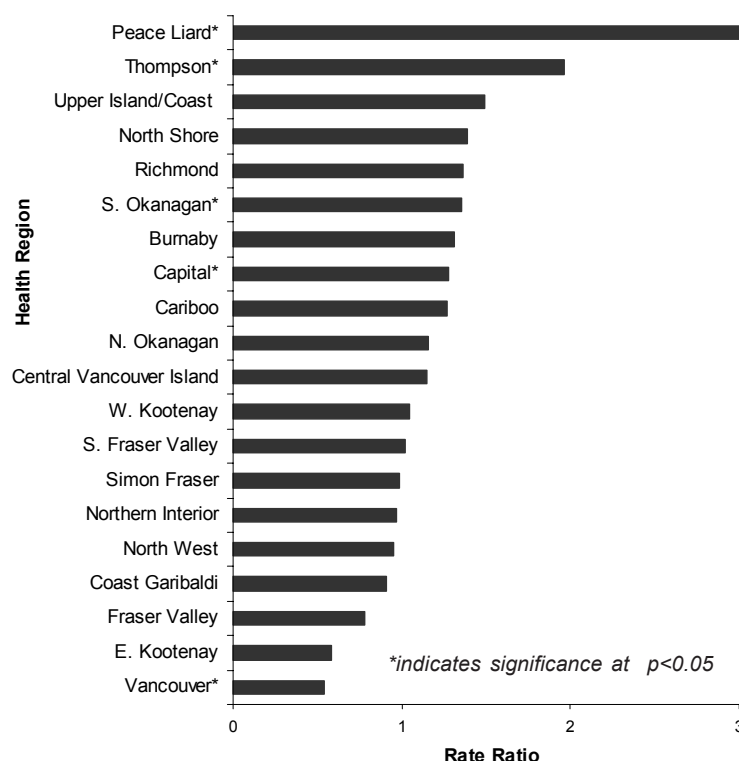
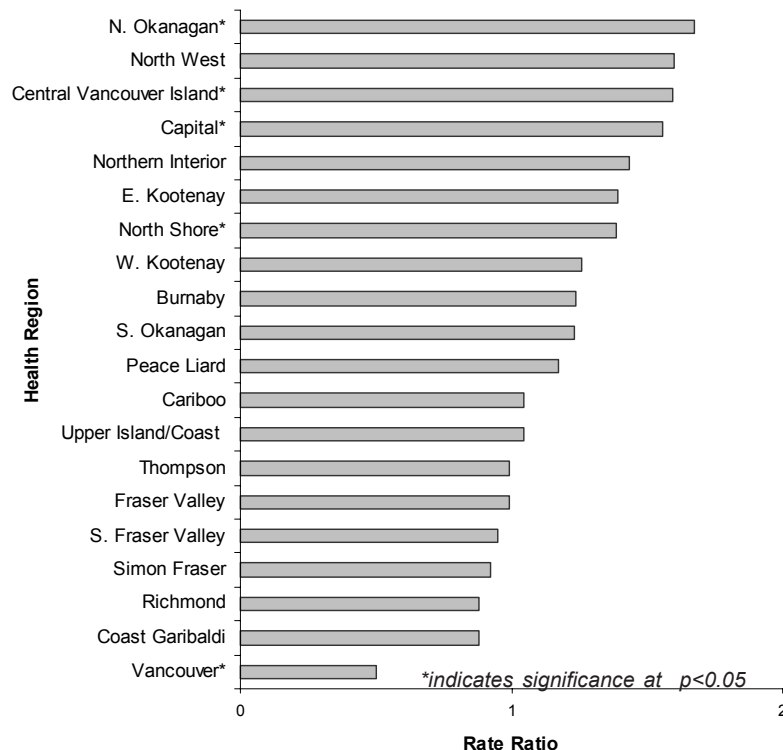


Figure 2.16: Mortality Rate Ratio, 1987-1998, BC, by Health Region, Females, Ages 85+





CHAPTER

3

HOSPITALIZATION



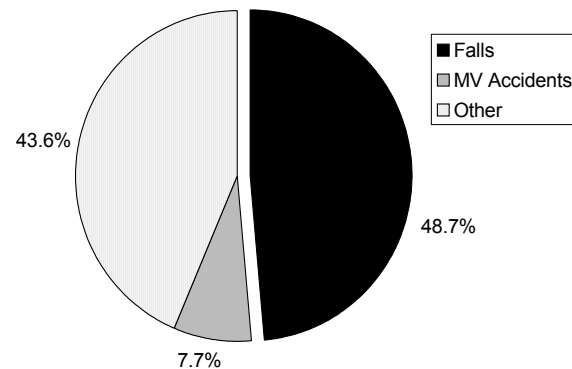
FALL-RELATED HOSPITALIZATIONS

FALL-RELATED HOSPITALIZATIONS BY AGE AND GENDER

Compared to other causes of unintentional injuries, falls represented approximately half of hospitalized cases (48.7%; 95% CI: 48.4-49.0) among males aged 65 years old and over. Transportation injuries (including MV Occupant, MV-Bicycle, Non-MV Bicycle, MV Pedestrian, Motorcycle, Off-Road Vehicle and Other Transport) represented 7.7% (95% CI: 7.4-7.9). The remaining other unintentional injuries (excluding undetermined intent, postoperative complications, and misadventure) represented 43.6% (95% CI: 43.2-43.9). Among females, approximately two thirds of hospitalized cases due to unintentional injury were due to falls (64.8%; 95% CI: 64.5-65.1). Transportation represented 4.7% (95% CI: 4.5-4.8) of hospitalized cases. The remaining 30.5% (95% CI: 30.2-31.7) were due to other unintentional injuries. There was a significantly higher proportion of falls among females compared to males ($\chi^2=2679.7$, $p=.0001$). (Figures 3.1, 3.2)

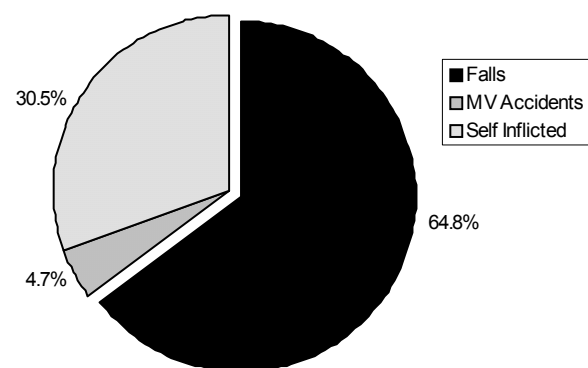
The age-specific hospital separation rates per 100,000 as well as the total number of hospital separations due to falls from 1987 to 1998 are presented in Table 3.1. There was a total of 100,513 hospital separations due to falls among seniors (ages 65+) during the 12-year period from 1987 to 1998. During the study period, the hospital separation rates among seniors 65 years old and over were 1122.6 (95% CI: 1078.4-1166.8) and 2022.6 (95% CI: 1971.02-2074.23) separations per 100,000 for males and females, respectively. As judged by the confidence intervals [Appendix B-1], there was a statistically significant difference between males and females, with higher rates among females than males. A Chi-square test of trend reveals, for both males and

Figure 3.1: Falls vs Other Injuries, Hospital Separations, BC, 1987-98, ages 65+, Males



females, significantly higher rates of hospitalizations among older age groups than younger age groups ($\chi^2=15888.9$, $p=.0001$ for males and $\chi^2=40218.2$, $p=.0001$ for females). During the study period, injuries among females were significantly higher than among males in all age groups. Overall, hospital separation rates for females were 80% higher than for males. [Appendix B-1]

Figure 3.2: Falls vs Other Injuries, Hospital Separations, BC, 1987-98, Ages 65+, Females



LEADING CATEGORIES OF FALLS

The number of hospitalizations and the age-specific hospital separation rates by categories of falls are shown in Tables 3.2a-e. The first leading category of hospital separations for all age groups and for both genders was falls on same level/slip or trip. Rates for this category were at least four times higher in comparison with other categories.

Table 3.1: Age-Specific Hospital Separation Rates per 100,000 Person-Years and Number of Hospital Separations Due to Falls, B.C., 1987-1989

Age group	Male		Female	
	Total # of Injuries 1987-1998	Rate	Total # of Injuries 1987-1998	Rate
65-69	4,762	520.29	7,400	728.52
70-74	5,391	744.42	10,311	1139.67
75-79	5,909	1154.51	13,804	1945.36
80-84	6,227	2046.08	16,158	3383.88
85+	7,408	3902.46	23,143	5879.62
65+	29,697	1122.57	70,816	2022.63

Age group 65-69

Among males aged 65-69 years old, the second leading categories included falls from one level to another (95% CI: 17.6-41.7), falls from stairs (95% CI: 30.9-61.1), falls from ladder or scaffolding (95% CI: 44.2-79.3), and falls from chair or bed (95% CI: 22.5-49.0). Among females aged 65-69 years old, the second leading category was falls from stairs (95% CI: 67.5-107.2). Falls from chair or bed (95% CI: 32.1-60.9), falls from one level to another (95% CI: 15.7-37.3) and falls from ladder or scaffolding (95% CI: 7.7-24.5) were ranked as third leading categories. (Table 3.2a) [Appendix B-2a]

Age group 70-74

Among males aged 70-74 years old, the second leading categories of falls included falls from stairs (95% CI: 41.6-80.8), falls from chair or bed (95% CI: 41.1-79.9), falls from ladder or scaffolding (95% CI: 39.1-77.2), and falls from one level to another (95% CI: 20.3-49.7). Among females aged 70-74 years old, the second leading categories included falls from stairs (95% CI: 87.2-134.6) and falls from chair or bed (95% CI: 63.1-104.1). The third leading categories included falls from one level to another (95% CI: 17.1-41.1) and falls from ladder or scaffolding (95% CI: 5.0-20.6). (Table 3.2b) [Appendix B-2b]

Table 3.2a: Age-Specific Hospital Separation Rates, 1987-98, BC, per 100,000 Person-Years, by Category of Falls and Gender, Ages 65-69

Category of Falls:	Male			Female			Total		
	Number of Cases	Rate	Rank	Number of Cases	Rate	Rank	Number of Cases	Rate	Rank
Stairs	401	43.81	3	870	85.65	2	1271	65.81	2
Ladder/Scaffolding	542	59.22	2	140	13.78	5	682	35.32	4
Building	146	15.95		36	3.54		182	9.43	
Hole	17	1.86		25	2.46		42	2.18	
Cliff	6	0.66		5	0.49		11	0.57	
Chair or Bed	304	33.21	4	449	44.20	3	753	38.99	3
One Level to Another	248	27.10	5	246	24.22	4	494	25.58	5
Same Level Slip/Trip	1715	187.38	1	3761	370.27	1	5476	283.58	1
Collision/Push - Sports	7	0.77		14	1.38		21	1.09	
Collision/Push - Other	14	1.53		26	2.56		40	2.07	
Fracture Unspecified	99	10.82		129	12.70		228	11.81	
Other/Unspecified	1263	137.99		1699	167.27		2962	153.39	
All Falls	5163	520.29		8270	728.52		13433	695.63	

*Ranking of the leading categories was based on the rates and their 95% confidence intervals among the specified categories. CI overlapped categories received the same ranking.

