CHAPTER 4

PROJECTIONS

PROJECTIONS

REGIONAL PROJECTIONS IN HOSPITAL SEPARATIONS DUE TO FALLS BY GENDER

Eastern Regions

Males 65-79

From 1987 to 1998, with the exception of North Okanagan, which showed a slight but not significant upward trend, downward trends in the rates of hospital separations were observed for the Eastern Regions. However, none of these trends were significant. (*Figure 4.1*)[*Appendix C-1*]

If the above trends persist, the rates, due to falls, for the four Eastern Health Regions will show a slight decreasing trend. Overall, the rates of hospital separations will decrease significantly from 1987 to 2012 (χ^2=42.4, p=.0001). The number of hospital separations will also slightly decrease over this time period, despite population increases. (*Figure 4.2*) [*Appendix C-2*]

Females 65-79

From 1987 to 1998, non-significant downward trends in the rates of hospital separations were observed in all the Eastern Health Regions. (*Figure 4.3*)[*Appendix C-3*]

If the above trends continue, the rates, due to falls for the four Eastern Regions will show a decreasing trend. Overall, the rates of hospital separations will decrease significantly from1987 to 2012 (χ^2=42.4, p=.0001). The number of hospital separations will also slightly decrease despite increases in the seniors population. (*Figure 4.4*) [*Appendix C-4*]

Figure 4.1: Hospital Separation Rates Due to Falls, per 10,000, BC, Eastern Regions, 1987-2012, Males 65-79

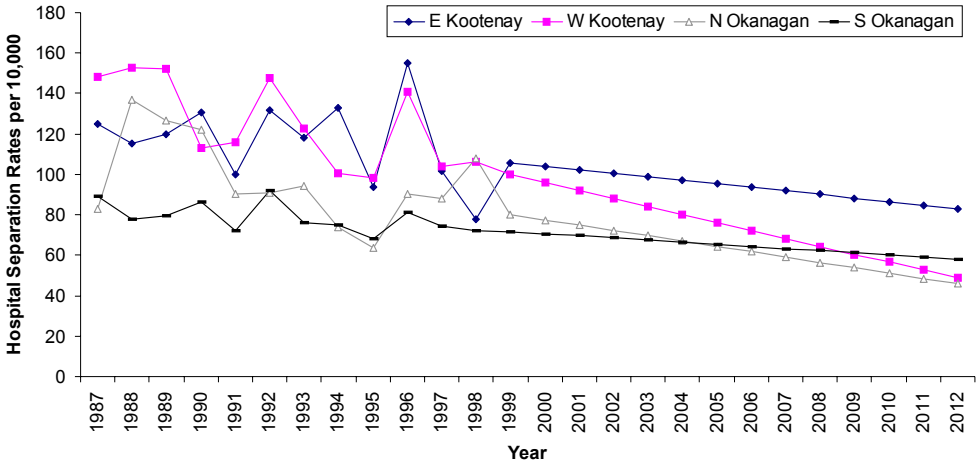
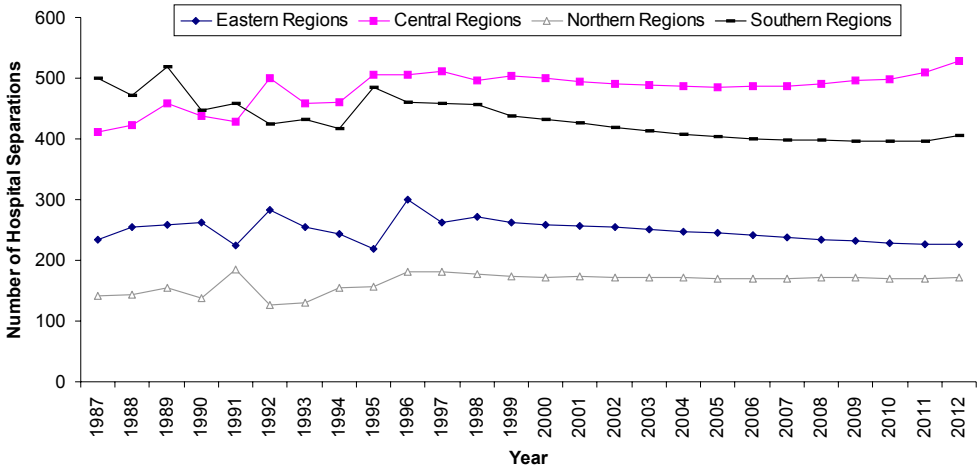


Figure 4.2: Number of Hospital Separations Due to Falls, BC, All Regions, 1987-2012, Males 65-79



Males 80+

From 1987 to 1998, upward but non-significant trends in the rates of hospital separations were observed for East Kootenay and South Okanagan. Small but non-significant downward trends were observed in West Kootenay and North Okanagan. (*Figure 4.5*) [*Appendix C-5*]

If the above trends continue, together with the demographic changes, the rates due to falls among the male elderly population (80 years old and over) will increase significantly for South Okanagan (χ^2=15.3, p=.0001) and decrease significantly for West Kootenay (χ^2=4.5, p=.03) and North Okanagan (χ^2=16.5, p=.0001). Overall, the rates of hospital separations due to falls in the Eastern Health Regions will slightly increase from 1987 to 2012, but not significantly. However, the number of hospital admissions in the Eastern Regions is expected to increase over time. (*Figure 4.6*) [*Appendix C-6*]

Figure 4.3: Hospital Separation Rates Due to Falls, per 10,000, BC, Eastern Regions, 1987-2012, Females 65-79

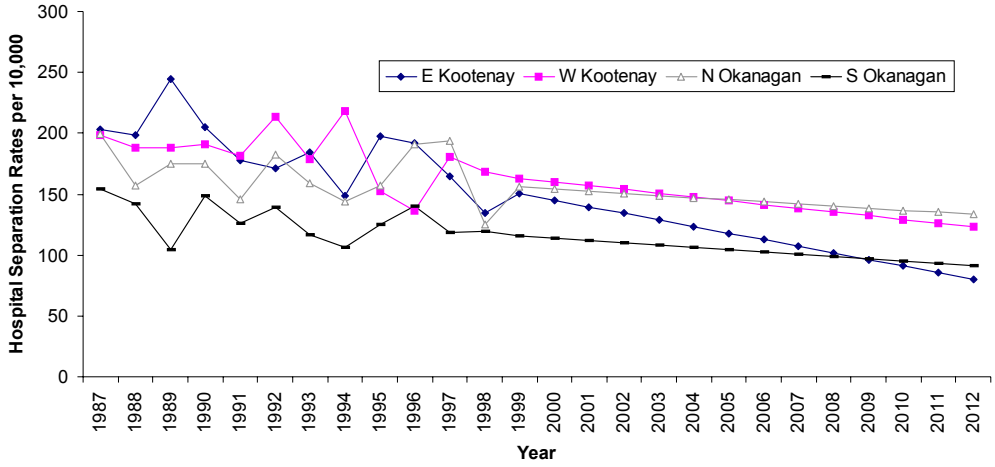


Figure 4.4: Number of Hospital Separations Due to Falls, BC, All Regions, 1987-2012, Females 65-79

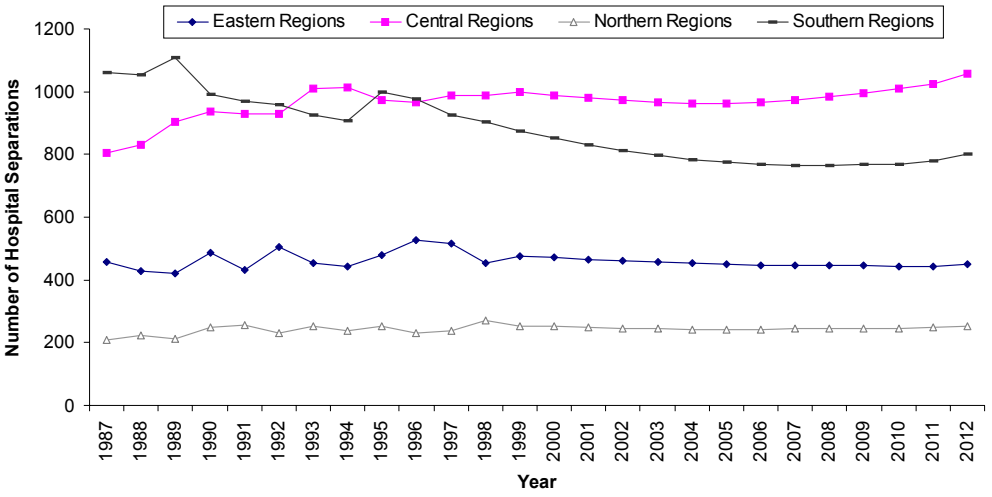
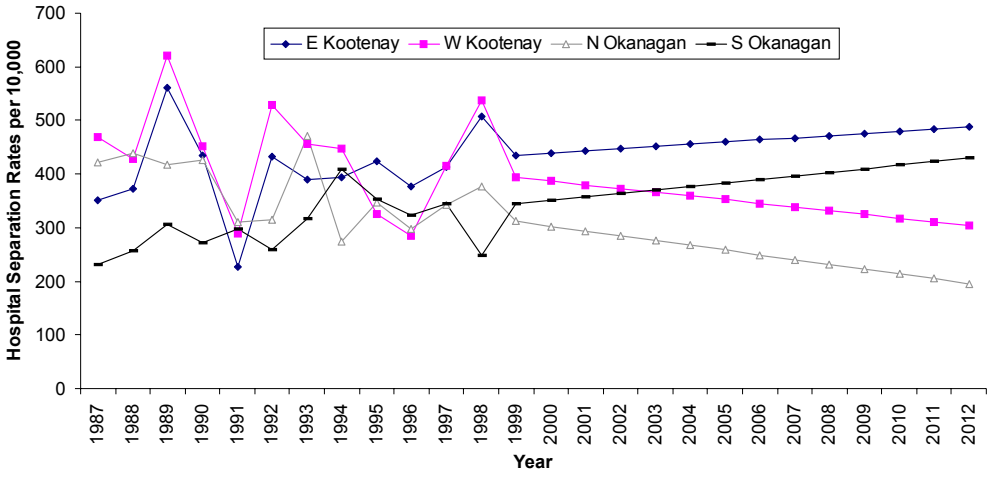


Figure 4.5: Hospital Separation Rates Due to Falls, per 10,000, BC, Eastern Regions, 1987-2012, Males 80+



Females 80+

From 1987 to 1998, non-significant downward trends in the rates of hospital separations were observed in West Kootenay and North Okanagan. In East Kootenay and South Okanagan, there were small but non-significant upward trends. (*Figure 4.7*) [*Appendix C-7*]

If the above trends continue, together with the demographic changes, the rates due to falls among the female elderly population of the four Eastern Health Regions will decrease significantly for West Kootenay (χ^2=95.9, p=.0001) and North Okanagan (χ^2=40.4, p=.0001), but not for East Kootenay and South Okanagan. The overall hospital separation rate for the Eastern Regions is projected to decrease significantly by about 25% by the year 2012 (χ^2=48.9, p=.0001). However, the actual number of hospital admissions is expected to increase. (*Figure 4.8*) [*Appendix C-8*]

Figure 4.6: Number of Hospital Separations Due to Falls, BC, All Regions, 1987-2012, Males 80+

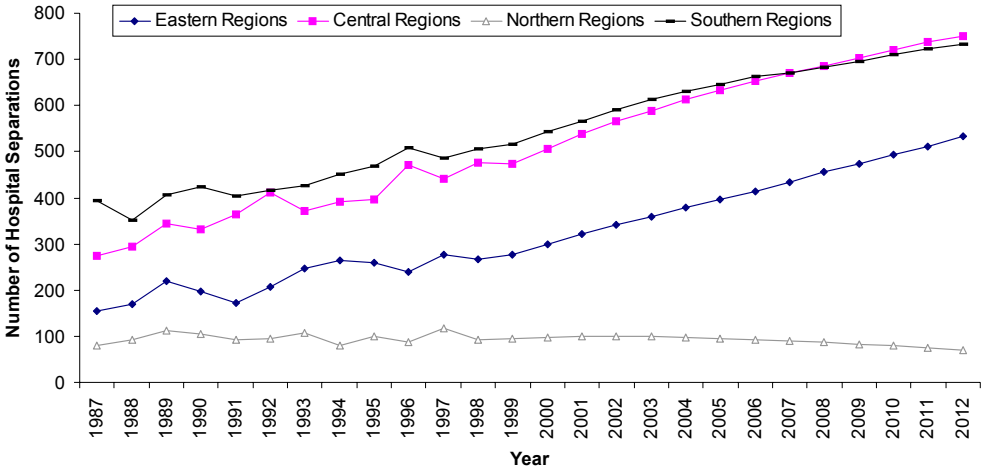


Figure 4.7: Hospital Separation Rates Due to Falls, per 10,000, BC, Eastern Regions, 1987-2012, Females 80+

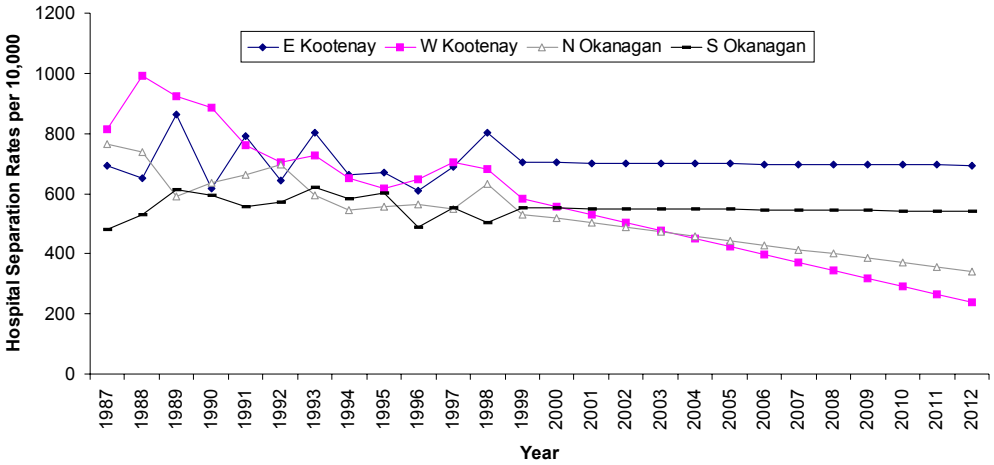
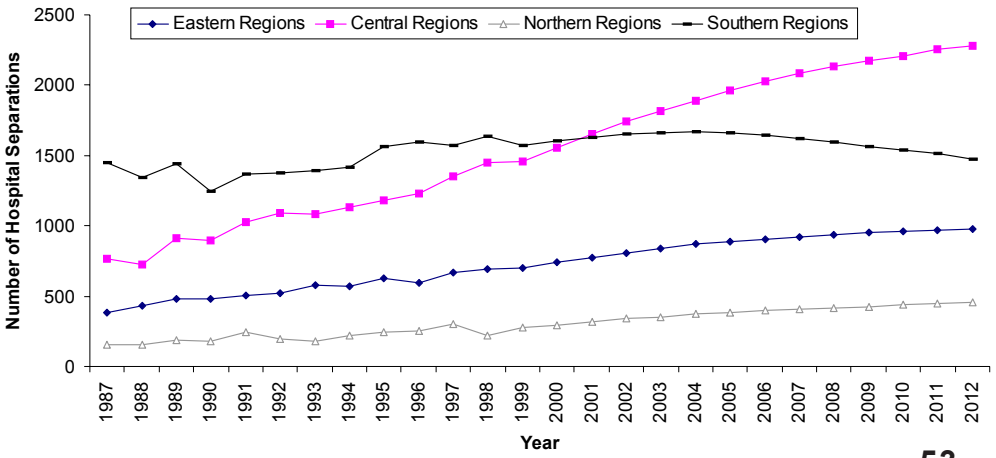


Figure 4.8: Number of Hospital Separations Due to Falls, BC, All Regions, 1987-2012, Females 80+



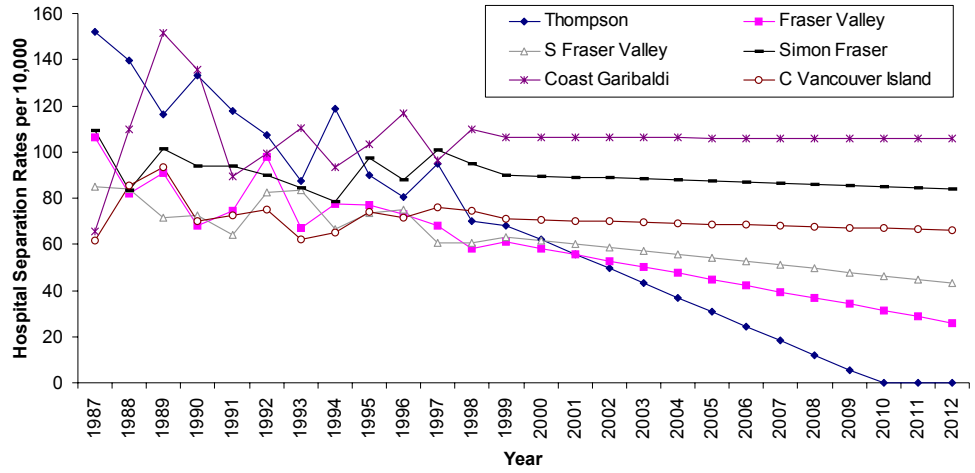
Central Regions

Males 65-79

From 1987 to 1998, significant downward trends in the rates of hospital separations were observed in Thompson (χ^2=8.8, p=.001) and Fraser Valley (χ^2=5.3, p=.03). Other downward trends were observed in South Fraser Valley and Simon Fraser, but they were not significant. An upward trend was observed in Coast Garibaldi and Central Vancouver Island, but it was not significant. (*Figure 4.9*) [*Appendix C-9*]