Table 3.2b: Age-Specific Hospital Separation Rates, 1987-98, BC, per 100,000 Person-Years, by Category of Falls and Gender, Ages 70-74

Category of Falls:	Male			Female			Total		
	Number of Cases	Rate	Rank*	Number of Cases	Rate	Rank*	Number of Cases	Rate	Rank*
Stairs	428	59.10	2	987	109.09	2	1415	86.87	2
Ladder/Scaffolding	398	54.96	2	92	10.17	3	490	30.08	3
Building	78	10.77		20	2.21		98	6.02	
Hole	15	2.07		18	1.99		33	2.03	
Cliff	1	0.14		3	0.33		4	0.25	
Chair or Bed	415	57.31	2	733	81.02	2	1148	70.48	2
One Level to Another	230	31.76	2	240	26.53	3	470	28.85	3
Same Level Slip/Trip	2030	280.31	1	5100	563.70	1	7130	437.71	1
Collision/Push - Sports	8	1.11		0	0.00		8	1.10	
Collision/Push - Other	15	2.07		24	2.65		39	2.39	
Fracture Unspecified	114	15.74		199	22.00		313	19.22	
Other/Unspecified	1659	229.08		2895	319.98		4554	279.57	
All Falls	5819	803.52		11298	1248.76		17117	1051.44	

*Ranking of the leading categories was based on the rates and their 95% confidence intervals among the specified categories. CI overlapped categories received the same ranking.

Age group 75-79

Among males aged 75-79 years old, the second leading categories included falls from chair or bed (95% CI: 88.7-154.5), falls from stairs (95% CI: 61.7-118.2), falls from ladder or scaffolding (95% CI: 35.1-79.9) and falls from one level to another (95% CI: 18.7-54.2). Among

females aged 75-79 years old, the second leading categories included falls from chair or bed (95% CI: 116.2-177.8) and falls from stairs (95% CI: 113.9-174.9). The third leading categories included falls from one level to another (95% CI: 20.9-51.1) and falls from ladder or scaffolding (95% CI: 4.4-22.2). (Table 3-2c)

[Appendix B-2c]

Table 3.2c: Age-Specific Hospital Separation Rates, 1987-98, BC, per 100,000 Person-Years, by Category of Falls and Gender, Ages 75-79

Category of Falls:	Male			Female			Total		
	Number of Cases	Rate	Rank*	Number of Cases	Rate	Rank*	Number of Cases	Rate	Rank*
Stairs	446	87.14	2	1016	143.18	2	1462	119.69	2
Ladder/Scaffolding	271	52.95	2	70	9.86	3	341	27.92	3
Building	53	10.36		14	1.97		67	5.49	
Hole	11	2.15		11	1.55		22	1.80	
Cliff	4	0.78		3	0.42		7	0.57	
Chair or Bed	599	117.03	2	1020	143.75	2	1619	132.55	2
One Level to Another	163	31.85	2	232	32.70	3	395	32.34	3
Same Level Slip/Trip	2245	438.63	1	6688	942.52	1	8933	731.37	1
Collision/Push - Sports	8	1.56		3	0.42		11	0.90	
Collision/Push - Other	15	2.93		52	7.33		67	5.49	
Fracture Unspecified	130	25.40		311	43.83		441	36.11	
Other/Unspecified	1964	383.73		4384	617.83		6348	519.73	
All Falls	6355	1241.65		14820	2088.54		21175	1733.65	

*Ranking of the leading categories was based on the rates and their 95% confidence intervals among the specified categories. CI overlapped categories received the same ranking.

Table 3.2d: Age-Specific Hospital Separation Rates, 1987-98, BC,
per 100,000 Person-Years, by Category of Falls and Gender, Ages 80-84

Category of Falls:	Male			Female			Total		
	Number of Cases	Rate	Rank*	Number of Cases	Rate	Rank*	Number of Cases	Rate	Rank*
Stairs	379	124.54	2	936	196.02	3	1315	168.2	3
Ladder/Scaffolding	129	42.39	3	41	8.59		170	21.74	4
Building	26	8.54		10	2.09		36	4.60	
Hole	7	2.30		6	1.26		13	1.66	
Cliff	3	0.99		3	0.63		6	0.77	
Chair or Bed	632	207.66	2	1467	307.23	2	2099	268.47	2
One Level to Another	118	38.77	3	231	48.38	4	349	44.64	4
Same Level Slip/Trip	2531	831.64	1	7420	1553.93	1	9951	1272.77	1
Collision/Push - Sports	2	0.66		2	0.42		4	0.51	
Collision/Push - Other	20	6.57		51	10.68	5	71	9.08	
Fracture Unspecified	109	35.82		301	63.04		410	52.44	
Other/Unspecified	2271	746.21		5690	1191.63		7961	1018.24	
All Falls	6606	2170.63		17094	3579.92		23700	3031.32	

* Ranking of the leading categories was based on the rates and their 95% confidence intervals among the specified categories. CI overlapped categories received the same ranking.

Age group 80-84

Among males aged 80-84 years old, the second leading categories included falls from stairs (95% CI: 86.5-174.6) and falls from chair or bed (95% CI: 158.5-272.1). The next leading categories included falls from ladder or scaffolding (95% CI: 23.3-77.1) and falls from one level to another (95% CI: 20.7-72.4). Among

females aged 80-84 years old, the second leading category was falls from chair or bed (95% CI: 257.3-366.8). The third leading category was falls from stairs (95% CI: 153.8-240.8). A fourth leading category was falls from one level to another (95% CI: 30.9-75.6). Finally, the fifth leading category was falls from collision/push - other (95% CI: 4.1-27.6). (Table 3.2d)

Table 3.2e: Age-Specific Hospital Separation Rates, 1987-98, BC,
per 100,000 Person-Years, by Category of Falls and Gender, Ages 85+

Category of Falls:	Male			Female			Total		
	Number of Cases	Rate	Rank	Number of Cases	Rate	Rank	Number of Cases	Rate	Rank
Stairs	360	189.65	3	743	188.76	3	1103	189.05	3
Ladder/Scaffolding	67	35.29	5	17	4.32		84	14.40	
Building	21	11.06		12	3.05		33	5.66	
Hole	5	2.63		10	2.54		15	2.57	
Cliff	1	0.53		5	1.27		6	1.03	
Chair or Bed	843	444.08	2	2335	593.22	2	3178	544.70	2
One Level to Another	101	53.21	4	258	65.55	4	359	61.53	4
Same Level Slip/Trip	2969	1564.04	1	10220	2596.45	1	13189	2260.55	1
Collision/Push - Sports	1	0.53		2	0.51		3	0.51	
Collision/Push - Other	14	7.38		86	21.85	5	100	17.14	5
Fracture Unspecified	130	68.48		454	115.34		584	100.10	
Other/Unspecified	2896	1525.58		9001	2286.76		11897	2039.10	
All Falls	7768	4092.11		23886	6068.38		31654	5425.39	

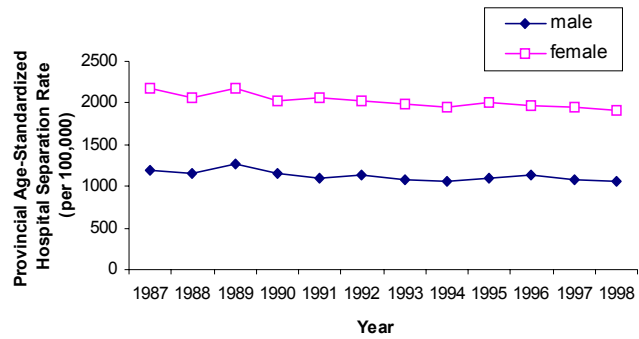
* Ranking of the leading categories was based on the rates and their 95% confidence intervals among the specified categories. CI overlapped categories received the same ranking.

[Appendix B-2d]

Age group 85+

Among males aged 85 years and over, the second leading category was falls from chair or bed (95% CI: 351.5-561.1). The third leading category was falls from stairs (95% CI: 129.1-266.3). The fourth leading categories included falls from one level to another (95% CI: 27.1-104.6) and falls from ladder or scaffolding (95% CI: 15.4-80.1). A similar pattern was observed among females aged 85 years and over, with the second leading category also being falls from chair or bed (95% CI: 515.5-682.7). The third leading category was falls from stairs (95% CI: 143.8-237.9). Finally, the fourth leading categories included falls from one level to another (95% CI: 42.9-100.0) and falls from collision/push - other (95% CI: 10.5-45.4). (Table 3.2e)

Figure 3.3: Trends for Age-Standardized Hospital Separation Rates, Falls, 1987-1998, BC, by Gender, Ages 65+



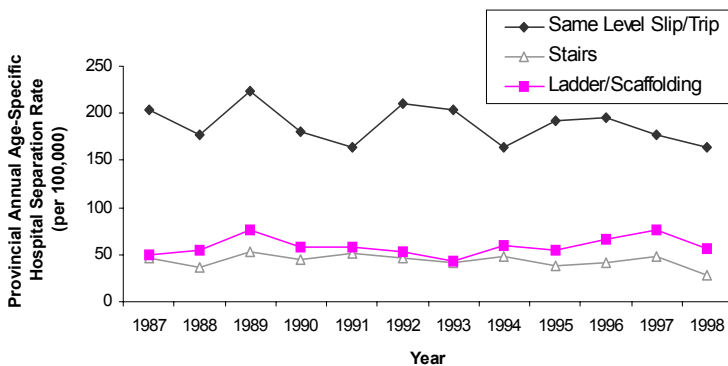
[Appendix B-2e]

TIME TRENDS

Trends in Fall-Related Hospitalizations

The provincial age-standardized hospital separation rates due to falls for each year by gender are presented in Figure 3.3. Injury rates were significantly higher among females than males, with rates among females nearly twice the rates among males. Among males, hospital separation rates dropped significantly by 12 percent from 1,193 per 100,000 in 1987 to 1,053 per 100,000 in 1998 ($\chi^2=44.7, p=.0001$). A similar drop was found for females, with rates decreasing significantly across the years from 2,173 to 1,919 per 100,000 ($\chi^2=81.16, p=.0001$). [Appendix B-3a]

Figure 3.4a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 65-69



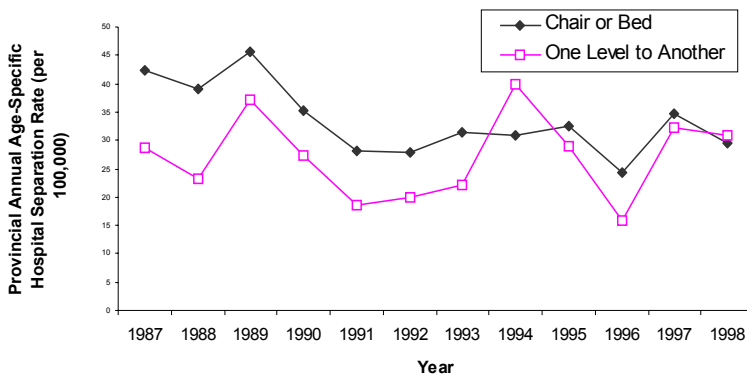
Trends by Leading Categories of Falls, Age and Gender

Age Group 65-69

Males

The trends for age-specific hospital separation rates among 65- to 69-year-old males are presented in Figures 3.4a,b. A non-significant downward trend was found for falls on same level/slip or trip throughout the study period. In this category, rates were three to four times higher than rates due to

Figure 3.4b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls Males, Ages 65-69



falls from ladder or scaffolding. These falls, as well as falls from stairs, showed no specific trends. Hospitalization rates due to falls from chair or bed decreased from 42 per 100,000 to 30 per 100,000 during the 12-year period 1987-1998. Meanwhile, hospitalization rates due to falls from one level to another remained stable. [Appendix B-3b]