If the above trends continue, the rates due to falls for the Central Regions will show a significant decreasing trend for Thompson (χ^2=199.5, p=.0001), Fraser Valley (χ^2=48.7, p=.0001), and South Fraser Valley (χ^2=29.3, p=.0001). The rates in Simon Fraser, Coast Garibaldi, and Central Vancouver Island will remain relatively stable. Overall, from 1987 to 2012 the rates of hospital separations will decrease significantly (χ^2=74.2, p=.0001). The number of hospital separations will increase slightly. (*Figure 4.2*) [*Appendix C-2*]

Figure 4.9: Hospital Separation Rates Due to Falls, per 10,000, BC, Central Regions, 1987-2012, Males 65-79

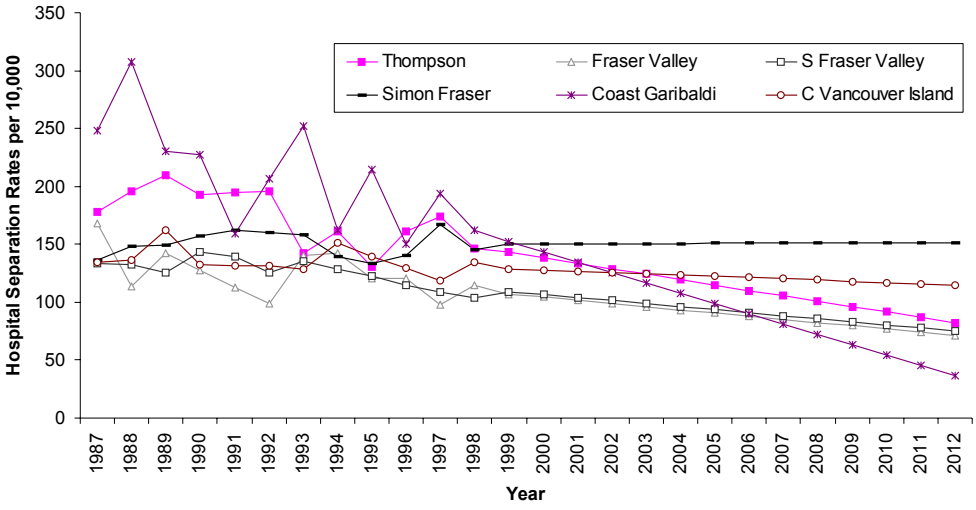


Females 65-79

From 1987 to 1998, there was an upward but non-significant trend in the rates of hospital separations in Simon Fraser. With the exception of Fraser Valley (χ^2=9.1, p=.003) and South Fraser Valley (χ^2=19.9, p=.0001), all of the Central Health Regions had non-significant downward trends. (*Figure 4.10*) [*Appendix C-10*]

If the above trends continue, the rates for Simon Fraser will increase slightly but not significantly in the succeeding years. On the other hand, all the other health regions will experience a significant decrease in the hospital separation rates. Overall, the hospital separation rate for the Central Regions will decrease significantly by 2012 (χ^2=102.2, p=.0001). In contrast, the number of hospital separations for this region is expected to increase substantially. (*Figure 4.4*) [*Appendix C-4*]

Figure 4.10: Hospital Separation Rates Due to Falls, per 10,000, BC, Central Regions, 1987-2012, Females 65-79



Males 80+

From 1987 to 1998, non-significant downward trends in the rates of hospital separations were observed in most of the Central Health Regions. An upward trend was observed in Simon Fraser, but it was not significant. (*Figure 4.11*) [*Appendix C-11*]

The rates for Simon Fraser will increase significantly in the succeeding years (χ^2=11.2, p=.001) if the above trends continue. The other health regions, on the other hand, will experience a significant decrease in the hospital separation rates. Overall, the hospital separation rates for Central Regions will decrease significantly by 2012 (χ^2=27.2, p=.0001). The number of hospital separations for this region is expected to increase. (*Figure 4.6*) [*Appendix C-6*]

Females 80+

From 1987 to 1998, there was an upward but non-significant trend in the rates of hospital separations in Simon Fraser. In contrast, the rest of the Central Regions had non-significant downward trends. (*Figure 4.12*) [*Appendix C-12*]

Simon Fraser will experience a non-significant increase in the hospital separation rates. If the above trends persist, the other health regions, with the exception of Fraser Valley and Coast Garibaldi, will experience a significant decrease in the hospital separation rates. The overall rate for the Central Health Regions will decrease significantly (χ^2=34.9, p=.0001). In 2012, the number of hospitalizations is expected to be more than twice the number admitted in 1987. (*Figure 4.8*) [*Appendix C-8*]

Northern Regions

Males 65-79

From 1987 to 1998, with the exception of Peace Liard, downward trends in the rates of hospital separations

Figure 4.11: Hospital Separation Rates Due to Falls, per 10,000, BC, Central Regions, 1987-2012, Males 80+

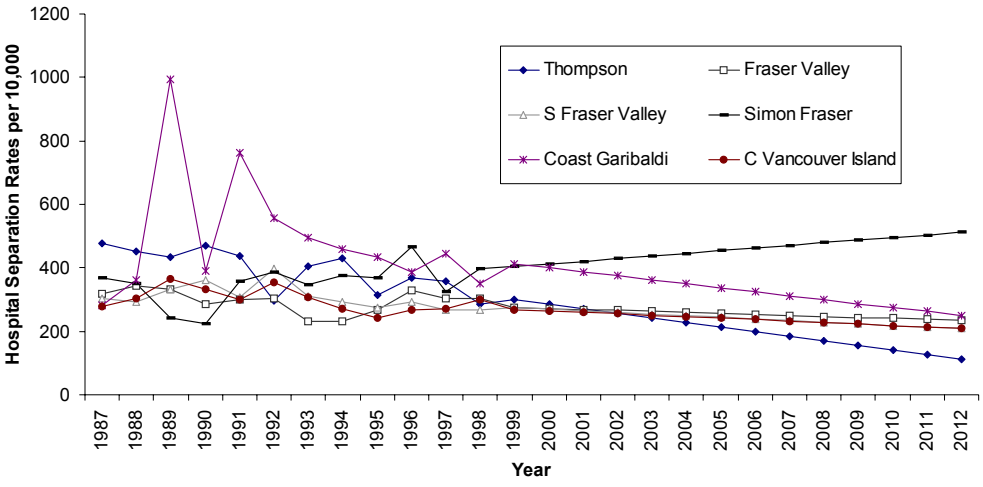
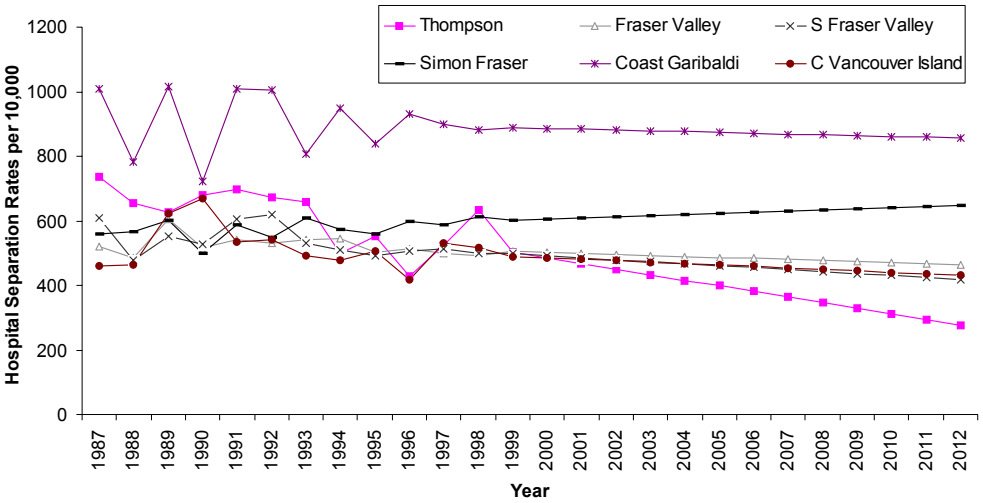


Figure 4.12: Hospital Separation Rates Due to Falls, per 10,000, BC, Central Regions, 1987-2012, Females 80+



were observed in all the Northern Regions, but none were significant. (*Figure 4.13*) [*Appendix C-13*]

If these trends persist, non-significant downward trends will be observed in Upper Island and Peace Liard. The hospital separation rates due to falls will continue to decrease significantly for Cariboo (χ^2=35.4, p=.0001), North West (χ^2=57.7, p=.0001), and Northern Interior (χ^2=13.9, p=.0001). The overall rate for the Northern Regions is expected to decrease significantly (χ^2=55.7, p=.0001). By contrast, the number of hospital admissions for all the Northern Regions is expected to increase. (*Figure 4.2*) [*Appendix C-2*]

Figure 4.13: Hospital Separation Rates Due to Falls, per 10,000, BC, Northern Regions, 1987-2012, Males 65-79

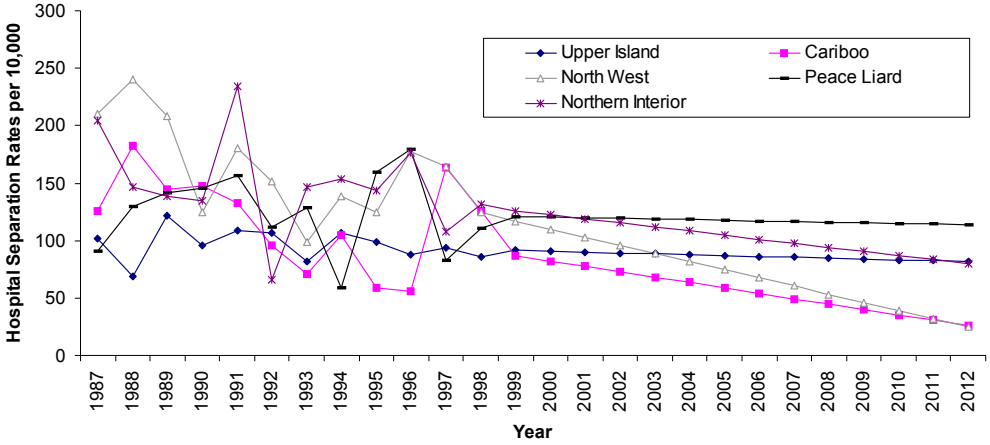


Figure 4.14: Hospital Separation Rates Due to Falls, per 10,000, BC, Northern Regions, 1987-2012, Females 65-79

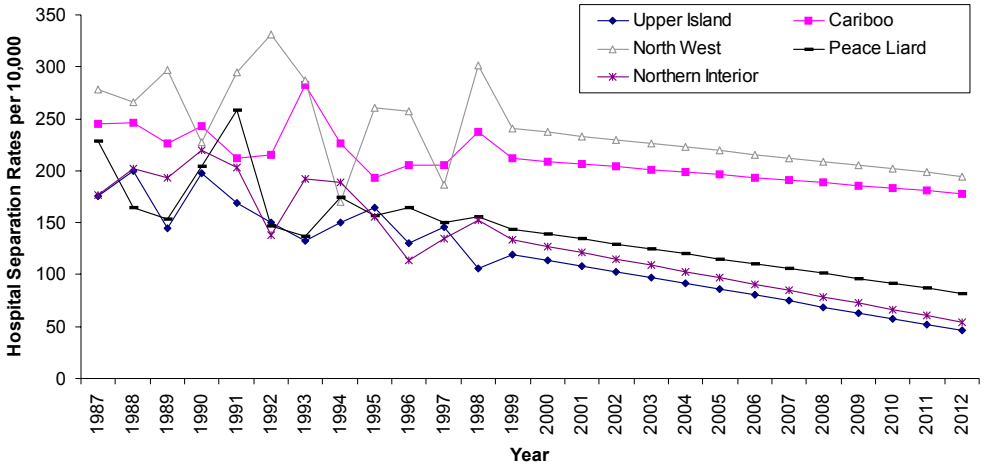
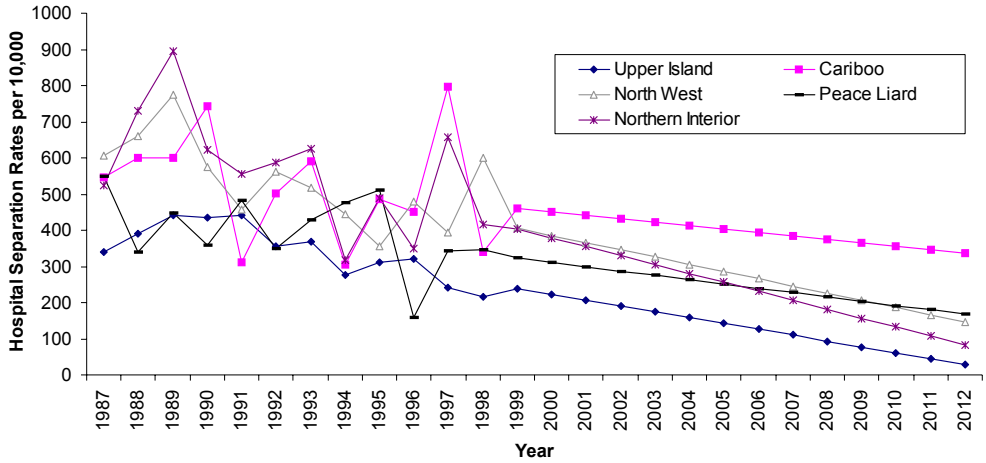


Figure 4.15: Hospital Separation Rates Due to Falls, per 10,000, BC, Northern Regions, 1987-2012, Males 80+



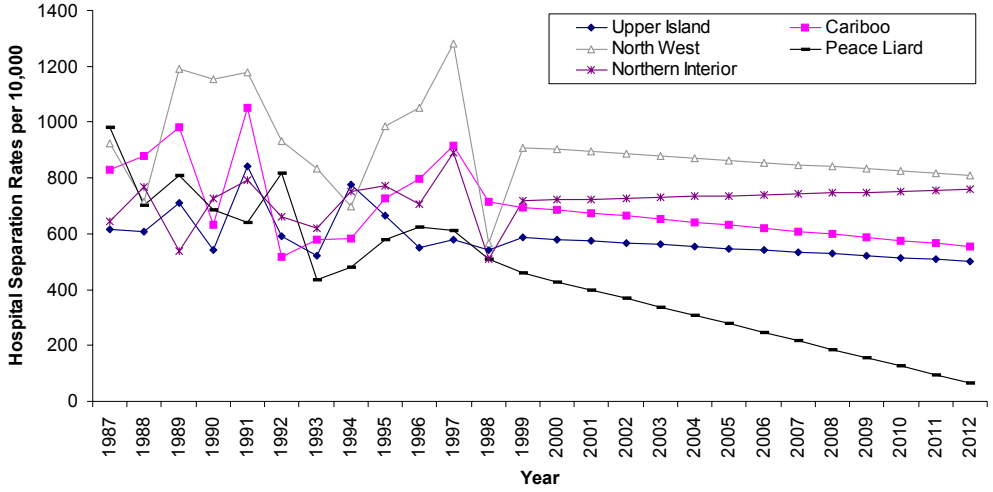
Females 65-79

From 1987 to 1998, with the exception of North West, where the rates were fluctuating, downward trends in the rates of hospital separations were observed in Upper Island, Cariboo, Peace Liard and

Northern Interior. However, none of these trends were significant. (*Figure 4.14*) [*Appendix C-14*]

If the above trends continue, significant downward trends will be observed in Upper Island (χ^2=55.8, p=.0001), North West (χ^2=4.3, p=.04), Peace Liard (χ^2=9.8, p=.002), and Northern Interior (χ^2=42.9, p=.0001).