Females

Downward but non-significant trends were found for falls on same level/slip or trip, as they declined from 402 per 100,000 in 1987 to 336 per 100,000 in 1998. Falls from stairs and falls from chair or bed remained relatively stable across the years. On a lower scale, a relative but non-significant increase can be observed in hospitalization rates due to falls from one level to another. Meanwhile rates of hospitalization due to falls from ladder or scaffolding remained stable. (Figures 3.5a,b) [Appendix B-3c]

Age Group 70-74

Males

Slowly decreasing but non-significant trends were observed in hospital separation rates due to falls on same level/slip or trip. Similar rates with no apparent trend were found in hospitalization due to falls from stairs and falls from chair or bed. On a lower scale, a non-significant decrease was observed in hospitalization due to falls from ladder or scaffolding between 1993 and 1998. Falls from one

Figure 3.5a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 65-69

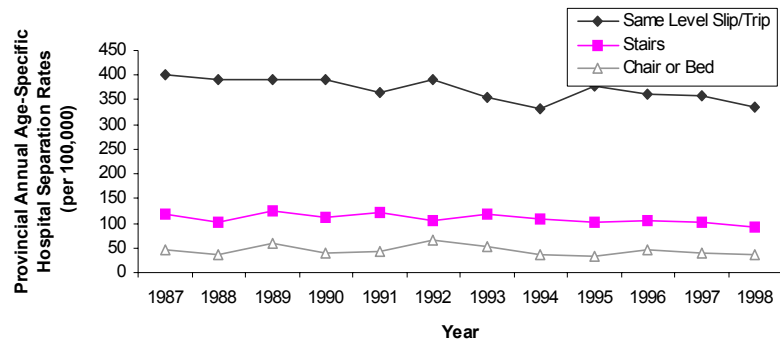


Figure 3.5b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 65-69

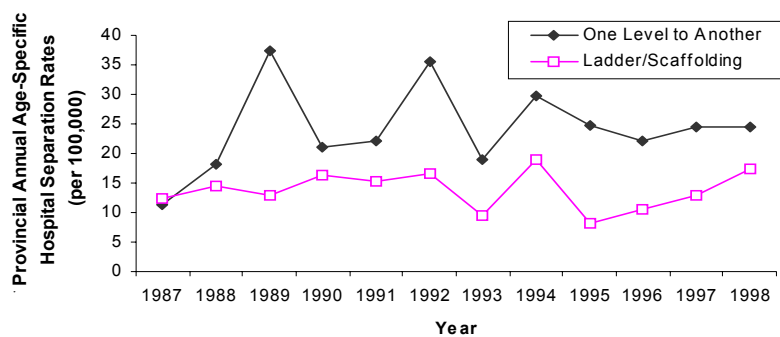


Figure 3.6a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 70-74

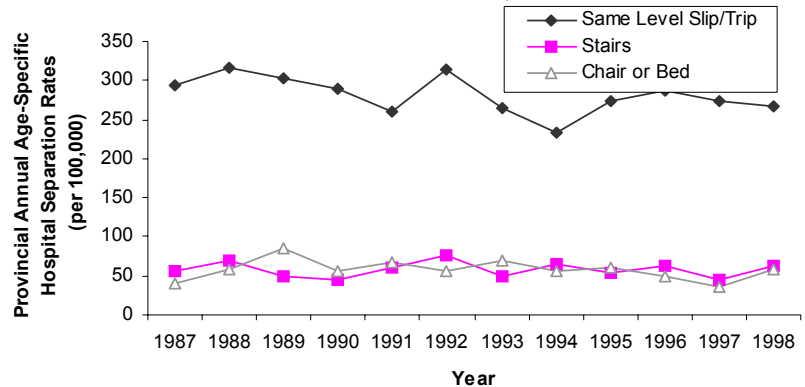
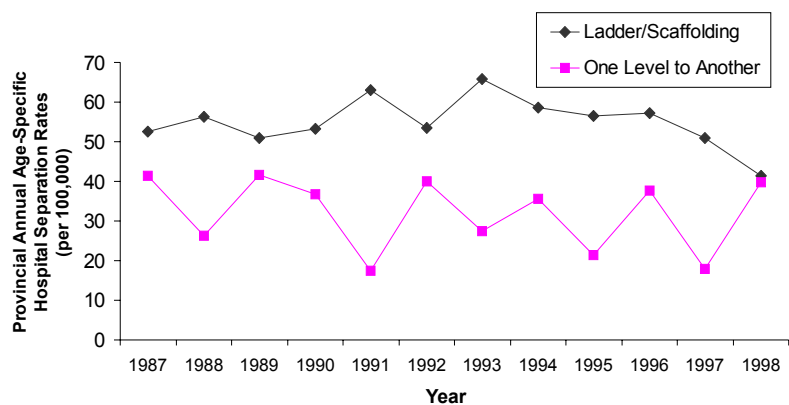


Figure 3.6b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 70-74



Fall-Related Hospitalizations

level to another showed a fluctuating pattern with no apparent trend. (Figures 3.6a,b) [Appendix B-3d]

Females

Among the 70- to 74-year-old females, there was a non-significant decrease in hospitalization due to falls on same level/slip or trip. The decrease was especially apparent between 1994 and 1998. Falls from stairs and falls from chair or bed remained relatively stable. On a lower scale, there was a non-significant upward trend in the rates due to falls from one level to another, especially from 1995 to 1998. Hospitalization rates due to falls from ladder or scaffolding showed no apparent trend. (Figures 3.7a,b) [Appendix B-3e]

Age Group 75-79

Males and Females

Hospital separation rates due to the three leading categories of falls, among 75-79-year-old males and females, can be seen in Figures 3.8a and 3.9a respectively. Among males, there was a non-significant decrease in falls on same level/slip or trip between 1987 and 1994. This decrease was followed by an increase and leveling off between 1994 and 1998. Among females, there was a significant downward trend ($\chi^2=29.1$, $p=.0001$) in these types of falls. Falls from chair or bed and falls from stairs remained

Figure 3.7a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 70-74

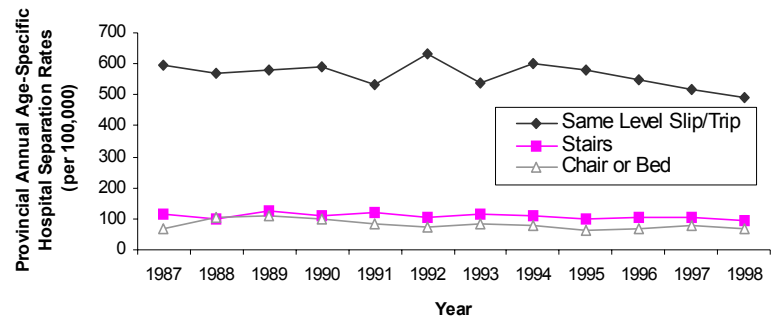


Figure 3.7b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 70-74

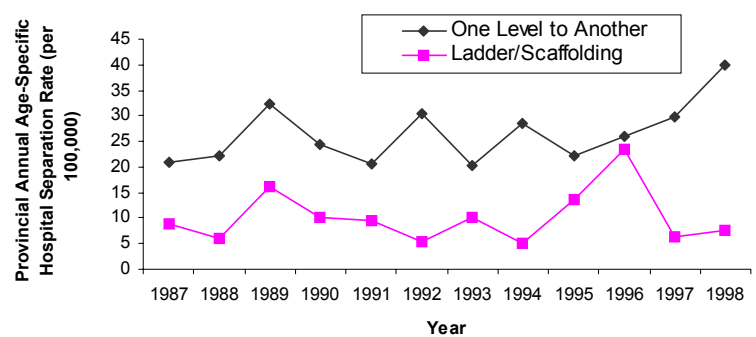


Figure 3.8a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 75-79

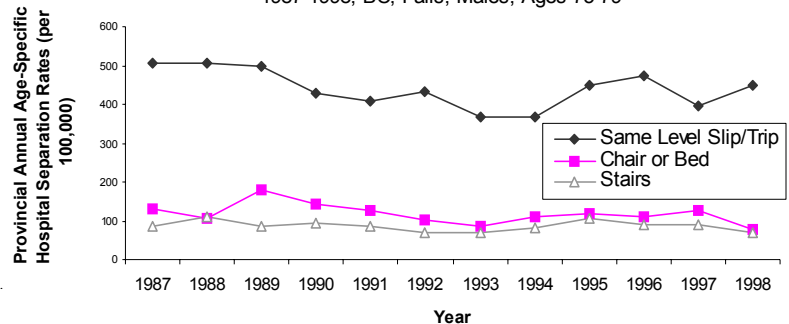


Figure 3.8b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 75-79



stable for both genders.

Despite notable fluctuations, a non-significant downward trend was found for the rates due to falls from ladder or scaffolding, in males. No apparent trend was observed for falls from one level to another in males. Among females, a significant upward trend was found for hospitalization rates due to falls from one level to another between 1990 and 1998 ($\chi^2=9.2, p=.002$). On the other hand, rates of hospitalization of females, due to falls from ladder or scaffolding, remained stable (Figure 3.8b for males and Figure 3.9b for females). [Appendices B-3f,g]

Age Group 80-84

Males and Females

Hospital separation rates due to the three leading causes of falls, among 80- to 84-year-old males and females, are presented in Figure 3.10a and Figure 3.11a. For falls on same level/slip or trip, the rates were relatively stable among both males and females. Falls from chair or bed and falls from stairs remained stable overall for both males and females.

On a lower scale, falls from ladder or scaffolding and falls from one level to another in males showed a large fluctuation with no specific trend. A non-significant increase in hospitalization due to falls from one level to another was noted among males (from 1995 to 1998). Among females, falls from one level to another showed a similar pattern. There was an increase and then leveling off of the rates from 1990 to 1998.