Figure 4.16: Hospital Separation Rates Due to Falls, per 10,000, BC, Northern Regions, 1987-2012, Females 80+



Cariboo is expected to show a non-significant downward trend. The overall rate of the Northern Regions is projected to decrease significantly (χ^2=70.6, p=.0001) in the succeeding years. The number of hospital admissions is expected to increase over time. (*Figure 4.4*) [*Appendix C-4*]

Males 80+

From 1987 to 1998, downward trends in the rates of hospital separations were observed in all the Northern Health Regions, but none of them were significant. (*Figure 4.15*) [*Appendix C-15*]

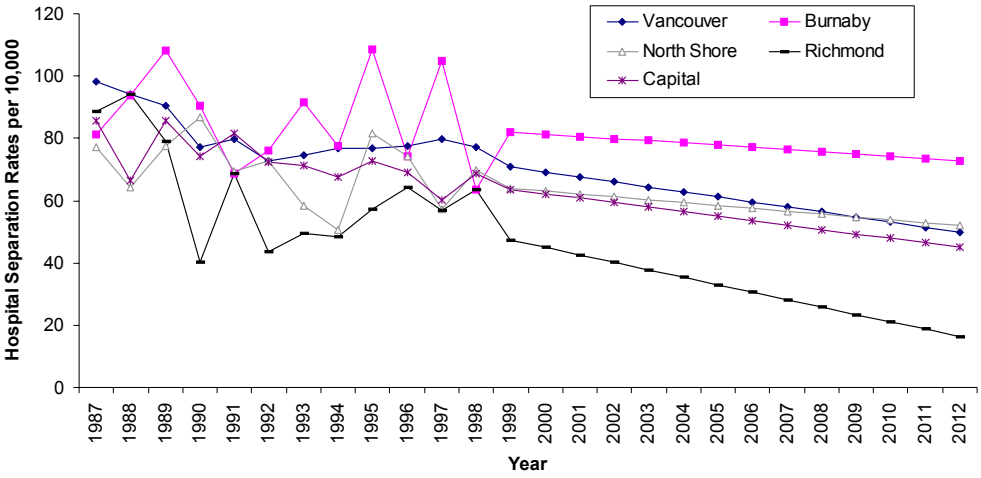
If these trends persist, significant downward trends will be observed in Upper Island (χ^2=71.5, p=.0001), North West (χ^2=20.7, p=.0001), Peace Liard (χ^2=6.3, p=.01), and Northern Interior (χ^2=53.7, p=.0001). Cariboo is expected to show a non-significant downward trend.

The overall rate for the Northern Regions will decrease significantly (χ^2=119.8, p=.0001). Despite increases in the elderly male population, the number of hospital admissions for Northern Regions is expected to decrease slightly. (*Figure 4.6*) [*Appendix C-6*]

Females 80+

From 1987 to 1998, with the exception of Northern Interior, downward trends in the rates of hospital separations were observed in Upper Island, Cariboo, North West and Peace Liard. Northern Interior showed an

Figure 4.17: Hospital Separation Rates Due to Falls, per 10,000, BC, Southern Regions, 1987-2012, Males 65-79



upward trend. None of these trends were significant, however. (*Figure 4.16*) [*Appendix C-16*]

If the above trends continue, Northern Interior is projected to observe a non-significant increase in the rates in the succeeding years. Significant downward trends are expected in Upper Island (χ^2=3.9, p=.04), Cariboo (χ^2=4.5, p=.03), and Peace Liard (χ^2=63.0, p=.0001). North West, on the other hand, will observe a non-significant downward trend. As for the Northern Health Regions' overall rates, a significant downward trend is expected (χ^2=11.9, p=.001). However, the number of hospital admissions of females aged 80 years and over is expected to increase, unlike their male counterparts. (*Figure 4.8*) [*Appendix C-8*]

Figure 4.18: Hospital Separation Rates Due to Falls, per 10,000, BC, Southern Regions, 1987-2012, Females 65-79

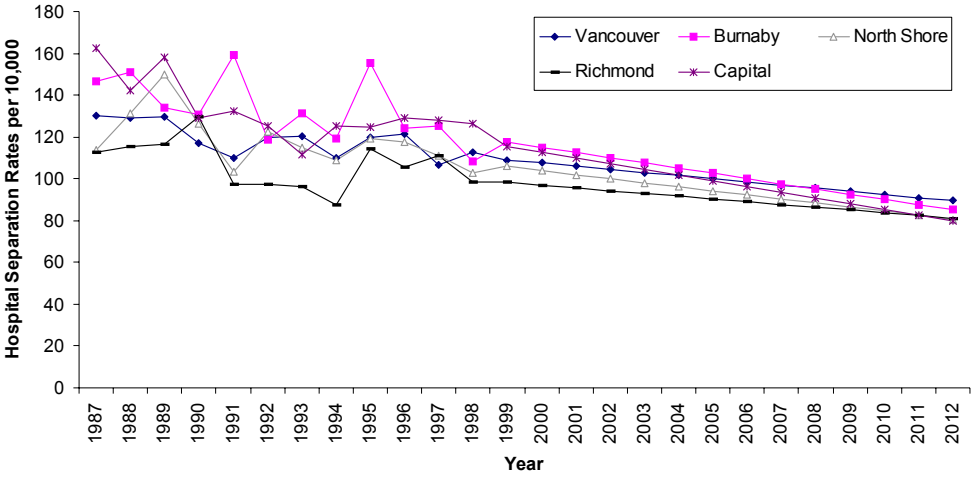
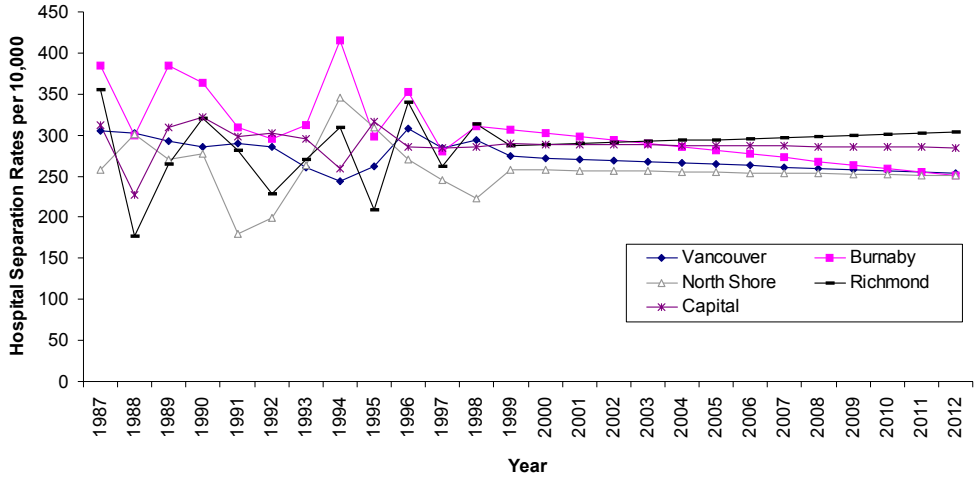


Figure 4.19: Hospital Separation Rates Due to Falls, per 10,000, BC, Southern Regions, 1987-2012, Males 80+



Southern Regions

Males 65-79

From 1987 to 1998, non-significant downward trends in the rates of hospital separations were observed in all Southern Regions. (*Figure 4.17*) [*Appendix C-17*]

In the succeeding years, with the continuation of the above trends, significant downward trends will be observed in Vancouver (χ^2=24.8, p=.0001), Richmond (χ^2=33.7, p=.0001), and Capital (χ^2=17.7, p=.0001). Burnaby and North Shore will show a non-significant decrease. The overall rate for the Southern Regions will decrease significantly (χ^2=66.4, p=.0001). The number of hospital admissions of males 65 to 79 years old is also expected to decrease slightly. (*Figure 4.2*) [*Appendix C-2*]

Females 65-79

From 1987 to 1998, downward trends in the rates of hospital separations were observed in all Southern Regions. With the exception of Capital (χ^2=18.7,

p=.0001), none of these decreasing trends were significant. (*Figure 4.18*) [*Appendix C-18*]

If the above trends continue in the succeeding years, all five Southern Health Regions will observe a significant decrease in the hospital separation rates due to falls. The overall rate for the Southern Region will decrease significantly (χ^2=83.4, p=.0001). Similar to males of the same age, the number of hospital admissions will project a decrease from 1987 to 2012. (*Figure 4.4*) [*Appendix C-4*]

Males 80+

From 1987 to 1998, non-significant downward trends in the rates of hospital separations were observed in the Southern Health Regions, including Vancouver, Burnaby, North Shore, Richmond and Capital. (*Figure 4.19*) [*Appendix C-19*]

With the continuation of these trends, the rates of hospital separations due to falls in North Shore and Capital are projected to remain rather stable, while in Richmond a small but non-significant increase will occur. Vancouver and Capital will show a non-significant downward trend in the hospital separation rates. Only Burnaby is expected to show a significant downward trend (χ^2=4.4, p=.03). The overall rate for the Southern Health Regions will decrease, but not significantly. However, the number of hospital admissions is expected to increase. (*Figure 4.6*) [*Appendix C-6*]

Females 80+

From 1987 to 1998, downward trends in the rates of hospital separations were observed in Vancouver, Burnaby, North Shore, Richmond and Capital. However, only Capital showed a significant decrease in the hospital separation rates (χ^2=16.6, p=.0001). (*Figure 4.20*) [*Appendix C-20*]

In the succeeding years, all five Southern Health Regions are expected to observe a significant decrease in the hospital separation rates due to falls. The overall rate for the Southern Regions is expected to decrease significantly (χ^2=128.8, p=.0001). The number of hospital admissions, meanwhile, will project a slight increase by 2012. (*Figure 4.8*) [*Appendix C-8*]

Future Patterns of Regional Variations Due to Falls Relative to the Province

Males 65-79

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for males aged 65 to 79 years in *Figure 4.21*. Compared to the provincial rate, and taking into account the demographic changes and the continuation of the current trends, significantly higher rates are expected in the Peace Liard (1.85, 95% CI: 1.24-2.76), Coast Garibaldi (1.68, 95% CI: 1.26-2.24), Northern Interior (1.60, 95% CI: 1.21-2.13), East Kootenay (1.48, 95% CI: 1.09-

Figure 4.20: Hospital Separation Rates Due to Falls, per 10,000, BC, Southern Regions, 1987-2012, Females 80+

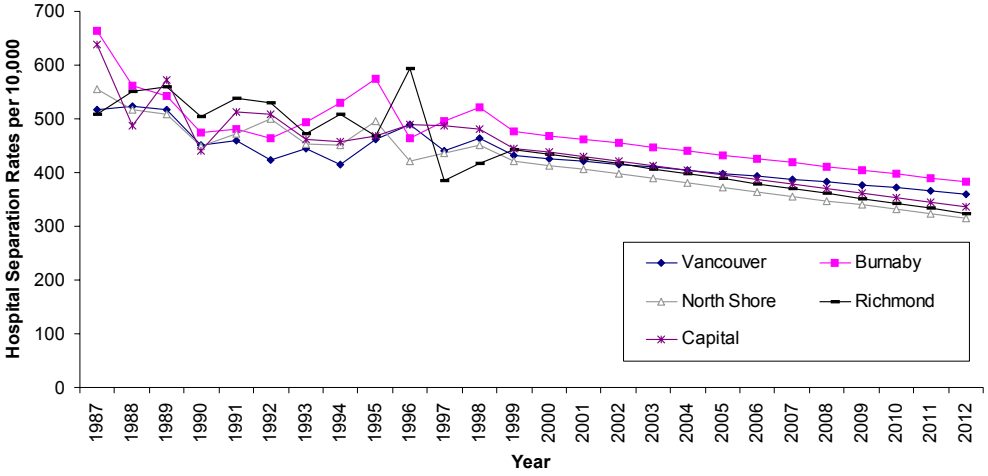


Figure 4.21: Hospital Separation Rate Ratio Relative to the Province, Falls, by Health Regions, BC, 1999-2012, Males 65-79

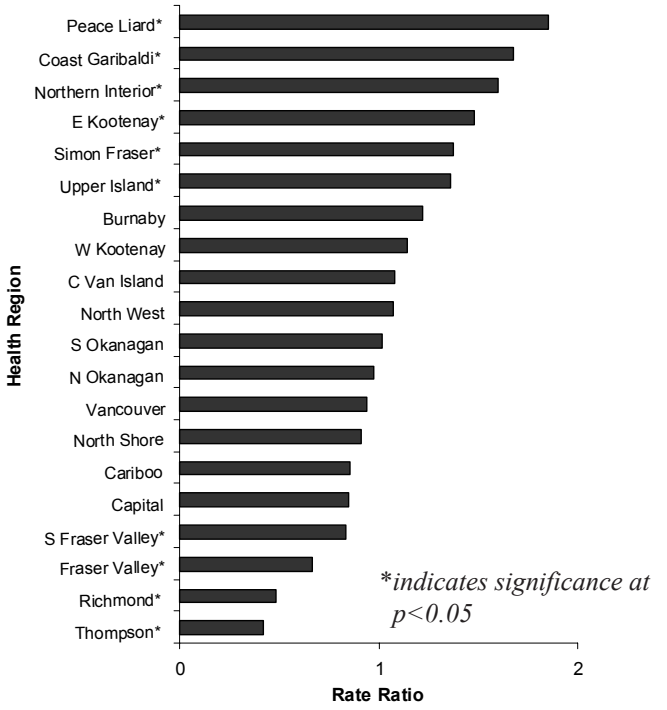


Figure 4.22: Hospital Separation Rate Ratio Relative to the Province, Falls, by Health Regions, BC, 1999-2012, Females 65-79

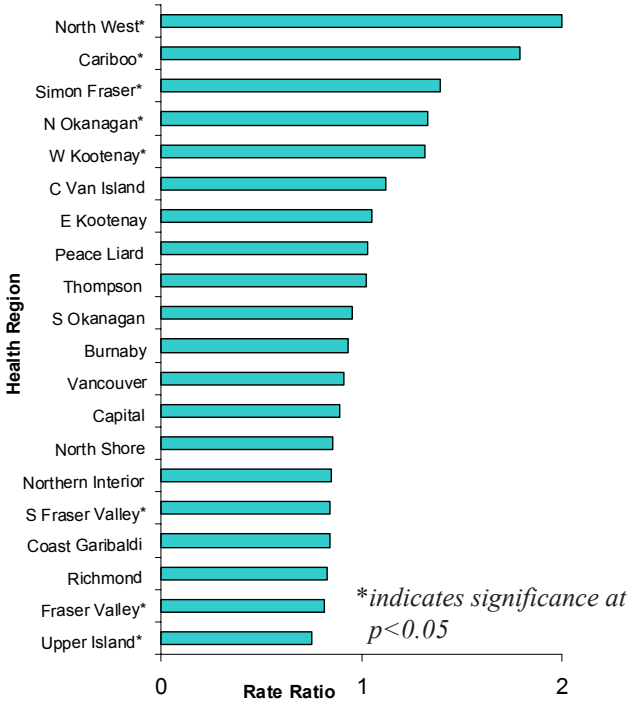


Figure 4.23: Hospital Separation Rate Ratio Relative to the Province, Falls, by Health Regions, BC, 1999-2012, Males 80+

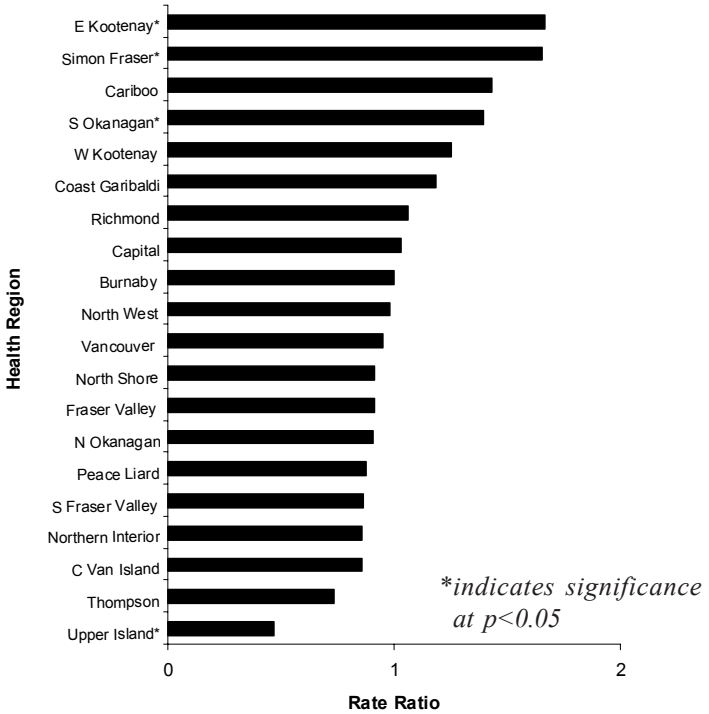
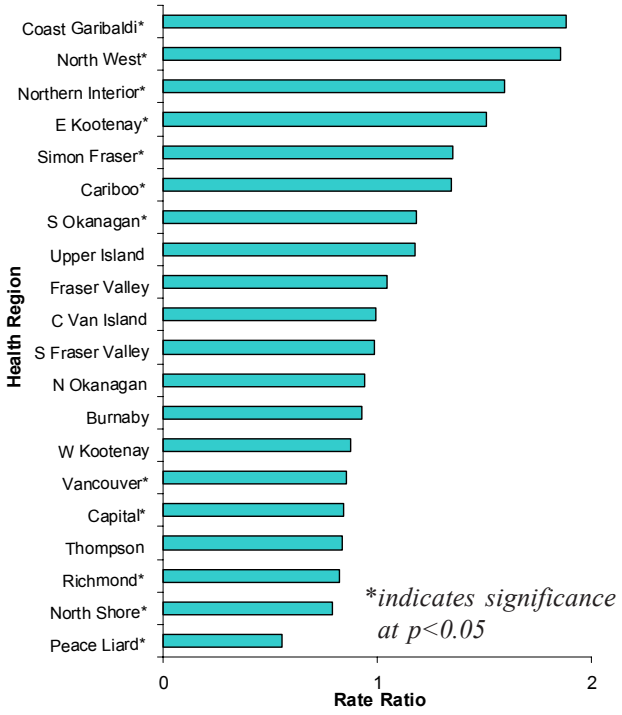


Figure 4.24: Hospital Separation Rate Ratio Relative to the Province, Falls, by Health Regions, BC, 1999-2012, Females 80+



2.00), Simon Fraser (1.38, 95% CI: 1.14-1.66) and Upper Island Regions (1.36, 95% CI: 1.04-1.78). The lowest significant ratios are expected in South Fraser Valley (0.83, 95% CI: 0.70-0.99), Fraser Valley (0.67, 95% CI: 0.51-0.88), Richmond (0.49, 95% CI: 0.33-0.73), and Thompson (0.42, 95% CI: 0.29-0.62). [*Appendix C-21*]

Females 65-79

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for females aged 65 to 79 years in *Figure 4.22*. Compared to the provincial rate, and taking into account the demographic changes and the continuation of the current trends, significantly higher ratios are expected in North West (2.00, 95% CI: 1.57-2.55), Cariboo (1.79, 95% CI: 1.41-2.29), Simon Fraser (1.39, 95% CI: 1.22-1.60), North Okanagan (1.33, 95% CI: 1.11-1.59), and West Kootenay (1.31, 95% CI: 1.04-1.65). The lowest significant ratios are expected in Upper Island (0.75, 95% CI: 0.57-0.99), Fraser Valley (0.82, 95% CI: 0.68-0.98), and South Fraser Valley (0.85, 95% CI: 0.75-0.96). [*Appendix C-21*]

Males 80+

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for males aged 80 years and over in *Figure 4.23*. Compared to the provincial rate, and considering the demographic changes and the continuation of the current trends, significantly higher rates are expected in East Kootenay (1.66, 95% CI: 1.28-2.17), Simon Fraser (1.66, 95% CI: 1.40-1.96), and South Okanagan (1.40, 95% CI: 1.22-1.60). The lowest significant ratio is expected in Upper Island (0.47, 95% CI: 0.30-0.73). [*Appendix C-22*]

Females 80+

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for females aged 80 years and older in *Figure 4.24*. Compared to the provincial rate, and taking into account the demographic changes and the continuation of the current trends, significantly higher ratios are expected in Coast Garibaldi (1.88, 95% CI: 1.60-2.22), North West (1.85, 95% CI: 1.48-2.33), Northern Interior (1.60, 95% CI: 1.31-1.95), East Kootenay (1.51, 95% CI: 1.26-1.80), Simon Fraser (1.35, 95% CI: 1.22-1.49), Cariboo (1.35, 95% CI: 1.05-1.73) and South Okanagan (1.18, 95% CI: 1.08-1.30). The lowest significant ratios are expected in Vancouver (0.85, 95% CI: 0.78-0.93), Capital (0.84, 95% CI: 1.24-2.76), Richmond (0.83, 95% CI: 0.70-0.97), North Shore (0.79, 95% CI: 0.68-0.92), and Peace Liard (0.56, 95% CI: 0.35-0.88). [*Appendix C-22*]

REGIONAL PROJECTIONS IN HOSPITAL SEPARATIONS DUE TO FALLS IN THE HOME BY GENDER

Eastern Regions

Males 65-79

From 1989 to 1998, an upward but non-significant trend in the separation rates due to falls in the home was observed in North Okanagan. The trends were mostly decreasing or stable in the rest of the Eastern Regions. None of them were significant. (*Figure 4.25*) [*Appendix C-23*]

If the above trends continue, the rates will decrease significantly for East Kootenay (χ^2=8.7, p=.003) in the succeeding years. For North Okanagan and South Okanagan, the rates due to falls in the home will remain stable. Overall, the Eastern Health Regions will observe a non-significant downward trend in the hospital separation rates, across time. In contrast, the

number of hospital separations is projected to increase from 1989 to 2012. (*Figure 4.26*) [*Appendix C-24*]

Females 65-79

From 1989 to 1998, upward but non-significant trends in the rates of hospital separations were observed in West Kootenay, North Okanagan and South Okanagan. A downward but not significant trend was observed in East Kootenay. (*Figure 4.27*) [*Appendix C-25*]

If the above trends continue, the rates of hospital separations will continue to increase for West Kootenay, North Okanagan and South Okanagan. However, only North Okanagan will show a significant increase (χ^2=9.7, *p*=.002). The rates will decrease significantly for East Kootenay (χ^2=14.9, *p*=.0001). The Eastern Health Regions' regional rates of hospital separations will increase overall, but not significantly. The number of hospital separations are projected to double from 1989 to 2012. (*Figure 4.28*) [*Appendix C-26*]

Figure 4.25: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Eastern Regions, 1989-2012, Males 65-79

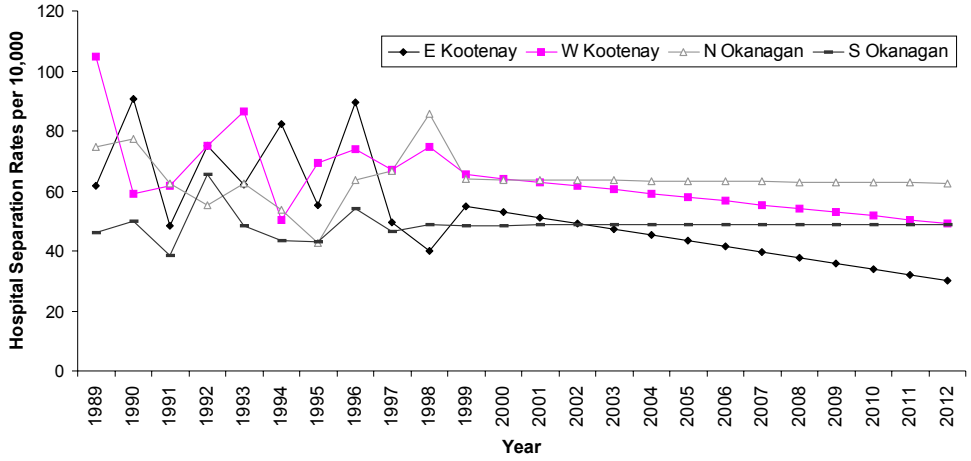


Figure 4.26: Number of Hospital Separations Due to Falls in the Home, BC, All Regions, 1989-2012, Males 65-79

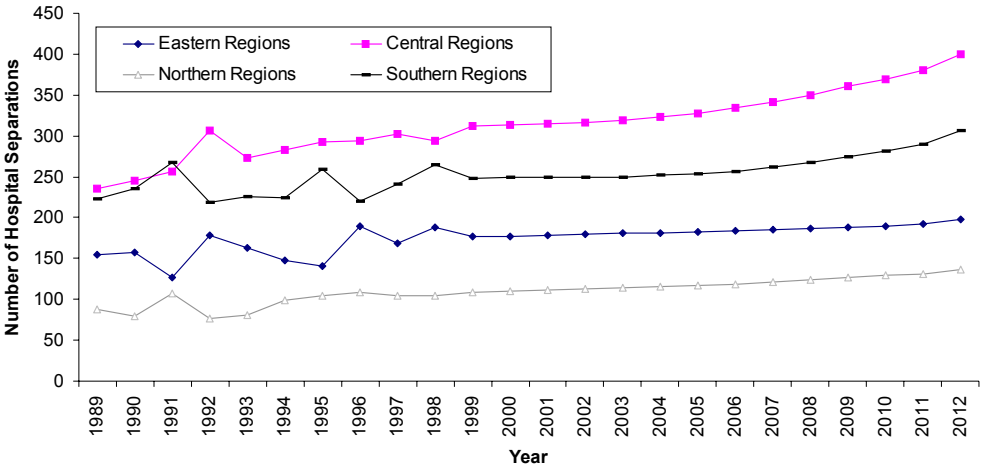
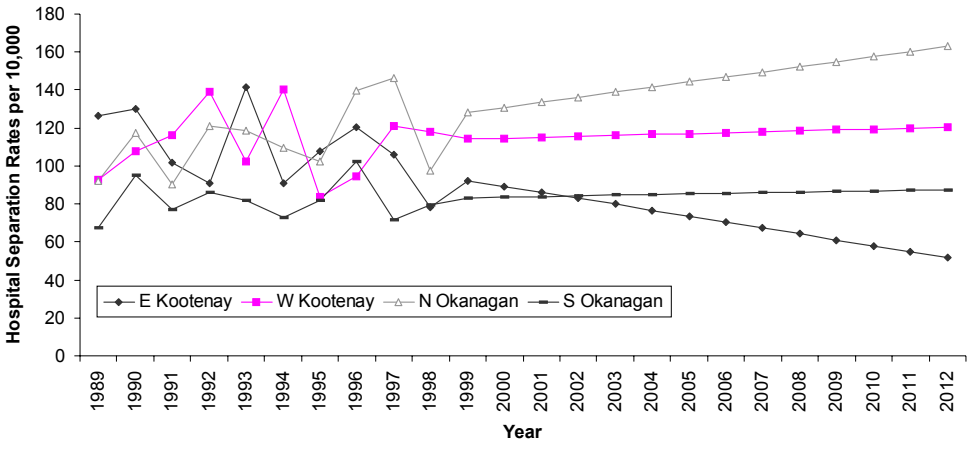


Figure 4.27: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Eastern Regions, 1989-2012, Females 65-79



Males 80+

From 1989 to 1998, upward but non-significant trends in the separation rates due to falls in the home were observed for East Kootenay, North Okanagan and South Okanagan. A small but non-significant downward trend was observed in West Kootenay. (*Figure 4.29*) [*Appendix C-27*]

By 2012, North Okanagan and South Okanagan are expected to have had a significant increase in the rates of hospitalizations (χ^2=6.8, p=.01 and χ^2=11.3, p=.001 respectively). West Kootenay will observe a non-significant decrease in the rates. Overall, the Eastern Health Regions will experience a significant upward trend in the hospital separation rates (χ^2=14.0, p=.0001). The number of hospitalizations will increase as well. (*Figure 4.30*) [*Appendix C-28*]

Females 80+

From 1989 to 1998, an upward trend in the rates of hospital separations due to falls in the home was observed in East Kootenay and

Figure 4.28: Number of Hospital Separations Due to Falls in the Home, BC, All Regions, 1989-2012, Females 65-79

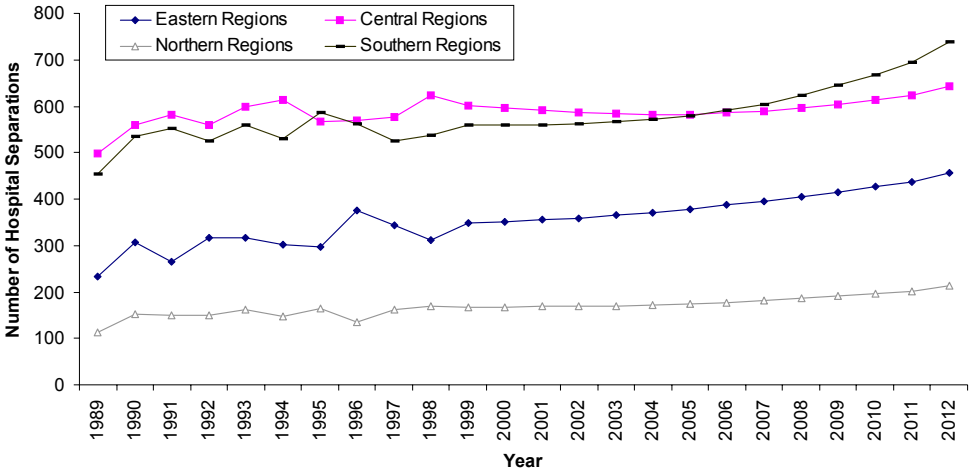


Figure 4.29: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Eastern Regions, 1989-2012, Males 80+

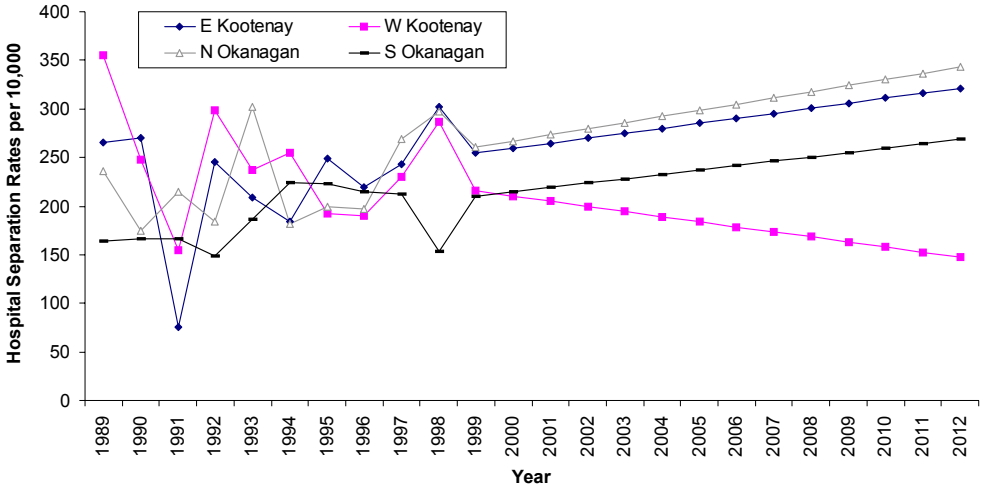
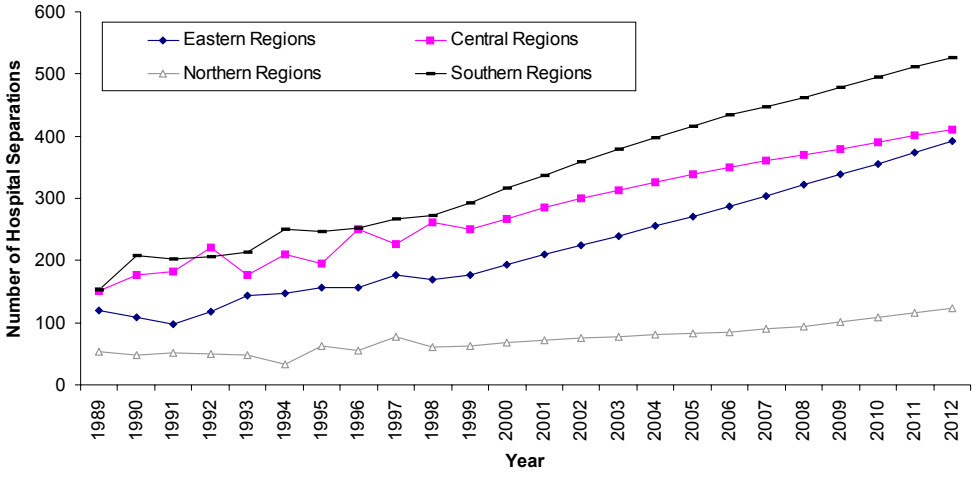


Figure 4.30: Number of Hospital Separations Due to Falls in the Home, BC, All Regions, 1989-2012, Males 80+



North Okanagan. This increasing trend was significant only in North Okanagan (χ^2=6.1, p=.01). Decreasing but not significant trends were observed in West Kootenay and South Okanagan. (*Figure 4.31*) [*Appendix C-29*]

If the above trends continue, the rates of hospital separations will continue to increase significantly for North Okanagan (χ^2=22.0, p=.0001) and decrease significantly for West Kootenay (χ^2=9.9, p=.002) and South Okanagan (χ^2=10.2, p=.001). The overall Eastern Health Regions' regional rate of hospital separations will, however, remain stable. On the other hand, the number of hospital separations is projected to increase by a factor of three from 1989 to 2012. (*Figure 4.32*) [*Appendix C-30*]

Figure 4.31: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Eastern Regions, 1989-2012, Females 80+

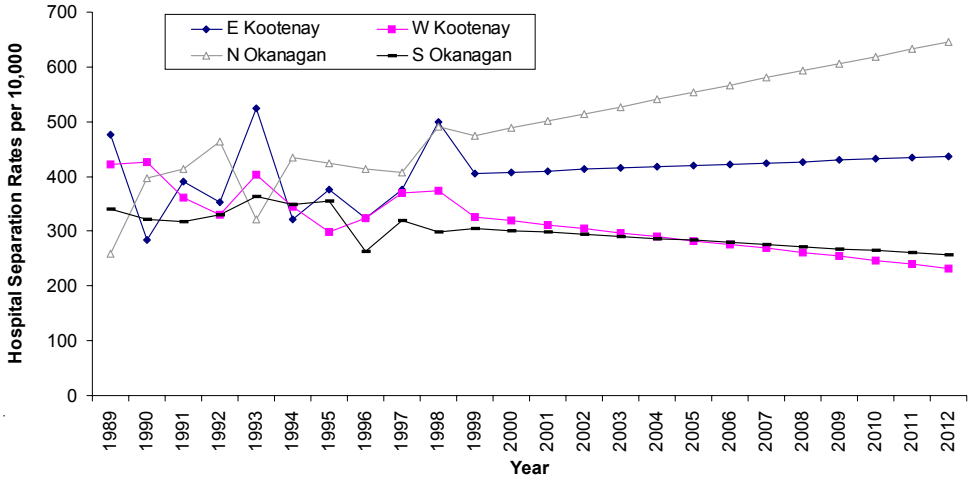


Figure 4.32: Number of Hospital Separations Due to Falls in the Home, BC, All Regions, 1989-2012, Females 80+