Figure 3.9a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 75-79

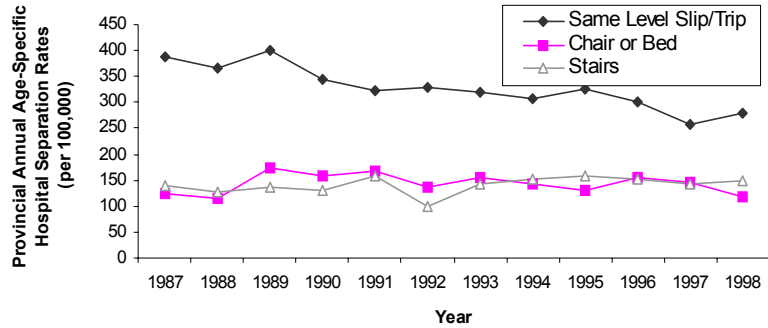


Figure 3.9b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 75-79

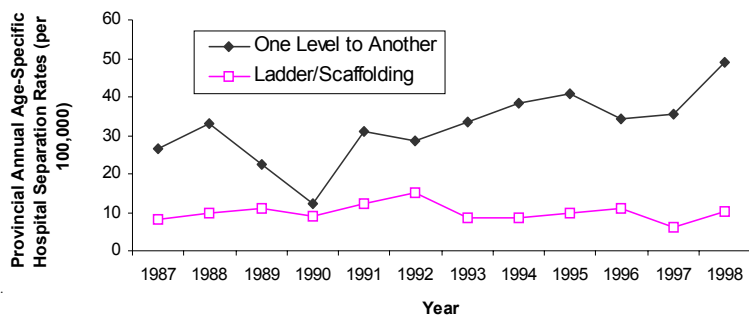


Figure 3.10a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 80-84

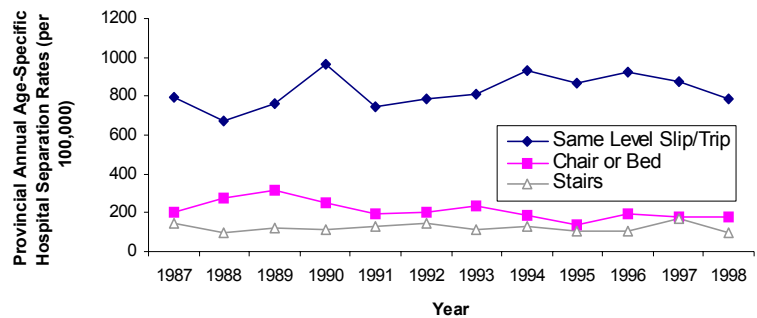
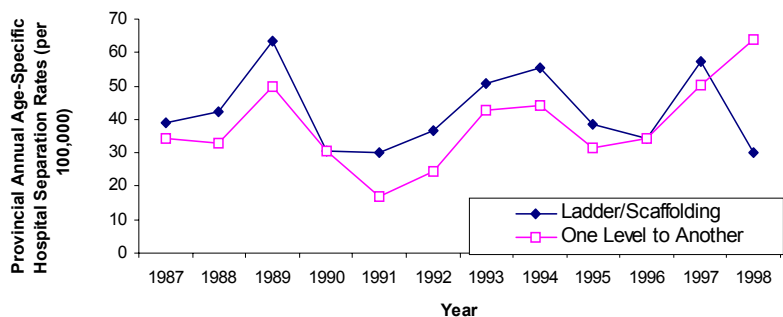


Figure 3.10b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 80-84



Falls due to collision had rather stable rates during the 12-year period among 80-84 years old females. (Figures 3.10b, 3.11b) [Appendices B-3h, i]

Age Group 85+

Males and Females

Hospital separation rates for the leading categories of falls among males and females 85 years old and over were very similar (Figures 3.12a, 3.13a), with the exception of falls on same level/slip or trip, where the rates were much higher among females. There were no significant trends for falls on same level, falls from chair or bed, and falls from stairs for both males and females.

On a lower scale (Figures 3.12b, 3.13b), falls from one level to another showed a non-significant increase from 16 per 100,000 in 1987 to 80 per 100,000 in 1998 among males, and a significant increase from 67 to 87 per 100,000 among females ($\chi^2=5.8, p=.02$). Among males, falls from ladder or scaffolding fluctuated with no significant trend. A similar pattern was observed for falls due to collision, among females. [Appendices B-3j, k]

Figure 3.11a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 80-84

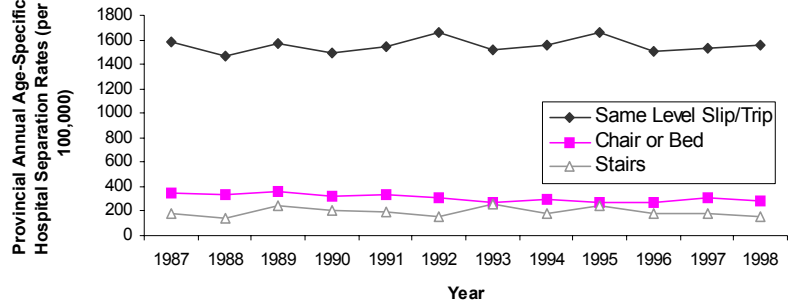


Figure 3.11b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 80-84

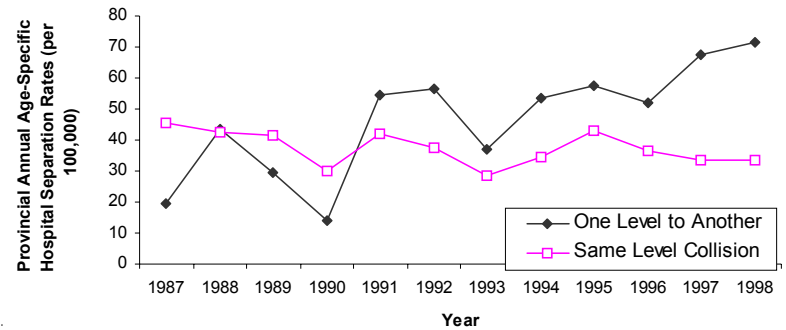


Figure 3.12a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 85+

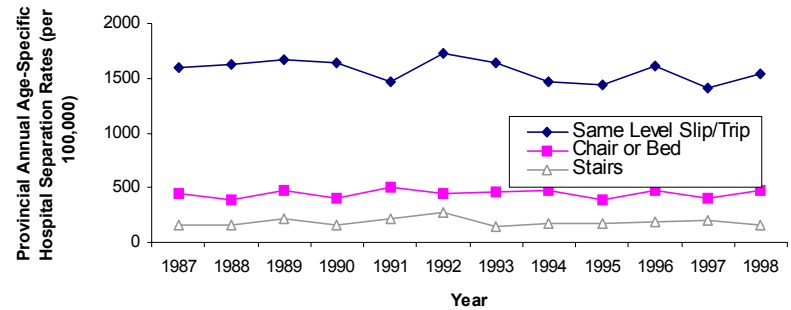


Figure 3.12b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Males, Ages 85+

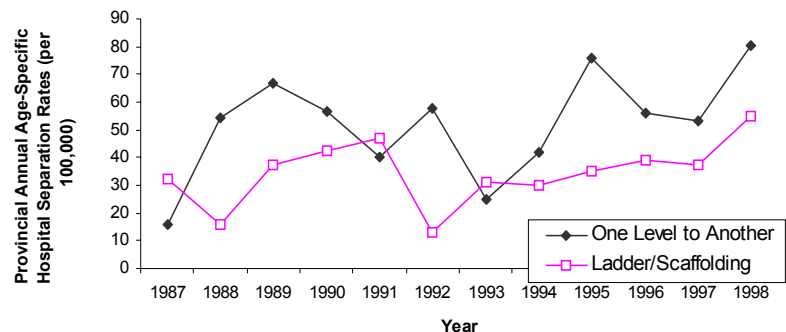


Figure 3.13a: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 85+

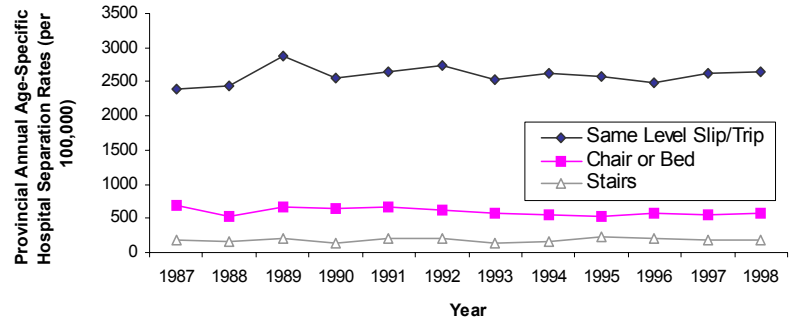
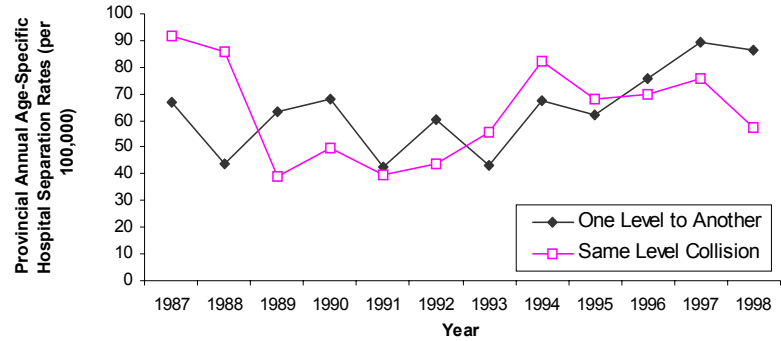


Figure 3.13b: Trends for Annual Age-Specific Hospital Separation Rates, 1987-1998, BC, Falls, Females, Ages 85+



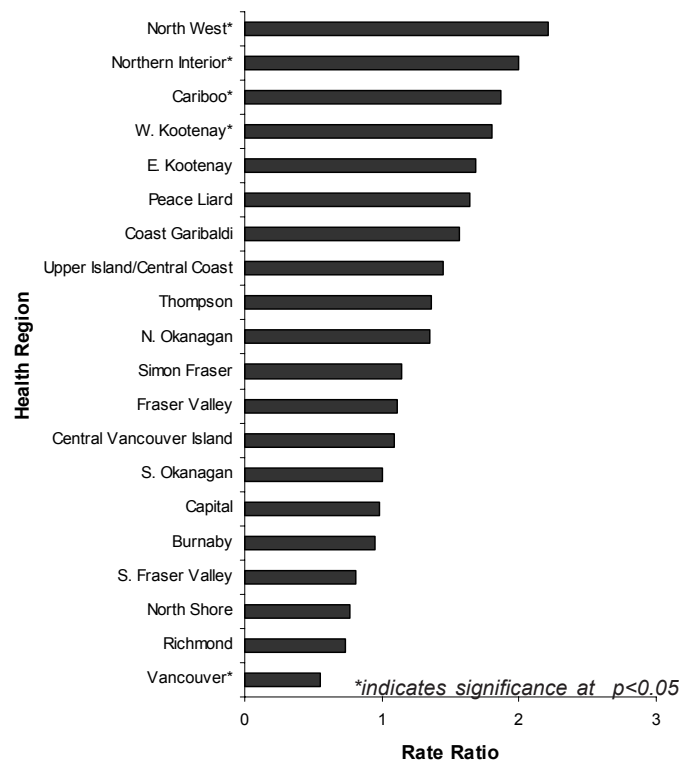
REGIONAL VARIATIONS

Regional Variations in Hospital Separations Due to Falls by Age and Gender

Males Aged 65-69

Regional variations among males aged 65-69 are shown in *Figure 3.14*. North West (2.21, 95% CI: 1.23-4.00), Northern Interior (2.00, 95% CI: 1.20-3.33), Cariboo (1.87, 95% CI: 1.04-3.36) and West Kootenay (1.80, 95% CI: 1.10-2.93) had hospital separation rate ratios significantly higher than the provincial rate of 1. East Kootenay (1.69, 95% CI: 0.98-2.90), Peace Liard (1.64, 95% CI: 0.74-3.65) and Coast Garibaldi (1.56, 95% CI: 0.87-2.81) also showed high rates, but they were not significantly different from the BC average. Vancouver showed significantly lower rates than the provincial average (0.55, 95% CI: 0.42-0.73). [*Appendix B-4*]

Figure 3.14: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Males Ages 65-69



Females Aged 65-69

For 65- to 69-year-old females, the North West and Cariboo had the highest separation rate, 2.21 (95% CI: 1.31-3.72) and 1.99 (95% CI: 1.19-3.33) times higher than the BC average. Other regions with high separation rates were Peace Liard (1.77, 95% CI: 0.89-3.51), Thompson (1.75, 95% CI: 1.21-2.53), Northern Interior (1.65, 95% CI: 1.00-2.73), East Kootenay (1.64, 95% CI: 1.03-2.61), Coast Garibaldi (1.62, 95% CI: 0.99-2.64) and North Okanagan (1.51, 95% CI: 1.06-2.16). However, as shown by the 95% confidence intervals, only North West, Cariboo, Thompson, East Kootenay and North Okanagan Health Regions had significantly higher rates than the provincial average. Finally, Vancouver had a significantly lower separation rate ratio (0.47, 95% CI: 0.37-0.59). (Figure 3.15) [Appendix B-5]