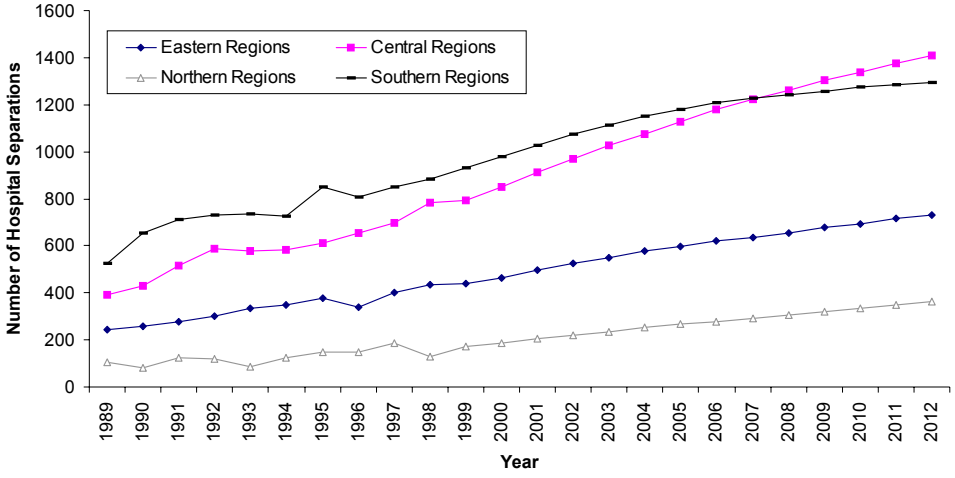
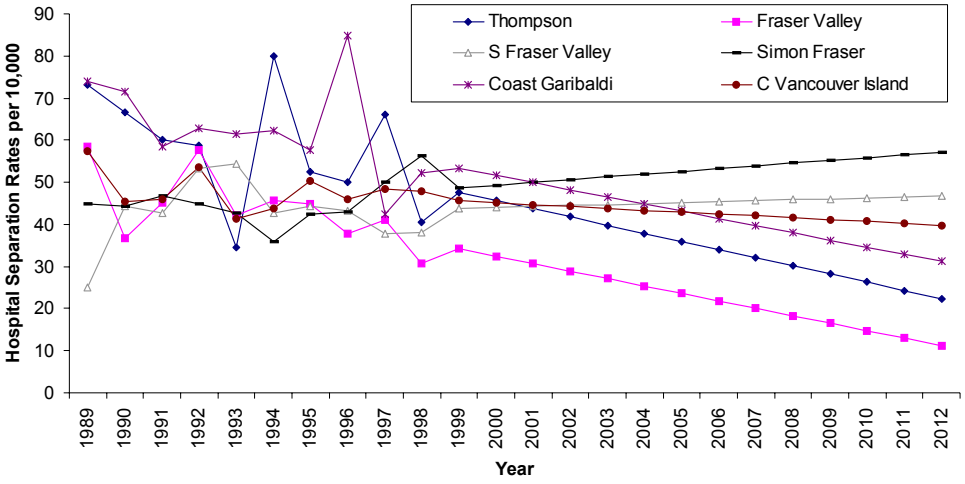


Figure 4.33: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Central Regions, 1989-2012, Males 65-79



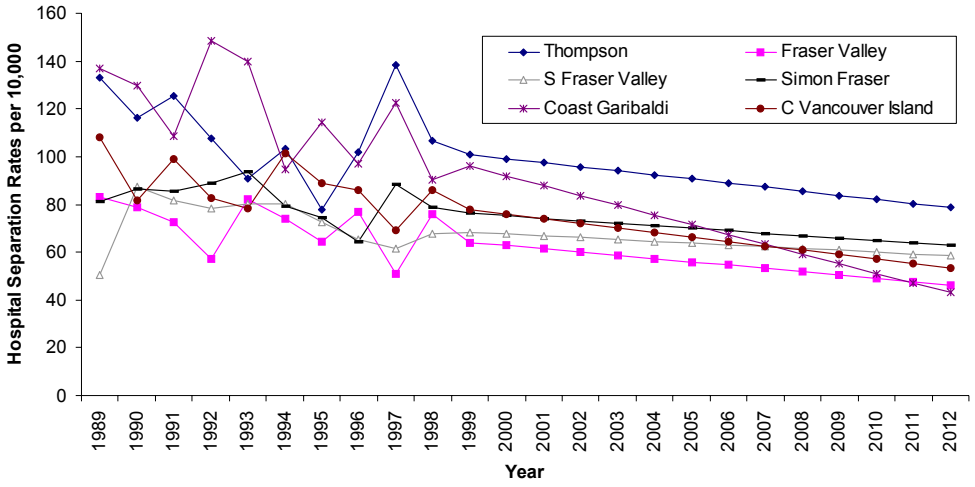
Central Regions

Males 65-79

From 1989 to 1998, downward trends in the rates of hospital separations were observed in Thompson, Fraser Valley, Coast Garibaldi, and Central

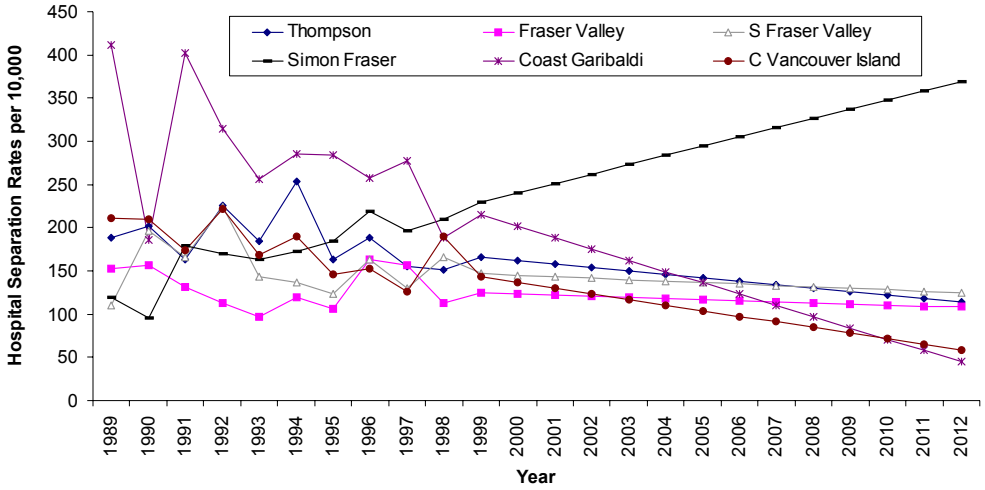
Vancouver Island. With the exception of Fraser Valley (χ^2=6.4, p=.01), none of these decreasing trends were significant. Upward trends were observed in South Fraser Valley and Simon Fraser, but they were not significant. (*Figure 4.33*) [*Appendix C-31*]

Figure 4.34: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Central Regions, 1989-2012, Females 65-79



If the above trends continue, South Fraser Valley and Simon Fraser will experience non-significant increasing rates of hospital separations up to the year 2012. For the rest of Central Region, trends will continue to decrease in the succeeding years. Overall, the regional rate due to falls in the home for the Central Health Regions will decrease significantly (χ^2=6.2, p=.01). However, the number of hospital admissions is projected to increase noticeably from 1987 to 2012. (*Figure 4.26*) [*Appendix C-24]*

Figure 4.35: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Central Regions, 1989-2012, Males 80+



Females 65-79

From 1989 to 1998, an upward but not significant trend in the rates of hospital separations in South Fraser Valley was observed. The trends were mostly downward in the Central Regions. None of these decreasing trends were significant, however. (*Figure 4.34*) [*Appendix C-32*]

With the continuation of the above trends, the rates due to falls in the home in the Central Health Regions will experience slight but significant increases for South Fraser Valley (χ^2=6.5, p=.01). The rest of the region will have a non-significant decrease in the rates. The overall regional rate due to falls in the home for this region is projected to decrease significantly (χ^2=56.5, p=.0001). The number of hospital separations is projected to increase from 1989 to 2012. (*Figure 4.28*) [*Appendix C-26*]

Males 80+

With the exception of Simon Fraser, downward trends in the rates of hospital separations were observed in Thompson, Fraser Valley, South Fraser Valley, Coast Garibaldi, and Central Vancouver Island from 1989 to 1998. An upward trend was observed in Simon Fraser, but it was not significant. (*Figure 4.35*) [*Appendix C-33*]

If the above trends continue, Simon Fraser will experience a significant increase in the rates of hospital separations up to the year 2012 (χ^2=16.0, p=.0001). As for the other Central Health Regions, trends will continue to go down in the succeeding years. Overall, the regional rate due to falls in the home for the Central Health Regions will decrease significantly (χ^2=9.3, p=.002); however, the number of hospital admissions is projected to increase noticeably from 1989 to 2012. (*Figure 4.30*) [*Appendix C-28*]

Females 80+

From 1989 to 1998, there was a significant upward trend in the rates of hospital separa-

Figure 4.36: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Central Regions, 1989-2012, Females 80+

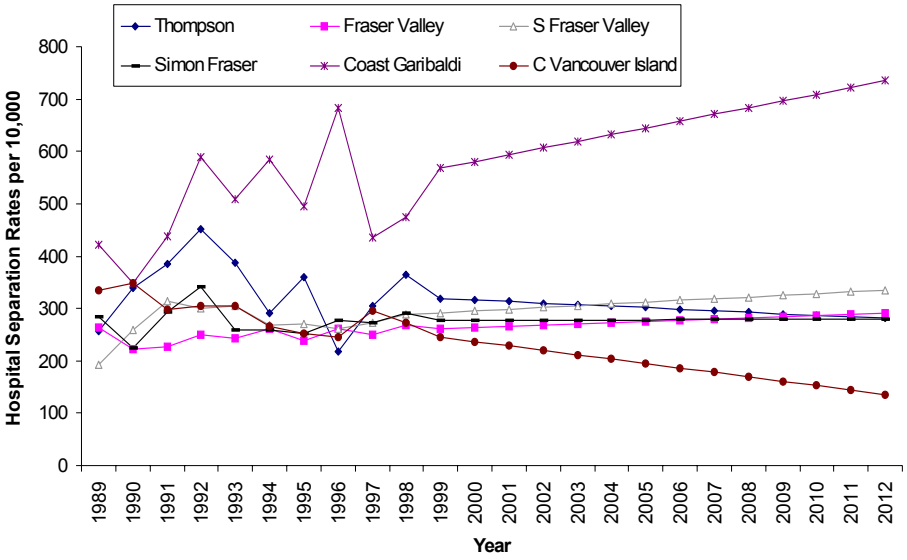


Figure 4.37: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Northern Regions, 1989-2012, Males 65-79

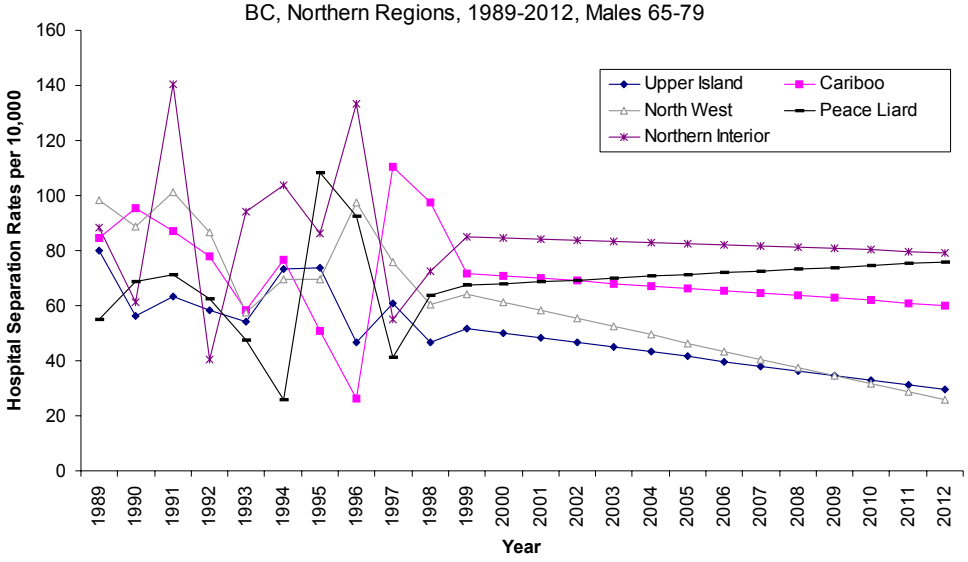
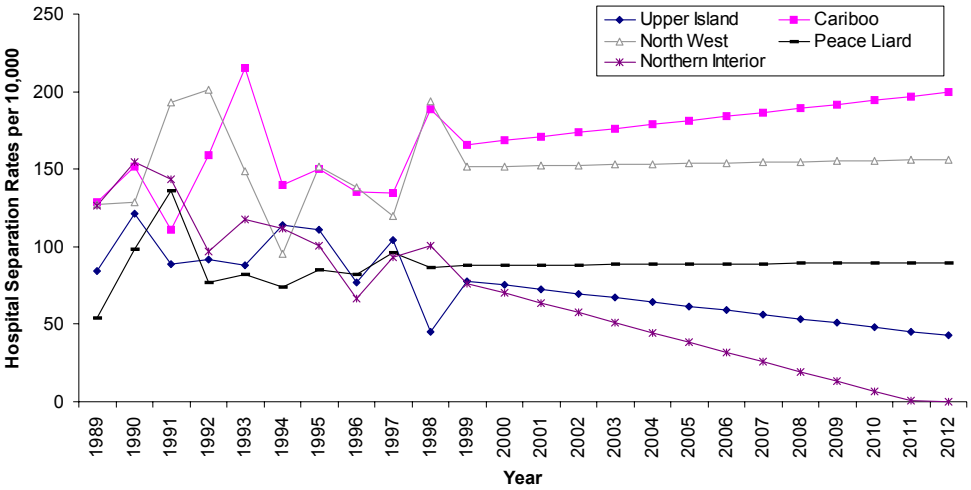
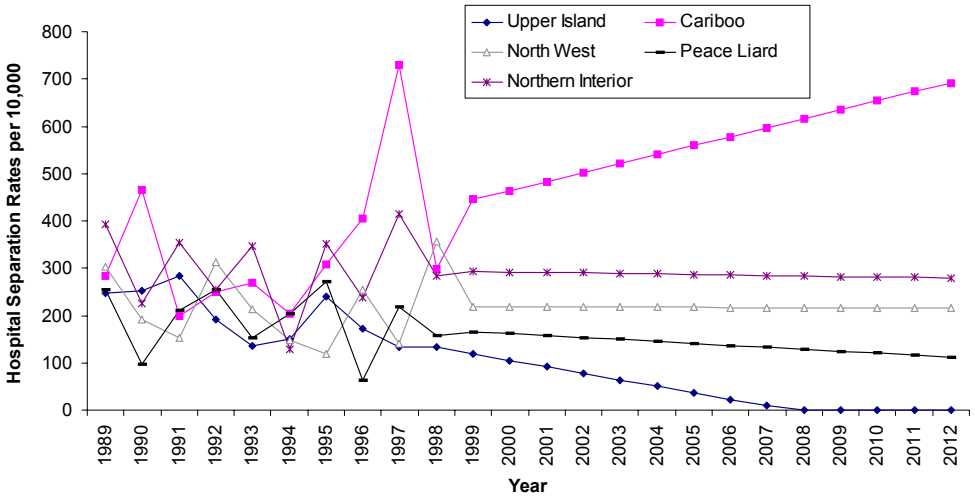


Figure 4.38: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Northern Regions, 1989-2012, Females 65-79



tions in South Fraser Valley (χ^2=21.3, p=.01). Coast Garibaldi also had an upward trend, but it was not significant. All other Central Health Regions had non-significant downward trends. (*Figure 4.36*) [*Appendix C-34*]

Figure 4.39: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Northern Regions, 1989-2012, Males 80+



With the continuation of the above trends, the rates due to falls in the home in the Central Health Regions will increase significantly for South Fraser Valley (χ^2=10.9, p=.001) and Coast Garibaldi (χ^2=9.8, p=.002). The overall regional rate is projected to increase, but not significantly. The number of hospital admissions is also expected to increase. (*Figure 4.32*) [*Appendix C-30*]

Northern Regions

Males 65-79

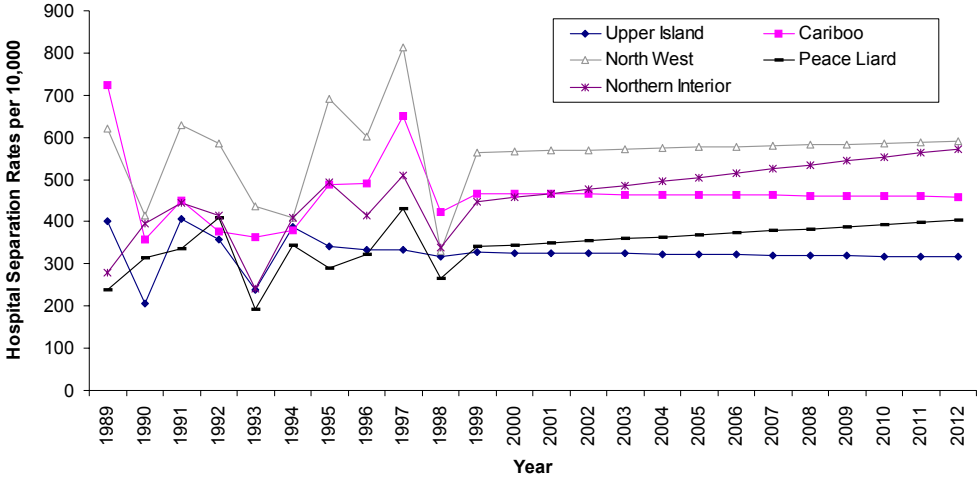
From 1989 to 1998, an upward but not significant trend in the rates of hospital separations was observed in Peace Liard. In all other Northern Regions, the rates showed non-significant decreases. (*Figure 4.37*) [*Appendix C-35*]

With the continuation of these trends, the hospital separation rates due to falls in the home for Peace Liard is projected to increase slightly, but not significantly, in the succeeding years. It is projected that the regional rate of hospital separations due to falls in the home for the Northern Health Regions will decrease significantly (χ^2=11.7, p=.001). However, the number of hospital separations is projected to increase. (*Figure 4.26*) [*Appendix C-24*]

Females 65-79

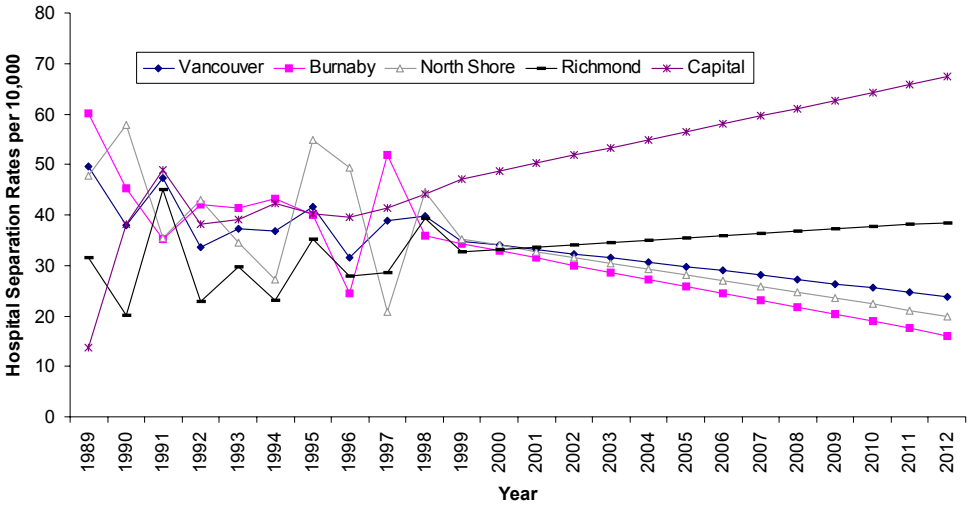
From 1989 to 1998, slightly increasing but not significant trends in the rates of hospital separations were observed in Cariboo, North West, and Peace Liard. Significant downward trends were observed in Upper Island (χ^2=3.7, p=.05) and Northern Interior (χ^2=8.4, p=.004). (*Figure 4.38*) [*Appendix C-36*]

Figure 4.40: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Northern Regions, 1989-2012, Females 80+



If the above trends continue, the hospital separation rates due to falls in the home for Cariboo will continue to increase, but not significantly. The rate for North West will increase slightly, but significantly (χ^2=24.0, p=.0001). The overall regional rate is expected to decrease significantly (χ^2=12.2, p=.0001), while the number of hospital separations due to falls in the home for this region is projected to increase. (*Figure 4.28*) [*Appendix C-26*]

Figure 4.41: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Southern Regions, 1989-2012, Males 65-79



Males 80+

An upward but not significant trend in the rates of hospital separations was observed in Cariboo from 1989 to 1998. In all other Northern Health Regions, the rates remained stable or showed a small and non-significant decrease. (*Figure 4.39*) [*Appendix C-37*]

With the continuation of these trends, the hospital separation rates due to falls in the home for Cariboo is projected to increase significantly in the succeeding years (χ^2=10.1, p=.002). It is projected that the regional rate of hospital separations due to falls in the home for the Northern Health Regions will decrease, but not significantly. However, the number of hospital separations is projected to increase. (*Figure 4.30*) [*Appendix C-28*]

Females 80+

From 1989 to 1998, increasing but not significant trends in the rates of hospital separations were observed in Peace Liard and Northern Interior, while Upper Island, North West and Cariboo showed relatively stable rates. (*Figure 4.40*) [*Appendix C-38*]

Directions of the trends of the hospital separation rates vary from one health region to another. In the succeeding years, the hospital separation rates in Upper Island, North West, Peace Liard and Cariboo are projected to remain stable. Northern Interior rates, meanwhile, are projected to increase significantly (χ^2=5.7, p=.02). Overall, the regional rate of hospital separations for the Northern Health Regions is projected to increase slightly but not significantly. However, the number of hospital separations is projected to increase by a factor of three from 1989 to 2012. (*Figure 4.32*) [*Appendix C-30*]

Southern Regions

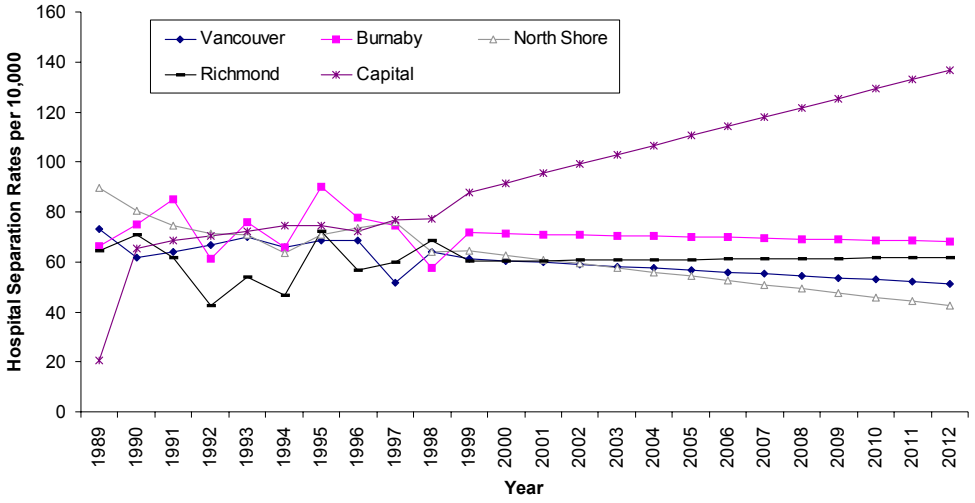
Males 65-79

A significant increase in the rates of hospital separations for falls in the home was observed in Capital from 1989 to 1998 (χ^2=9.3, p=.002). There was also an increasing trend in Richmond, but it was not significant. The rates were mostly downward in the rest of the Southern Regions, but not significantly. (*Figure 4.41*) [*Appendix C-39*]

With the continuation of the above trends, the rates due to falls in the home in the Southern Health Regions

will increase significantly for Capital (χ^2=19.3, p=.001). The rates for Richmond will increase slightly, but not significantly. The overall regional rate due to falls in the home for this region is projected to decrease, but not significantly. The number of hospital separations is projected to increase from 1989 to 2012. (*Figure 4.26*) [*Appendix C-24*]

Figure 4.42: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Southern Regions, 1989-2012, Females 65-79



Females 65-79

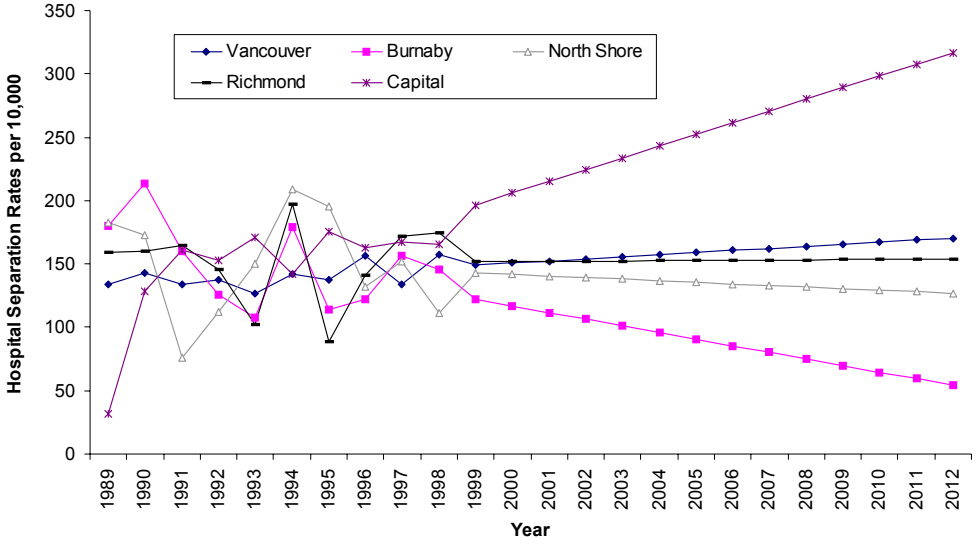
From 1989 to 1998, a significant upward trend in the rates of hospital separations was observed in Capital (χ^2=41.9, p=.0001). There was also an increasing trend in Richmond, but it was not significant. Non-significant downward trends were observed in Vancouver, Burnaby and North Shore. (*Figure 4.42*) [*Appendix C-40*]

Similar to the male projected trends of rates, females aged 65 to 79 years in Capital will experience a significant increase in the hospital separation rates (χ^2=69.9, p=.0001). The rates for Richmond will remain stable while the rest of the Southern Regions will show a decrease in the rates. Overall, the regional rate is expected to increase significantly (χ^2=6.51, p=.01), and the numbers of hospital separations due to falls in the home are projected to increase from 1989 to 2012. (*Figure 4.28*) [*Appendix C-26*]

Males 80+

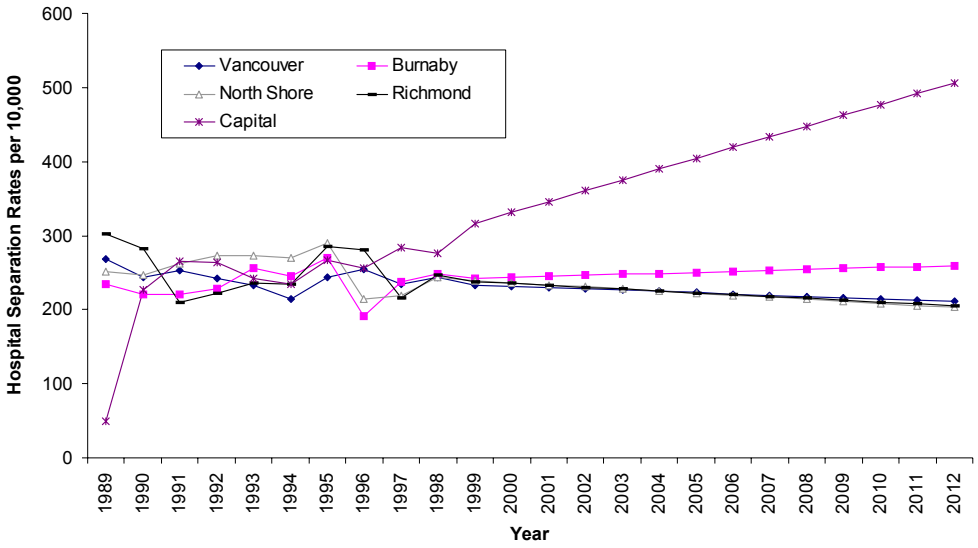
From 1989 to 1998, a significant increase in the rates of hospital separations for falls in the home was observed in Capital (χ^2=20.0, p=.0001). There was a small but non-significant upward trend in Vancouver as well. Non-significant downward trends, on the other hand, were observed in Burnaby and North Shore. The

Figure 4.43: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Southern Regions, 1989-2012, Males 80+



trend for Richmond remained relatively stable. (*Figure 4.43*) [*Appendix C-41*]

Figure 4.44: Hospital Separation Rates Due to Falls in the Home, per 10,000, BC, Southern Regions, 1989-2012, Females 80+



Projections made up to the year 2012 for rates due to falls in the home in the Southern Health Regions show that Capital will observe an increasing and significant trend (χ^2=55.7, p=.0001). Burnaby is projected to observe a significant downward trend (χ^2=22.0, p=.0001), while Richmond will remain stable. The regional rate is expected to increase significantly (χ^2=16.9, p=.0001), and the number of hospital separations is projected to increase. (*Figure 4.30*) [*Appendix C-28*]

Females 80+

Similar to other seniors in the region, females aged 80 years and older in Capital showed a significant upward trend in the rates of hospital separations from 1989 to 1998 (χ^2=63.5, p=.0001). There was also a small but non-significant upward trend in Burnaby. Downward trends were observed in Vancouver, North Shore and Richmond, but they were not significant. (*Figure 4.44*) [*Appendix C-42*]

With the continuation of the above trends, the projected hospital separation rate due to falls in the home will continue to increase significantly for Capital (χ^2=149.0, p=.0001). Vancouver (χ^2=4.31, p=.04) and North Shore (χ^2=4.05, p=.04) will observe significant downward trends in the succeeding years. The regional rate for the Southern Health Regions shows that rates will increase significantly (χ^2=34.0, p=.0001). Overall, the numbers for hospital separations due to falls in the home will also continue to increase. (*Figure 4.32*) [*Appendix C-30*]

Future Patterns of Regional Variations Due to Falls in the Home Relative to the Province

Males 65-79

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for males aged 65 to 79 years in *Figure 4.45*. Compared to the provincial rate, and taking into account the demographic changes and the continuation of the current trends, significantly higher ratios are expected in Northern Interior (1.87, 95% CI: 1.36-2.57), North Okanagan (1.44, 95% CI: 1.09-1.90), and Capital (1.31, 95% CI: 1.07-1.59). The lowest significant ratios are expected in Fraser Valley (0.51, 95% CI: 0.35-0.74), Burnaby (0.57, 95% CI: 0.38-0.85), North Shore (0.62, 95% CI: 0.42-0.92), Vancouver (0.67, 95% CI: 0.52-0.84) and Upper Island (0.92, 95% CI: 0.44-0.95). [*Appendix C-43*]

Figure 4.45: Average Annual Hospital Separation Rate Ratio, Falls in the Home, by Health Regions, BC, 1999-2012, Males 65-79

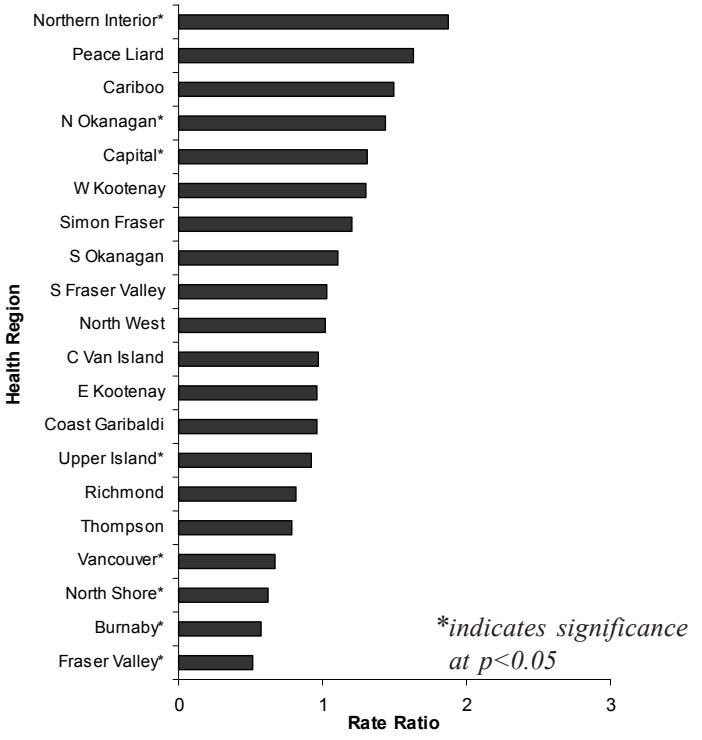


Figure 4.46: Average Annual Hospital Separation Rate Ratio, Falls in the Home, by Health Region, BC, 1999-2012, Females 65-79

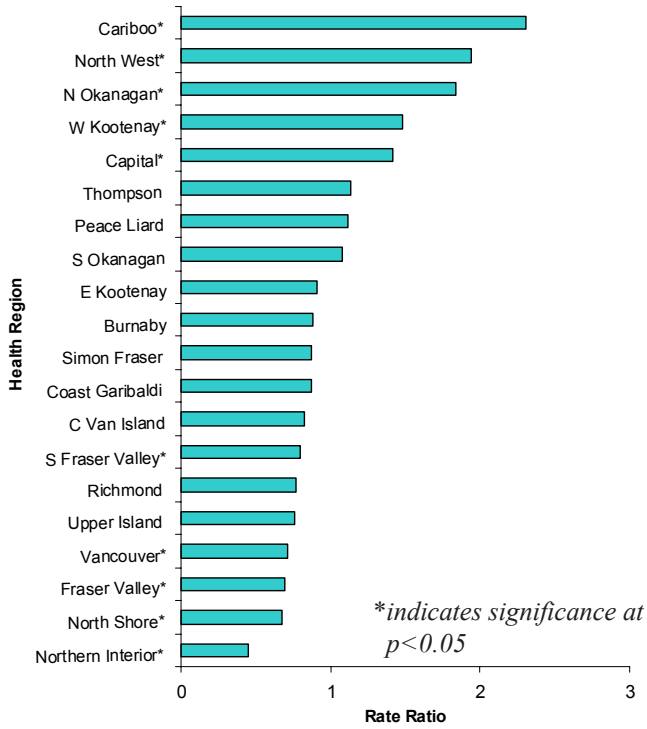


Figure 4.47: Average Annual Hospital Separation Rate Ratio, Falls in the Home, by Health Regions, BC, 1999-2012, Males 80+