Males Aged 70-74

The highest hospital separation rate ratios among 70- to 74-year-old males were in the North West (2.07, 95% CI: 1.10-3.91) and Northern Interior (2.13, 95% CI: 1.26-3.61) (Figure 3.16). High rate ratios were also found in Peace Liard (1.80, 95% CI: 0.82-3.94) and East Kootenay (1.63, 95% CI: 0.95-2.79), but were not statistically significant. Vancouver had a significantly lower rate in comparison with the provincial average (0.55, 95% CI: 0.43-0.71). [Appendix B-4]

Females Aged 70-74

The highest hospital separation rate ratio for 70- to 74-year-old females was also in the North West Health Region (2.34, 95% CI: 1.44-3.79). Significantly higher rate ratios were also found in Cariboo (1.98, 95% CI: 1.21-3.24), Coast Garibaldi (1.79, 95% CI: 1.18-2.70), East Kootenay (1.68, 95% CI: 1.12-2.50), Northern Interior (1.63, 95% CI: 1.01-2.63), West Kootenay (1.60, 95% CI: 1.11-2.30) and

Figure 3.15: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Females Ages 65-69

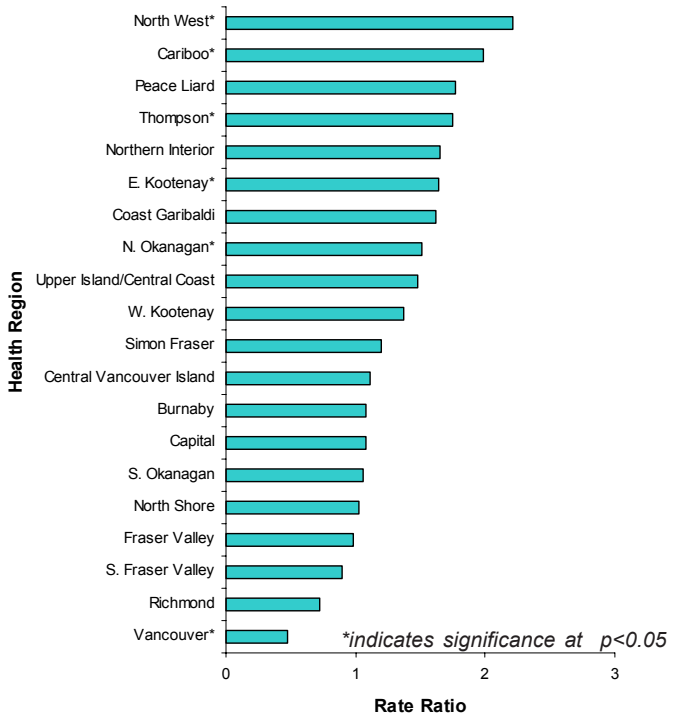


Figure 3.16: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Males Ages 70-74

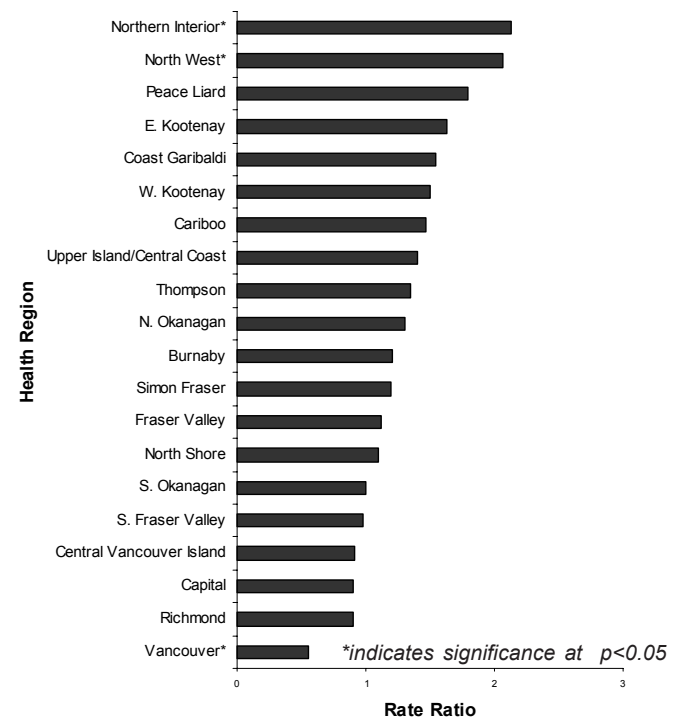
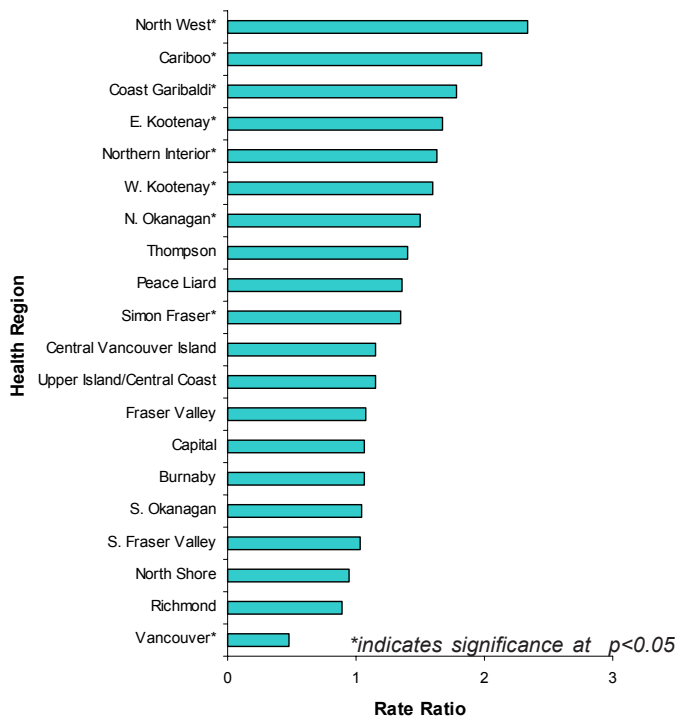


Figure 3.17: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Females Ages 70-74



North Okanagan (1.50, 95% CI: 1.10-2.05) (Figure 3.17). The lowest rate ratio was in Vancouver (0.47, 95% CI: 0.39-0.57). [Appendix B-5]

Males Aged 75-79

The highest hospital separation rate ratios due to falls among 75- to 79-year-old males were found in North West (2.42, 95% CI: 1.31-4.48) and Northern Interior (2.10, 95% CI: 1.21-3.65) (Figure 3.18). Rates 67-75% higher than average were found in Peace Liard (1.75, 95% CI: 0.78-3.95), West Kootenay (1.68, 95% CI: 1.08-2.60) and Thompson (1.67, 95% CI: 1.06-2.61). Vancouver had the lowest separation rate ratio due to falls (0.53, 95% CI: 0.41-0.67). [Appendix B-4]

Females Aged 75-79

Females aged 75-79 in North West (2.42, 95% CI: 1.55-3.80), Cariboo (2.11, 95% CI: 1.34-3.32), Coast Garibaldi (1.85, 95% CI: 1.29-2.66) and West Kootenay (1.55, 95% CI: 1.13-2.13) had the highest and

Figure 3.18: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Males Ages 75-79

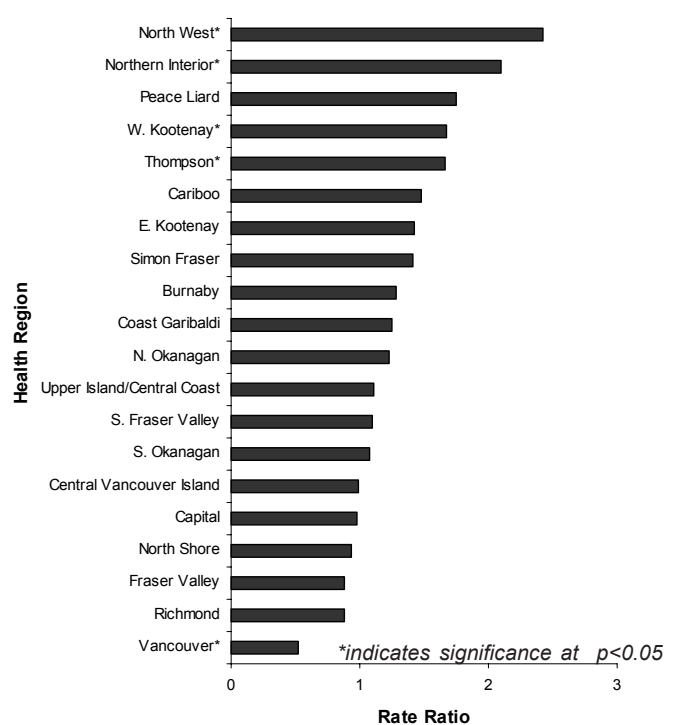


Figure 3.19: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Females Ages 75-79

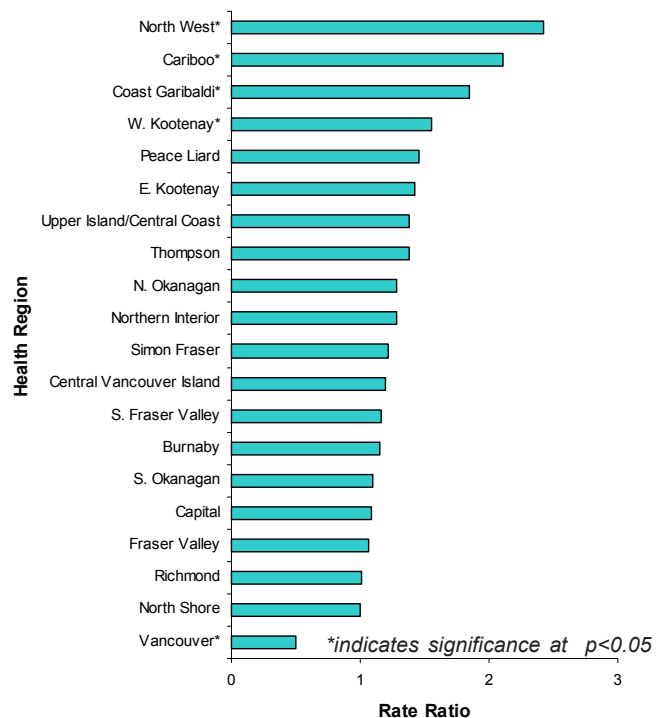
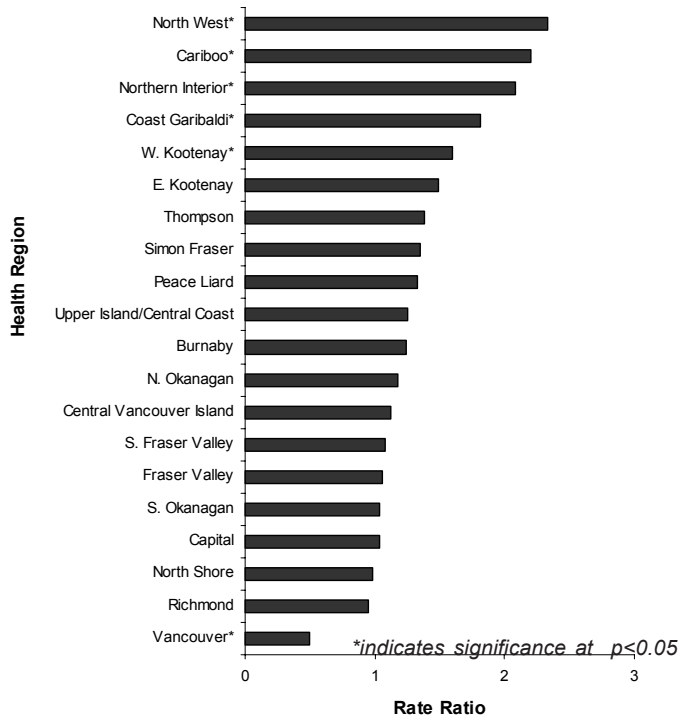