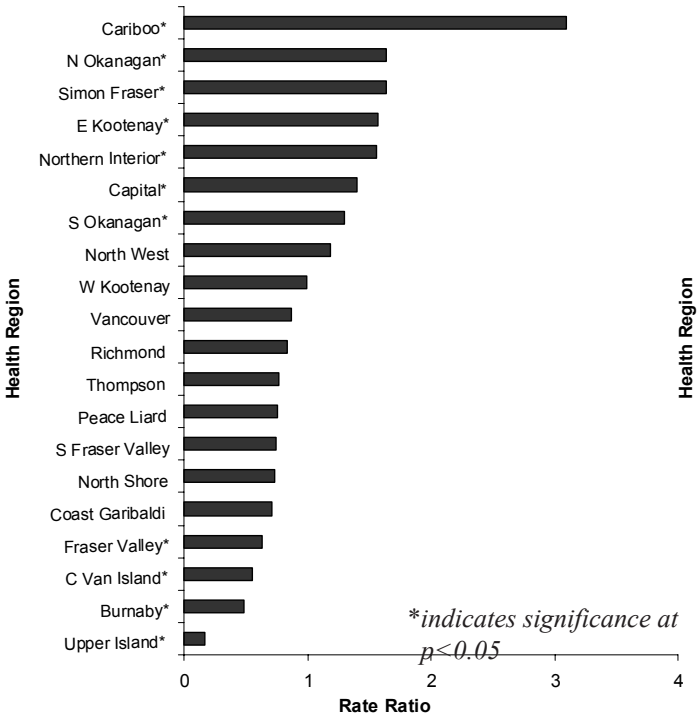
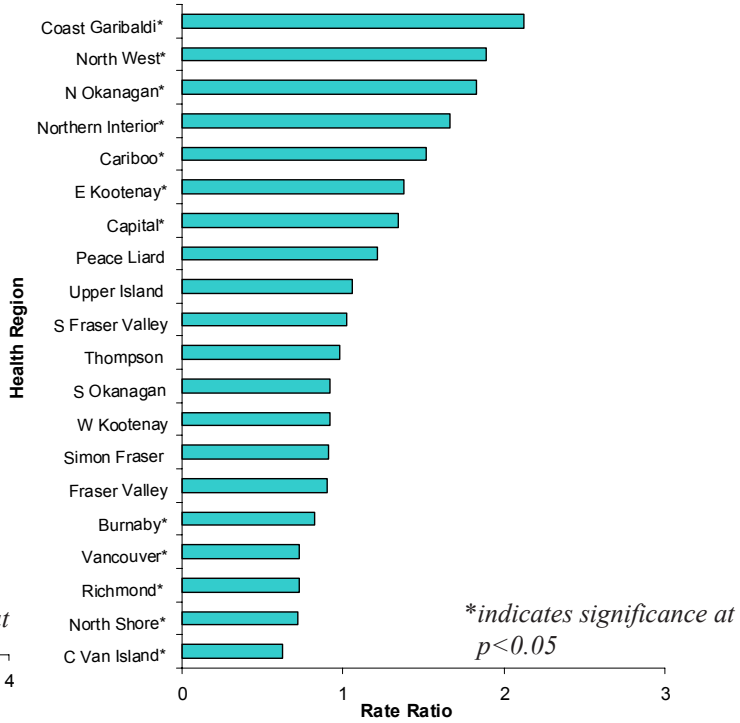


Figure 4.48: Average Annual Hospital Separation Rate Ratio, Falls in the Home, by Health Regions, BC, 1999-2012, Females 80+



Females 65-79

Figure 4.46 shows the overall pattern of regional variations in hospital separation ratios, relative to the province, for females aged 65 to 79 years. Compared to the provincial rate, and taking into account the demographic changes and the continuation of the current trends, significantly higher ratios are expected in Cariboo (2.30, 95% CI: 1.79-2.96), North West (1.94, 95% CI: 1.45-2.59), North Okanagan (1.84, 95% CI: 1.54-2.19), West Kootenay (1.48, 95% CI: 1.15-1.91), and Capital (1.42, 95% CI: 1.24-1.61). The lowest significant ratios are expected in Northern Interior (0.45, 95% CI: 0.28-0.73), North Shore (0.67, 95% CI: 0.52-0.87), Fraser Valley (0.70, 95% CI: 0.56-0.87), Vancouver (0.71, 95% CI: 0.60-0.83), and South Fraser Valley (0.80, 95% CI: 0.69-0.93). [*Appendix C-43*]

Males 80+

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for males aged 80 years and older in *Figure 4.47*. Compared to the provincial rate, and taking into account the demographic changes and the continuation of the current trends, significantly higher ratios are expected in Cariboo (3.09, 95% CI: 2.25-4.27), North Okanagan (1.64, 95% CI: 1.29-2.10), Simon Fraser (1.63, 95% CI: 1.33-2.01), East Kootenay (1.57, 95% CI: 1.12-2.20), Northern Interior (1.56, 95% CI: 1.03-2.35), Capital (1.40, 95% CI: 1.20-1.63) and South Okanagan (1.30, 95% CI: 1.10-1.55). The lowest significant ratios are expected in Upper Island (0.17, 95% CI: 0.00-0.20), Burnaby (0.48, 95% CI: 0.33-0.71), Central Vancouver Island (0.55, 95% CI: 0.41-0.74) and Fraser Valley (0.63, 95% CI: 0.47-0.85). [*Appendix C-44*]

Females 80+

The overall pattern of regional variations in hospital separation ratios relative to the province is shown for females in *Figure 4.48*. Compared to the provincial rate, and considering the demographic changes and the continuation of the current trends, significantly higher ratios are expected in Coast Garibaldi (2.13, 95% CI: 1.76-2.57), North West (1.89, 95% CI: 1.43-2.49), North Okanagan (1.83, 95% CI: 1.58-2.11), Northern Interior (1.67, 95% CI: 1.31-2.12), Cariboo (1.52, 95% CI: 1.13-2.03), East Kootenay (1.38, 95% CI: 1.09-1.73), and Capital (1.34, 95% CI: 1.22-1.47). The lowest significant ratios are expected in Central Vancouver Island (0.63, 95% CI: 0.53-0.74), North Shore (0.72, 95% CI: 0.60-0.87), Richmond (0.73, 95% CI: 0.59-0.90), Vancouver (0.73, 95% CI: 0.65-0.82) and Burnaby (0.82, 95% CI: 0.69-0.98). [*Appendix C-44*]

PROJECTED TRENDS BY SPECIFIC CATEGORIES

Projected Trends in Hospitalizations Due to Intracranial Injuries by Age and Gender

Males

Hospital separation rates due to intracranial injuries among males are presented in *Figure 4.49*. From 1987 to 1998, the rates of hospital separations were stable among males 65-74 years old. There was a small but non-significant decrease in the rates among males aged 75-79 years. A notable and significant upward trend was observed among males aged 80 years and over (χ^2=6.8, p=.01). In the reference group, ages 35-44 years, there was a small but non-significant downward trend. Taking into account the demographic changes, if the above trends continue, the rates among males aged 65-74 years will increase slightly, but not significantly. A small, but not significant, decrease is expected for males aged 75-79 years old. Finally, the rates among those aged 80 years and over will increase significantly by 2012 (χ^2=10.4, p=.001). [*Appendix C-45*]

Females

Hospital separation rates due to intracranial injuries among females are presented in *Figure 4.50*. From 1987 to 1998, rates of hospital separations among females 65-74 years old remained relatively stable, and there was a small, non-significant decrease in the rates among females aged 75-79 years. A notable but not significant downward trend was observed among females aged 80 years and over. In the reference group, ages 35-44 years, there was a small but significant downward trend (χ^2=22.4, p=.0001). Taking into account the demographic changes, and the continuation of the above trends, the rates among females aged 65 years and over will decrease slightly, but not significantly, over time. [*Appendix C-46*]

Projected Trends in Hospitalizations Due to Fractures of Lower Limb by Age and Gender

Males

Hospital separation rates due to fractures of lower limb among males are presented in *Figure 4.51*. From 1987 to 1998, the rates of hospital separations among males 65-74 years old remained stable, overall. There was a small but non-significant decrease among males aged 75-79 years. A notable but not significant upward trend was observed among males aged 80 years and over. In the reference group, ages 35-44 years, the rates were rather stable. Taking into account the demographic changes, if the above trends continue, the rates among males aged 65-79 years will decrease, but not significantly, while the rates among males aged 80 years and over will increase

Figure 4.49: Hospital Separation Rates Due to Falls, Intracranial Injuries, per 100,000, BC, 1987-2012, Males

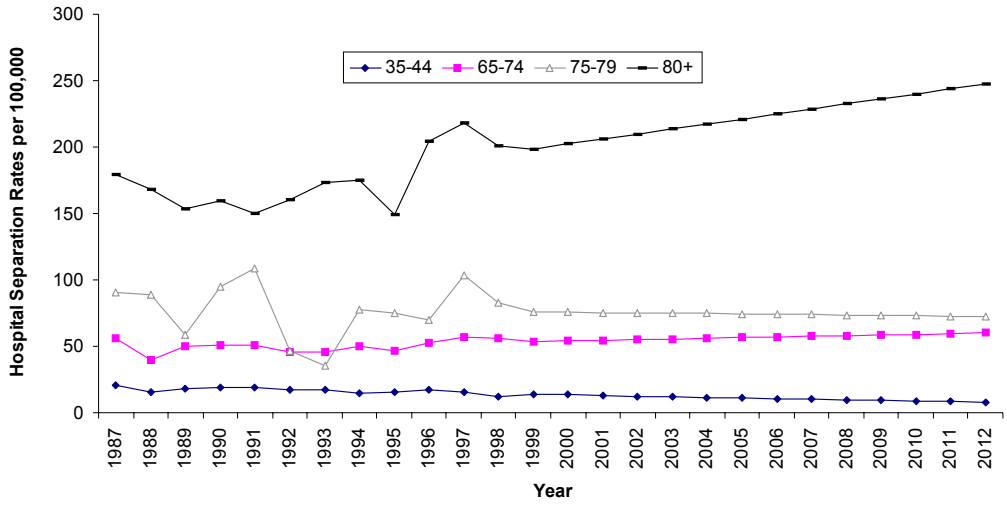
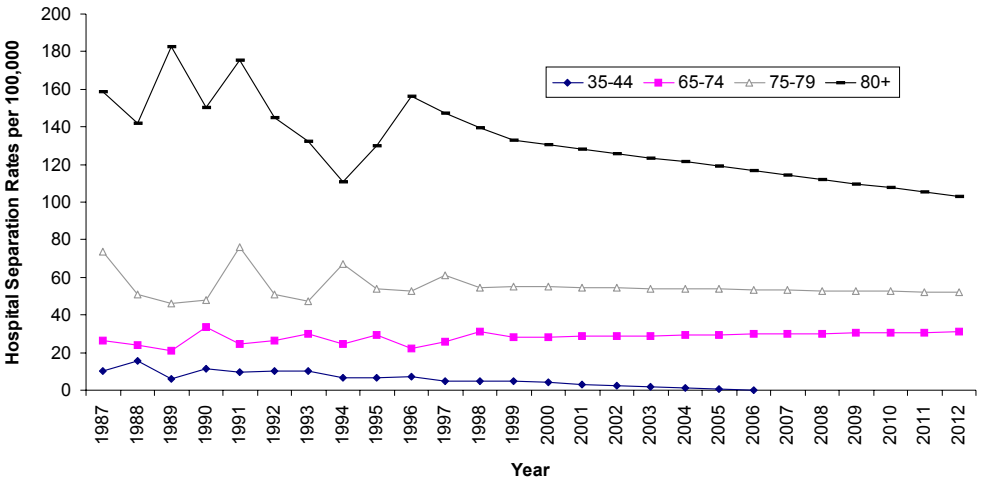


Figure 4.50: Hospital Separation Rates Due to Falls, Intracranial Injuries, per 100,000, BC, 1987-2012, Females



significantly by 2012 (χ^2=11.7, p=.001). [*Appendix C-47*]

Females

Hospital separation rates due to fractures of lower limb among females are presented in *Figure 4.52*. From 1987 to 1998, there was a small but non-significant decrease in the rates of hospital separations among females 65-74 and 75-79 years old. A notable but non-significant upward trend was observed among females aged 80 years and over. In the reference group, ages 35-44 years, there was a small but non-significant upward trend. Taking into account the demographic changes, and the continuation of the above trends, the rates among females aged 65-79 years will decrease, but not significantly. Among females aged 80 years and over, the rates will increase significantly (χ^2=6.6, p=.01). [*Appendix C-48*]

Figure 4.51: Hospital Separation Rates Due to Falls, Fractures of the Lower Limb, per 100,000, BC, 1987-2012, Males

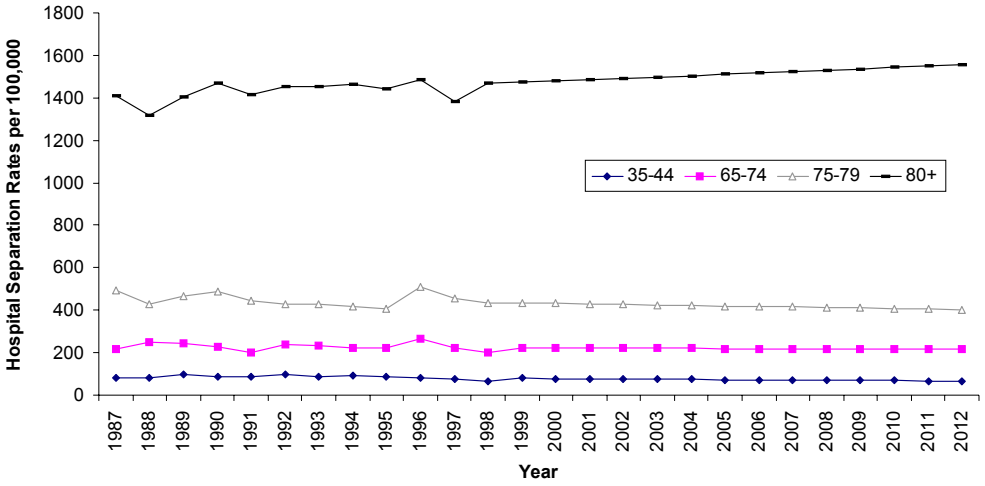
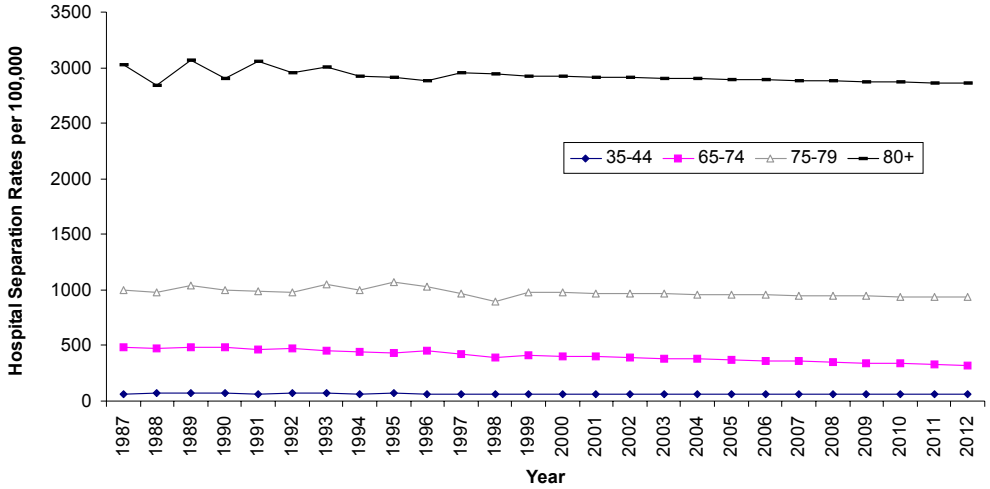


Figure 4.52: Hospital Separation Rates Due to Falls, Fractures of the Lower Limb, per 100,000, BC, 1987-2012, Females



Projected Trends in Hospitalizations Due to Fractures of Upper Limb by Age and Gender

Males

Hospital separation rates due to fractures of upper limb among males are presented in *Figure 4.53*. From 1987 to 1998, the rates were relatively stable for 65- to 74-year-old-males. A small but non-significant decrease in the rates of hospital separations among males 75-79 years old and 80 years and over was observed. In the reference group, ages 35-44 years, there was also a small but non-significant downward trend. Taking into account the demographic changes, if the above trends continue, the rates among males aged 65-74 years will decrease, but not significantly, while among males 75-79 years old, a significant decrease is expected (χ^2=22.9, p=.0001). Finally, the rates will remain stable among males aged 80 years and over. [*Appendix C-49*]