Figure 3.20: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Males Ages 80-84



statistically significant separation rate ratios (Figure 3.19). Vancouver had the lowest separation rates (0.50, 95% CI: 0.43-0.58). [Appendix B-5]

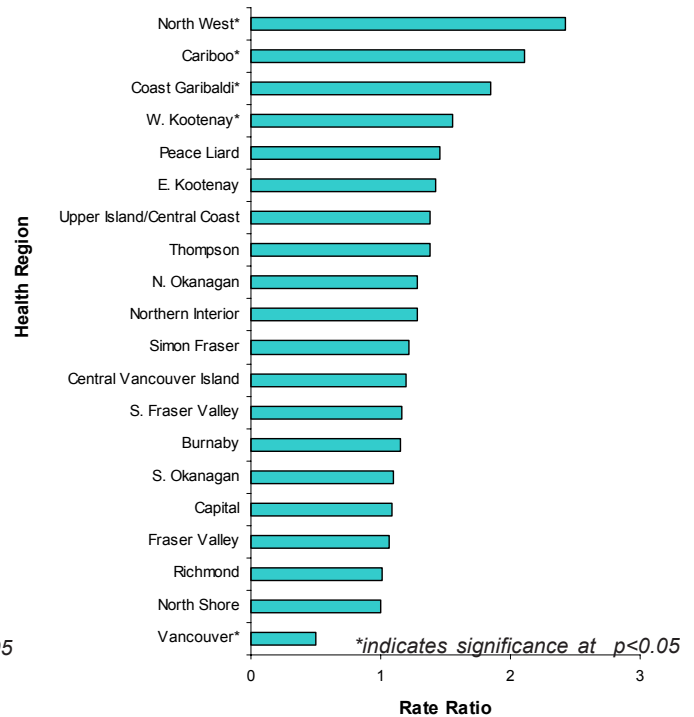
Males Aged 80-84

North West Health Region had the highest separation rate ratio (2.34, 95% CI: 1.22-4.48) (Figure 3.20). Next were Cariboo (2.20, 95% CI: 1.21-4.01), Northern Interior (2.08, 95% CI: 1.18-3.68), Coast Garibaldi (1.81, 95% CI: 1.07-3.07) and West Kootenay (1.60, 95% CI: 1.04-2.45). Vancouver showed significantly lower rates than the BC average (0.49, 95% CI: 0.39-0.62). [Appendix B-4]

Females Aged 80-84

The North West (2.24, 95% CI: 1.42-3.54) and Coast Garibaldi (2.17, 95% CI: 1.57-3.00) health regions had the highest separation rate ratios. Females in Cariboo (1.87, 95% CI: 1.15-3.02), West Kootenay (1.74, 95% CI: 1.32-2.30), East Kootenay (1.66, 95% CI: 1.18-2.34), Northern Interior (1.62, 95% CI: 1.03-2.55),

Figure 3.21: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Females Ages 80-84



Upper Island/Central Coast (1.48, 95% CI: 1.03-2.11) and Simon Fraser (1.34, 95% CI: 1.10-1.65) also had high rate ratios. Similar to other age groups, the only region with separation rates significantly less than the provincial average was Vancouver (0.49, 95% CI: 0.43-0.56). (Figure 3.21) [Appendix B-5]

Males Aged 85+

The highest hospital separation rate ratios among males aged 85 and over were found in the Northern Interior (1.96, 95% CI: 1.12-3.43) and Coast Garibaldi (1.76, 95% CI: 1.04-2.99). Significantly higher rates were also found in West Kootenay (1.58, 95% CI: 1.05-2.38). Vancouver had the lowest rate ratio (0.52, 95% CI: 0.43-0.64). (Figure 3.22) [Appendix B-4]

Females Aged 85+

For females 85 years old and over, North West (2.01, 95% CI: 1.36-2.96), Coast Garibaldi (1.90, 95% CI: 1.41-2.55), West Kootenay (1.63, 95% CI: 1.26-2.11) (Figure 3.23), Northern Interior (1.56, 95% CI: 1.03-

Figure 3.22: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Males Ages 85+

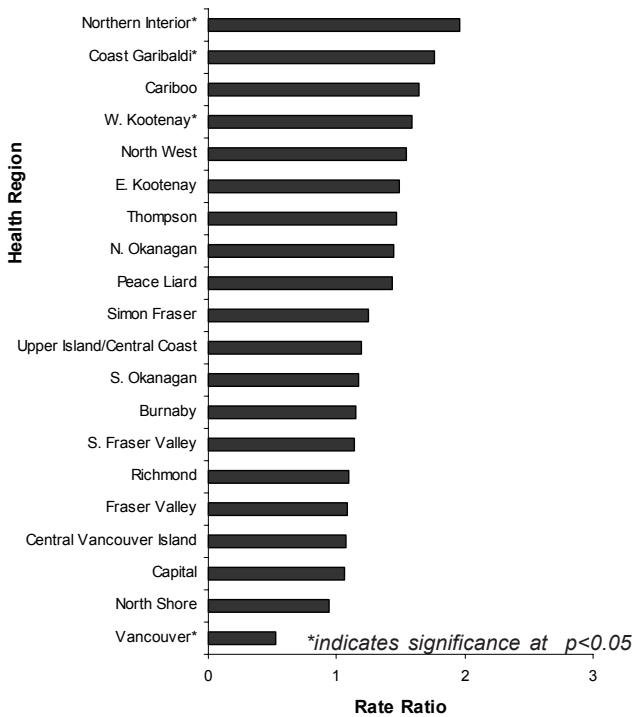
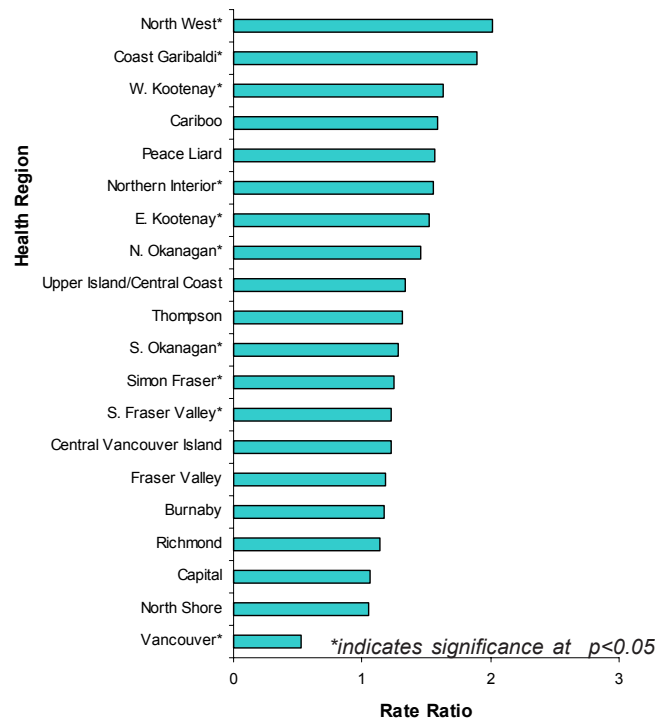


Figure 3.23: Age-Specific Hospital Separation Rate Ratio, 1987-1998, BC, Falls, by Health Region, Females Ages 85+

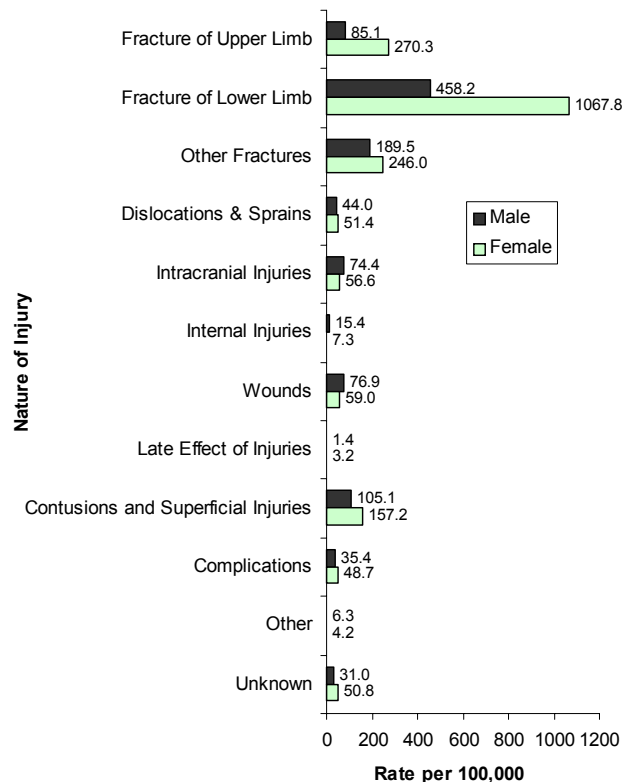


2.36), East Kootenay (1.53, 95% CI: 1.12-2.09) and North Okanagan (1.45, 95% CI: 1.14-1.84) had significantly high rates. Significantly higher rates (29% to 23%) were also found in the regions of South Okanagan (1.29, 95% CI: 1.09-1.51), Simon Fraser (1.25, 95% CI: 1.04-1.49) and South Fraser Valley (1.23, 95% CI: 1.07-1.41). The lowest rate was again in Vancouver (0.53, 95% CI: 0.48-0.59). [Appendix B-5]

NATURE OF INJURY BY GENDER

The age-standardized hospital separation rates by nature of injury and gender are presented in Figure 3.24. Fractures of lower limb were the most common type of injury in both genders, with rates more than two times higher than fractures of upper limb in females and other fractures in males. Fractures, in general, were more common among females as well as contusions and superficial injuries, dislocations and sprains. Intracranial injuries, wounds, and internal

Figure 3.24: Hospital Separation Rates per 100,000 Person-Years, 1987-1998, BC, Falls, by Nature of Injury and Gender, 65+



injuries were more common among males. In the following, we will illustrate the results for the most severe types of falls including fractures of upper and lower limb, other fractures and intracranial injuries. For each nature of injury, the rates between males and females are all significantly different [Appendix B-6a] For almost all categories, females have significantly higher rates of injury, except for intracranial injuries, internal injuries, and wounds.

Males

Among males, high rates were found for fractures of lower limb (458.2, 95% CI: 455.8-460.5), other fractures (189.5, 95% CI: 188.0-191.0), and fractures of upper limb (85.0, 95% CI: 84.0-86.1). Finally, intracranial injuries were high among males (74.4, 95% CI: 73.5-75.4). [Appendix B-6a]

Fractures of lower limb were reported in 40% of hospitalizations due to falls, followed by all other types of injuries with 35% of the hospitalizations (Figure 3.25a). Other fractures represented 17% of hospitalized cases. Fractures of upper limb, on the other hand, caused 8% of falls.

Females

Among females, the highest rates were found for fractures of lower limb (1067.8, 95% CI: 1064.7-1070.9), followed by fractures of upper limb (270.3, 95% CI: 268.7-271.8) and other fractures (246.0, 95% CI: 244.5-247.5). Intracranial injuries were significantly lower among females (56.6, 95% CI: 55.9-57.3). [Appendix B-6a]

Among females, more than half of the hospitalizations were because of fractures of lower limb, followed by all other types of injuries (22%) and fractures of upper limb (13%). Other fractures were reported in 12% of hospitalized female cases. (Figure 3.25b)

Figure 3.25a: Nature of Injury, Falls, BC, 1987-1998, Males

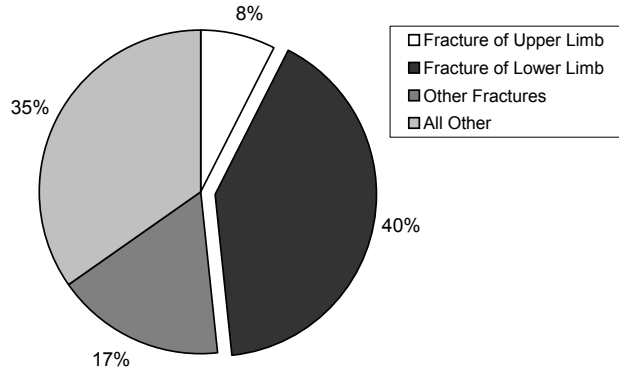


Figure 3.25b: Nature of Injury, Falls, BC, 1987-1998, Females

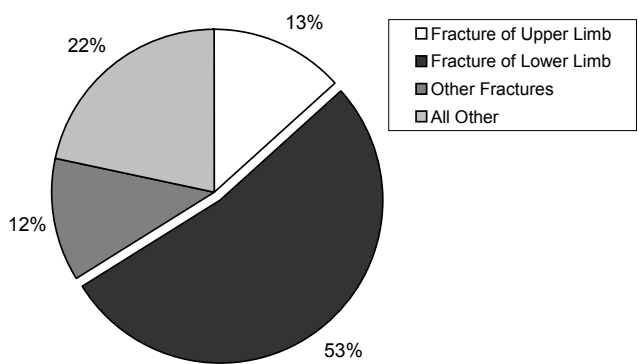
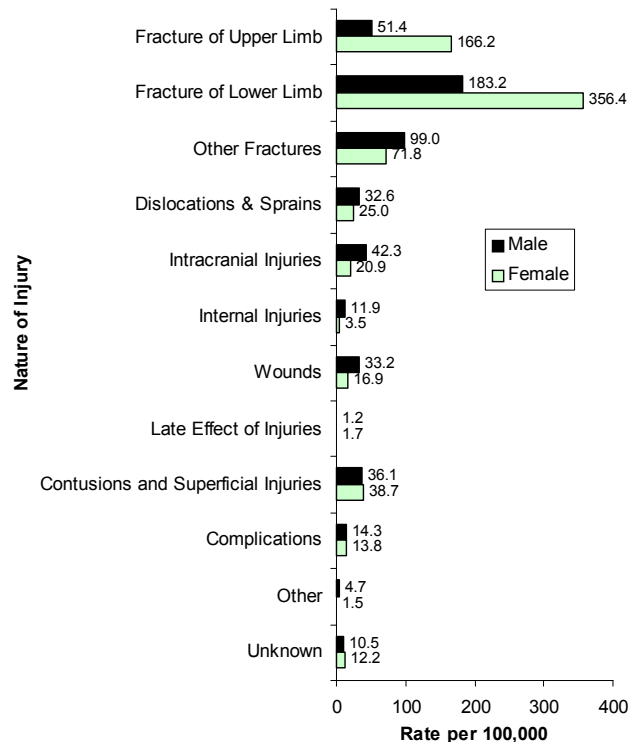


Figure 3.26: Hospital Separation Rates per 100,000 Person-Years, 1987-1998, BC, Falls, by Nature of Injury and Gender, Ages 65-69



Nature of Injury by Age Groups and Gender

Age Group 65-69

The distribution of hospital separation rates due to falls among the 65 to 69 years old group by nature of injury and gender is shown in *Figure 3.26*. The most common injuries were fractures of lower limb for both males (183.2, 95% CI: 155.2-216.3) and females (356.4, 95% CI: 318.4-398.9), with rates among females significantly higher than among males.

Fractures of upper limb followed, with rates three times higher among females (166.2, 95% CI: 140.9-196.0) in comparison with males (51.4, 95% CI: 37.5-70.2). Other fractures had the third highest rate, and were more common among males (98.9, 95% CI: 79.0-124.0) than among females (71.8, 95% CI: 55.8-92.3), although not significantly. Finally, intracranial injuries occurred with similar rates among males (42.3, 95% CI: 29.9-59.7) and females (20.8, 95% CI: 13.1-33.3). [*Appendix B-6b*]

Age Group 70-74

Fractures of lower limb were also the most frequent in this age group. Females had also significantly higher rates than males (566.9, 95% CI: 515.6-623.3 for females versus 284.9, 95% CI: 245.3-330.8 for males). Other fractures were the second leading type of injuries among males, but the rates were not significantly different from those among females (124.9, 95% CI: 99.7-156.6 among males and 130.9, 95% CI: 107.4-159.4 among females). Fractures of upper limb were the second leading type of injury among females and were significantly higher than among males (202.6, 95% CI: 172.9-237.4 among females and 66.1, 95%

Figure 3.27: Hospital Separation Rates per 100,000 Person-Years, 1987-1998, BC, Falls, by Nature of Injury and Gender, Ages 70-74

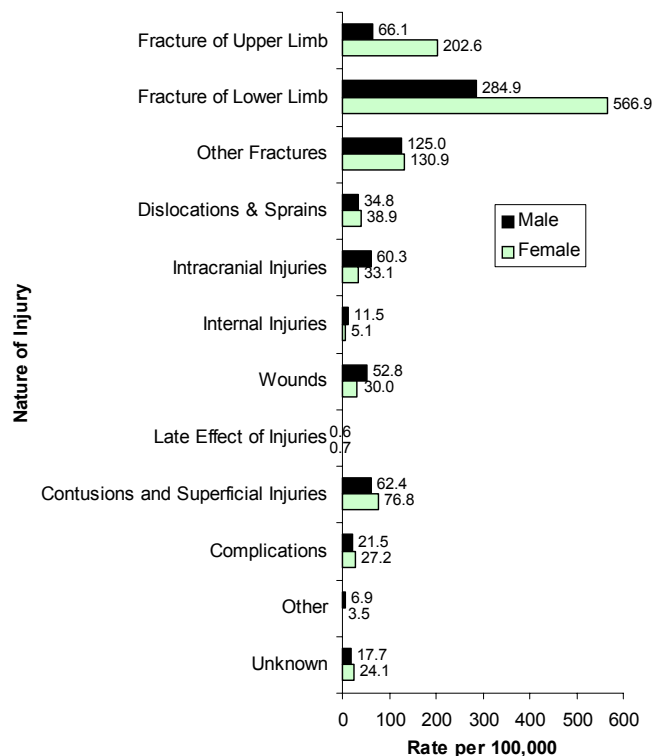
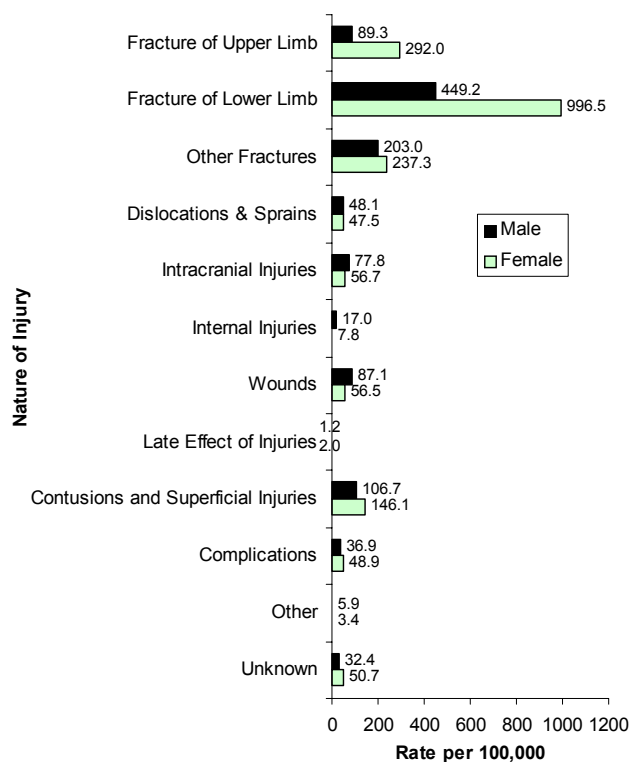


Figure 3.28: Hospital Separation Rates per 100,000 Person-Years, 1987-1998, BC, Falls, by Nature of Injury and Gender, Ages 75-79



CI: 48.5-90.2). Intracranial injuries were slightly higher among males than females, but the difference was not statistically significant (60.3, 95% CI: 43.6-83.5 for males and 33.1, 95% CI: 22.3-48.9 for females). (Figure 3.27) [Appendix B-6c]

Age Group 75-79

Similarly to other age groups, fractures of lower limb were the most common type of injury among the 75-79 years old group, with significantly higher rates among females (996.5, 95% CI: 919.2-1080.3) than among males (449.2, 95% CI: 389.9-517.5). Fractures of upper limb were significantly higher among females (292.0, 95% CI: 251.5-338.9) than among males (89.3, 95% CI: 64.9-122.7). Other fractures were next, but with no significant difference between males (203.0, 95% CI: 164.4-250.6) and females (237.3, 95% CI: 201.1-280.0). Finally, intracranial injuries among males (77.7, 95% CI: 55.3-109.3) were not significantly higher than among females (56.6, 95% CI: 40.4-79.5). (Figure 3.28) [Appendix B-6d]

Age Group 80-84

Significantly higher rates were found for fractures of lower limb in this age group compared to the 75-79 years old age group. Within the age group, significantly higher rates were found for females (1792.7, 95% CI: 1665.8-1929.2) compared to males (864.8, 95% CI: 757.6-987.2). Females also had significantly higher rates than males for fractures of upper limb (385.7, 95% CI: 329.3-451.9 for females and 140.6, 95% CI: 101.3-195.3 for males). Other fractures were next, but with no significant difference between genders (439.6, 95% CI: 379.0-509.8 for females versus 336.5, 95% CI:

Figure 3.29: Hospital Separation Rates per 100,000 Person-Years, 1987-1998, BC, Falls, by Nature of Injury and Gender, Ages 80-84

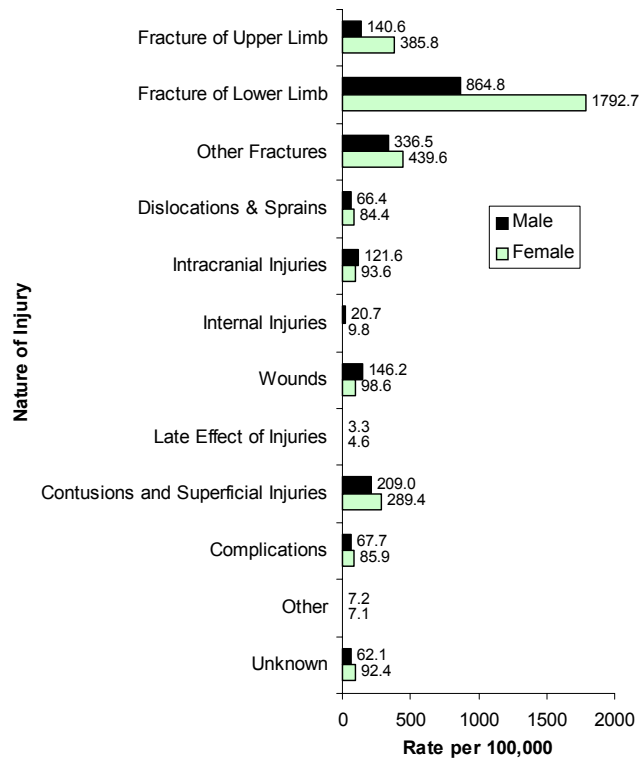
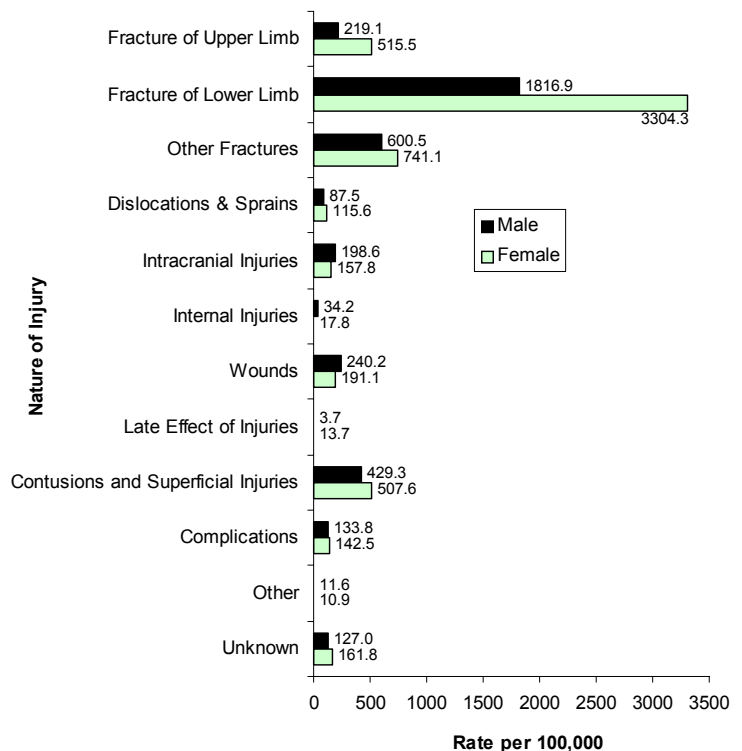


Figure 3.30: Hospital Separation Rates per 100,000 Person-Years, 1987-1998 BC, Falls, by Nature of Injury and Gender, Ages 85+



272.1-416.0 for males). Finally, there was no significant difference between the genders for intracranial injuries (121.6, 95% CI: 85.4-173.0 for males and 93.6, 95% CI: 67.9-129.1 for females) (Figure 3.29) [Appendix B-6e]

Age Group 85+

Fractures of lower limb remained the most common type of injury (Figure 3.30). Rates approximately doubled in comparison with the 80-84 years old group, reaching values significantly higher among females than among males: 3,304 per 100,000 person-years (95% CI: 3113.3-3506.9) among females and 1,817 per 100,000 (95% CI: 1618.5-2039.6) among males. Other fractures were next with a rate of 600.5 per 100,000 among males (95% CI: 491.1-734.3) and 741.1 per 100,000 among females (95% CI: 653.5-840.4). Fractures of upper limb were significantly higher among females (515.5, 95% CI: 443.4-599.3) than among males (219.1, 95% CI: 157.1-305.7). The rate of intracranial injuries continued to increase with age, but with no significant difference between males (198.6, 95% CI: 140.0-281.7) and females (157.8, 95% CI: 120.1-207.2). [Appendix B-6f]

Figure 3.31: Occurrence of Falls, BC, 1989-1998, Males

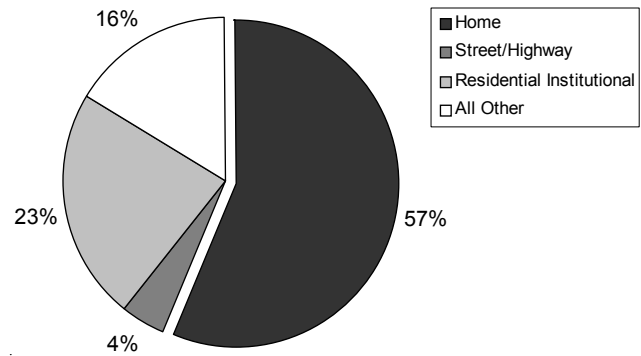
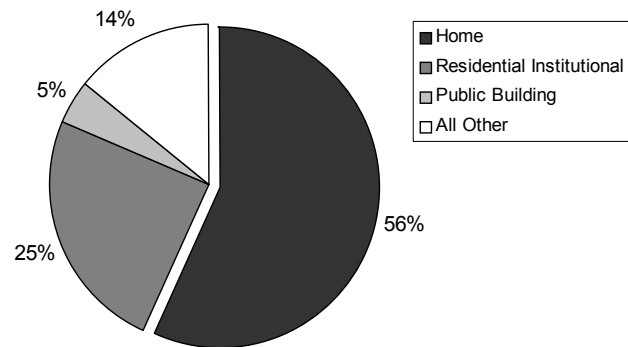


Figure 3.32: Occurrence of Falls, BC, 1989-1998, Females



PLACE OF OCCURRENCE

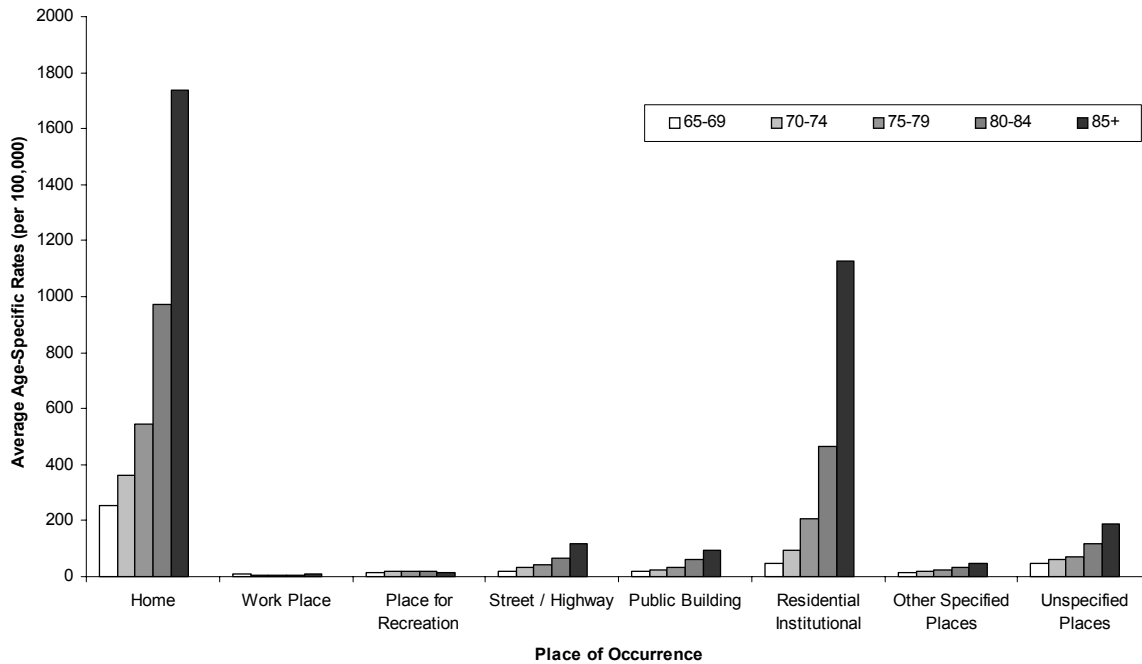
Place of Occurrence of Falls by Gender

The place of occurrence of falls was not specified in 16% of cases. Among specified cases, the most common place of occurrence of falls was at home. The second most common location was a residential/institutional place. Among males, 4% percent of falls happened on a street/highway, and among females, five percent of falls happened in a public building (Figures 3.31, 3.32).

Table 3.3: Age-Specific Hospital Separation Rates per 100,000 Person-Years, and Number of Hospital Separations Due to Falls, B.C., 1987-1998, by Place of Occurrence and Gender

Place of Occurrence	Male			Female			Total (both genders)		
	Total # of Injuries	Rate	Rank	Total # of Injuries	Rate	Rank	Total # of Injuries	Rate	Rank
Home	13,988	528.76	1	33,563	958.62	1	47,551	773.61	1
Work Place	185	6.99		162	4.63		347	5.65	
Place for Recreation/Sport	466	17.62		736	21.02		1,202	19.56	
Street/Highway	1,060	40.07	3	2,600	74.26		3,660	59.55	3
Public Building	857	32.40		2,699	77.09	3	3,556	57.85	
Residential Institutional	5,740	216.98	2	14,571	416.17	2	20,311	330.44	2
Other Specified Places	600	22.68		1,442	41.19		2,042	33.22	
Unspecified Places	1,972	74.54		3,386	96.71		5,358	87.17	

Figure 3.33: Age-Specific Hospital Separation Rates per 100,000 Person-Years, 1987-1998, Males, Falls, by Place of Occurrence and Age Group



The hospital separation rates due to falls by gender for each place of occurrence are presented in *Table 3.3*. The two most common places of injury occurrence were home (773.6, 95% CI: 749.9-798.1) and residential/institutional places (330.4, 95% CI: 315.1-346.6). These locations were followed by street/highway (59.5, 95% CI: 53.2-66.6) and public building (57.9, 95% CI: 51.6-64.8). [*Appendix B-7*]

Place of Occurrence of Falls by Age Groups and Gender

Males

Hospital separation rates among males by place of injury occurrence are presented in *Figure 3.33*. Falls occurring at home increased significantly with age. The highest rates were among those 85 years and older (1738.9, 95% CI: 1545.1-1957.1). The same significant pattern can also be seen for falls that occurred in

residential/institutional places (1125.2, 95% CI: 971.5-1303.3). On a lower scale, falls that took place on street/highway and in public buildings also increased with age, although not significantly. Rates of injuries occurring in the work place and place for recreation were, as expected, the lowest. [*Appendix B-8a*]

Females

A similar pattern of hospital separations for home injuries due to falls was found for females, with an important and significant increase with age. The highest rates were among the 85 years old and over group (2558.3, 95% CI: 2390.9-2737.4). A notable significant increase with age can be seen in falls occurring in residential/institutional places with a rate of 1876.9 (95% CI: 1734.4-2031.2) among the 85 years old and over group. Falls on street/highway and in public buildings were next with a slight, but not significant, increase with age. (*Figure 3.34*) [*Appendix B-8b*]

Figure 3.34: Age-Specific Hospital Separation Rates per 100,000 Person-Years, 1987-1998, Females, Falls, by Place of Occurrence and Age Group