Females

Hospital separation rates due to fractures of upper limb among females are presented in *Figure 4.54*. From 1987 to 1998, there was a small but non-significant decrease in the rates of hospital separations among females 65 years and older. In the reference group, ages 35-44 years, the rates were stable during the period. Taking into account the demographic changes, if the above trends continue, the rates among females aged 65-74 years will decrease significantly (χ^2=32.8, p=.0001). They will also decrease, but not significantly, among females 75 years old and over. [*Appendix C-50*]

Figure 4.53: Hospital Separation Rates Due to Falls, Fractures of the Upper Limb, per 100,000, BC, 1987-2012, Males

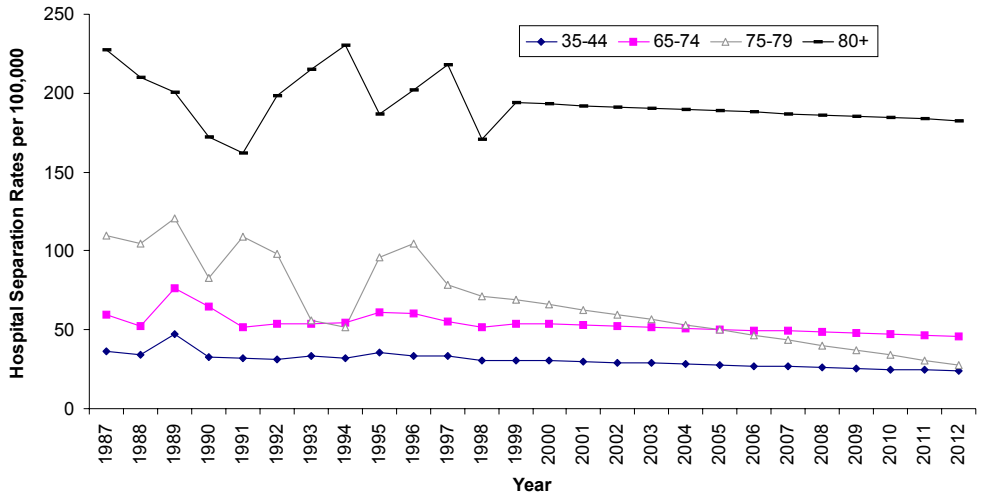
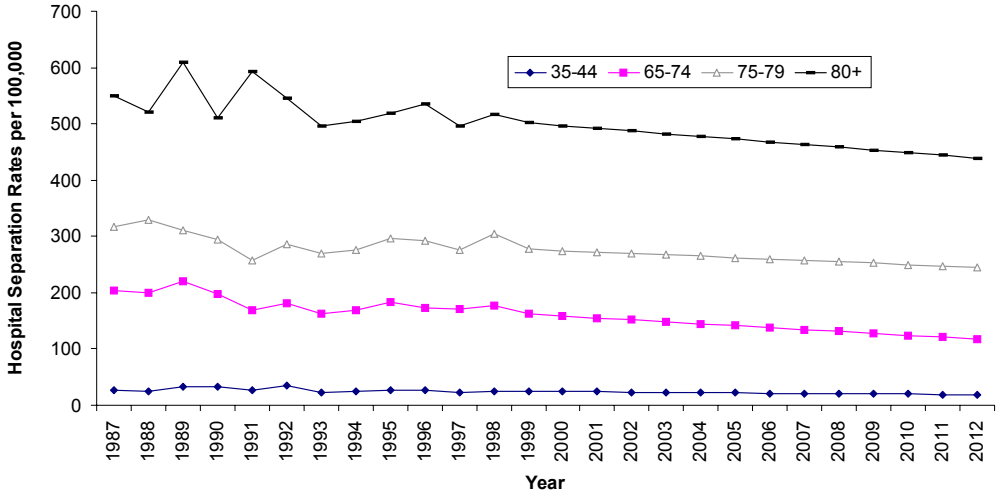


Figure 4.54: Hospital Separation Rates Due to Falls, Fractures of the Upper Limb, per 100,000, BC, 1987-2012, Females



CHAPTER 5

OPPORTUNITIES FOR ACTION

OPPORTUNITIES FOR ACTION

The provincial and regional profile of fall-related injuries and deaths among seniors developed in this study clearly supports the need for continued efforts in the area of fall prevention and control. This report assessed the burden of fall injuries among seniors in British Columbia and began exploring risk factors and risk conditions for these injuries. This assessment was completed by calculating injury rates and examining the variation across age groups, gender, geographic locations, and calendar years. Future projections were conducted by health regions for falls in general, and in particular, for falls occurring in the home. Future projections in rates of hospital separations for selected types of fall-related injuries were also examined. This section of the report will provide a review of the main results of this study, and discuss some options and recommendations to address the problem of fall-related injuries.

REVIEW OF MAIN RESULTS

Fall-related Mortality by Age and Gender

From 1987 to 1998, there were 3,183 deaths due to fall-related injuries among seniors in BC. When all age groups were combined, there was no statistically significant difference between the rates of death among males and females. However, when compared to other external causes of death, falls were responsible for a significantly higher proportion (10% more) of deaths among females than among males. Among females, higher rates of chronic conditions known to be associated with fall injuries (i.e., arthritis and osteoperosis) may account for higher fall-related mortality rates (Stevens & Olsen, 2000). Furthermore, self-inflicted injuries account for a considerably greater proportion of deaths in males (11% more). It is known that males have higher rates of successful suicide attempts than females. A higher vulnerability among the eldest is also indicated by the significantly higher rates of deaths among older age groups than younger age groups. It is notable that there were no gender differences among the 85 years and over age group. One possibility for the lack of gender differences may be the similarly reduced levels of activity in both genders among frail elderly.

Leading Causes of Fall-related Mortality

Regardless of age or gender, the leading causes of falls-related deaths for seniors aged 65 years and older included falls from stairs, falls from chair or bed/one level to another, and falls from the same level. Wyatt et al. (1999) also found similar results in a small study (n=51), where 53% of falls down stairs resulted in death. Falls from ladder/scaffolding also indicated elevated rates for males aged 65 to 74 years old. As expected, falls from ladder/scaffolding falls naturally decreased with age, indicating a decrease in this type of exposure with age. It is also notable that the mortality rates for falls from the same level increased with age, indicating a higher exposure and vulnerability to falls. Given their increased frailty, it is not surprising that mortality rates were much higher for seniors aged 85 and over, with no significant differences between males and females.

Time Trends in Injury Mortality

For all age groups combined (65 years and older), mortality rates among males were relatively stable across the calendar years, with no significant trend. By contrast, there was a significantly increasing trend among females. This may be a result of a move from institutionalization, with more women that have multiple

chronic conditions now living independently in communities that do not have the necessary support structure in place. A closer examination of the rates by age group revealed no significant trends among males aged 65-84 years old, but a significant downward trend among those 85 years old and over, for all **?** categories. As it is unclear if these individuals are community- or institution-dwelling elderly, given their advanced age, this reduction may be the result of falls prevention programs within long-term care facilities. For example, there have been considerable falls-prevention activities over the last decade conducted through Aimnet, which is funded by Health Canada, at the University of Victoria.

Among females aged 75-79 years, there was an increasing and significant trend. This upward trend may also partly explain the overall significant upward trend observed among females aged 65 years old and over, while the downward trend observed among males 85 years and over may partly explain the overall stable trend among males 65 years old and over.

The trends by leading causes of fall-related deaths and by age groups revealed no significant changes during the study period for all age groups, except among the older age groups. Among the 85 years old and over, the trends were decreasing significantly for most leading causes of fall-related deaths. However, the rates remained approximately ten times higher in comparison with younger age groups. These results indicate that, while we may have made some progress in increasing survival, there is much to be done to prevent fall exposures among the elderly and reduce their susceptibility.

Regional Variations in Fall-related Mortality

For males aged 65-74 years, there was no significant variation in mortality rates across the regions. Relative to the province, males aged 75 years and older experienced significantly lower rates in Vancouver. However, the 75-84 years age group experienced significantly elevated rates in the North West, Northern Interior, Cariboo, Central Vancouver Island, and Capital regions, and significantly lower rates in the South Fraser Valley. Finally, males aged 85 years and older experienced significantly elevated mortality rates in the Capital region, but also in the Peace Liard, Thompson, and South Okanagan regions.

Females aged 65-74 years experienced significantly elevated mortality rates due to falls in both the Northern Interior and the Thompson Health Region. Females aged 75-84 years had significantly elevated mortality in Northern Interior, and Thompson, but also in Cariboo and Coast Garibaldi regions. Females aged 85 and older experienced significantly higher mortality rates in North Okanagan, Central Vancouver Island, the Capital region, and the North Shore. Finally, it is notable that females of all ages experienced significantly lower mortality rates in Vancouver.

In general, it appears that relative to the province, Capital (especially for the oldest age group), Central Vancouver Island regions, and a few of the Interior and Northern Regions experience significantly elevated mortality rates due to falls. By contrast, Vancouver seems to consistently exhibit lower mortality rates. The Capital Region is a known retirement community, and therefore may have a higher proportion of active community-dwelling elderly at higher risk of falls than the institutionalized. Similarly, small communities may also have larger proportions of community-dwelling elderly, possibly due to a lack of long-term care facilities. Furthermore, the physical climate of the Interior and Northern Regions may have a significant impact on the rates of falls.

Injury Hospital Separations by Age and Gender

From 1987 to 1998, there were a total of 100,513 hospital separations due to unintentional fall-related injuries among seniors. Results of this report indicate that falls among seniors and elderly are the predominant reason for hospitalizations, for all external causes. Compared to other causes of injuries, falls represented approximately half of hospitalized cases among males, and approximately two-thirds among females aged 65 years old and over. Females experienced significantly higher rates of hospitalization than males. Overall, hospital separation rates increased significantly with age for both genders, but they were approximately 80% higher for females than for males. This is consistent with patterns evident in mortality data; increasing rates of chronic conditions and exposure to fall-risk may account for this.

Leading Causes of Injury Hospital Separations

The first leading category of hospital separations for all age groups and for both genders was falls from the same level by slipping or tripping. Rates for this category were at least four times higher in comparison with other categories, and approximately twice as prevalent among females than among males, across all age groups. Other leading causes of fall-related hospitalizations for both males and females were falls from stairs, falls from chair or bed, falls from ladder/scaffolding, and falls from one level to another. Falls from collision/push also emerge as an increasing problem for females aged 80 years and older. Overall, the ranking of the leading causes of falls indicates a decreasing physical tolerance to falls with age, with higher rates of falls from small heights, such as chair or bed or collision/push by others, in particular among females aged 80 years and over.

Trends in Fall-Related Hospitalizations

Injury rates were significantly higher among females than males, with rates among females nearly twice the rates among males. For both males and females, hospital separation rates dropped significantly by approximately 12 percent during the study period 1987-1998.

The trends by leading categories of falls by age and gender revealed that falls on same level/slip or trip were the major cause of hospitalizations for all age groups. Any elderly that are even minimally mobile are at risk for these types of falls, whereas a smaller percentage are sufficiently mobile to attempt stairs and ladders. This is consistent with Speechly et al.'s (1991) finding that senior citizens engaging in vigorous activity were more likely to be injured by a fall than seniors classified as frail and with restricted activity. With a few exceptions, such as falls from one level to another, which showed a small upward trend among females aged 85 years and over, most of the leading categories remained relatively stable across the study period. This is to be contrasted with the trends in mortality, which showed stable rates for all age groups except among the 85 years olds and over, for whom there was a decreasing trend. This result seems to suggest that the improvements in survival do not have an equivalent reduction in the incidence of falls.

Regional Variations in Fall-related Hospital Separations

The pattern of regional variations in hospital separations due to falls was similar to the mortality pattern, with a tendency towards higher injury rates among residents of Northern areas of BC, as compared to Southern areas. The Northern regions of BC also have higher occurrences of falls and cancer than Southern areas, as cited on page 18 of "A Report on the Health of British Columbians." Generally, both males and females

experienced significantly elevated rates in the North West, Northern Interior, West Kootenay, Coast Garibaldi, and Cariboo regions. East Kootenay had higher rates, compared to the province, for females in most age groups. It is notable that high rates were observed for South Okanagan, Simon Fraser and South Fraser Valley only for females aged 85 years and over. It is also notable that for all age groups and for both genders, Vancouver showed the lowest rates of hospitalization, compared to the province. These patterns of regional variation require further research to determine the reasons behind the differences in risk observed.

Nature of Injuries

Fractures were the most common type of injury due to falls, regardless of gender or age group. In particular, fractures of lower limb were overwhelmingly the most common type of fracture for both males and females, representing 40% of male injuries and 53% of female injuries. The fractures of lower limb are likely to be predominantly hip fractures, while many fractures of upper limb may result from attempts to prevent the fall or diminish its impact. Evidence for this comes from a study by Tinetti (1987), showing that force of impact and protective responses of the faller are contributing factors to sustaining a fall-related injury. Females had significantly higher rates for most types of injuries, corresponding to their higher rates of hospitalization due to falls. The leading nature of injuries for females were all fractures (lower limb, upper limb and other). Consistent with this finding is research by Stevens and Olson (2000) indicating elevated rates of hip fractures in females, accounting for 80 percent of hospitalizations from fall injuries.

For males, the top three were fractures of lower limb, contusion and superficial injuries, and other fractures. Osteoperosis is more of a factor for women than men, and would therefore explain the high fracture rates of both the upper and lower limbs (Armstrong et al., 1994, Stevens & Olson, 2001). The nature of injuries where males have higher rates of injury than females include wounds, intracranial, and internal injuries. Increased rates of these kinds of injuries may be the result of increased risk taking behaviour in males. Patridge et al. (1998) found victims of ladder falls were predominately males (93%), and sustained injuries as a result of excessive reaching and incorrect ladder placement (72%). Osteoporosis is more of a factor for women than men, and would therefore explain the high fracture rates of both the upper and lower limbs (Armstrong et al., 1994; Stevens & Olson, 2001.

Place of Occurrence of Fall Injuries

The most common place of occurrence of falls, regardless of gender or age group, was the home (57% among males, and 56% among females). The second most common place was a residential/institutional place (23% of falls among males, and 25% among females). Among males, four percent of falls happened on streets, and among females, five percent of falls happened in public buildings. Falls occurring at home and in a residential/institutional place increased significantly with age for both males and females. These patterns are consistent with where elderly are spending the majority of their time.

Future Projections of Regional Trends in Fall-related Hospital Separations

Assuming a linear continuation of the trends observed from 1987 to 1998, and taking into account future demographic changes, notable regional variations in both the rates and the number of hospital separations from 1998 up to the year 2012 were recorded among males and females aged 65 to 79 years, and 80 years and over.

In Eastern Regions, rates of fall-related hospital separations will decrease significantly for males and females aged 65 to 79 years from 1987 to 2012. The rates for males aged 80 years and over will show a slight, but not significant, increase. Among females of the same age, the trend of the regional rate is projected to decrease signficantly. Consistent with the rate trends, the number of hospital separations due to falls will decrease slightly for both males and females aged 65 to 79 years. However, among the elderly, aged 80 years and over, the numbers are expected to double among males, and increase by 40% among females.

In the Central Regions, the rates for all seniors of all ages and gender are expected to decrease signficantly. However, the number of hospital separations is expected to increase. This contrast is not surprising, given the growth of the seniors' population expected in the province, as well as the country.

In the Northern Regions, a significant downward trend is expected for both age groups and genders. Due to demographic changes, the number of hospital separations is projected to increase during the same time period. The only exception are males aged 80 years and over, for whom the number of hospital separations will decrease slightly.

Finally, in the Southern Regions the rates for males and females will decrease significantly, except for males 80 years old and over. Among the 65 to 79 year-olds, there is an expected decrease in the numbers of hospital separations among males and females. Among the elderly aged 80 years and over, the numbers are expected to increase among males and females. It is important to note that while hospitalization rates are expected to decrease, they may vary over time and areas due to factors not related to health, such as accessibility of treatment and medical or administrative decisions that impact the number and length of hospital stays. Regional projects demonstrate that variations between regions will persist in the future. Research at this stage will help delineate these differences in risk, enabling a strategy to focus on high risk areas.

Future Projections of Regional Trends in Hospital Separations Due to Falls Occurring in the Home

Assuming a linear continuation of the trends observed from 1989 to 1998, and considering future demographic changes, notable regional variations in both the rates and numbers of hospital separations for falls in the home, from 1998 up to the year 2012, were noted among males and females aged 65 to 79 years and 80 years and over.

For the most part, projected trends in the rates for the Eastern Regions for hospital separations due to falls in the home are expected to increase for females aged 65 to 79 years and males 80 years and older. For the younger males 65-79 years old, the rates will remain stable or will show a non-significant decrease.

Again, projected trends in rates for falls in the home in the Central Regions were consistent to those found for falls in general, with one exception. All seniors are expected to experience a decrease in rates, except for females aged 80 years and older. While they are expected to have decreased rates of falls overall, they will have increased rates of falls in the home.

In the Northern Regions, while the rates of falls in general are expected to decrease for males and females of all age groups, the rates of falls in the home are expected to increase slightly for females 80 years old and over.

Interestingly, the Southern Regions show decreasing trends in rates of all falls but overall increasing trends

for falls in the home. In all regions, it is possible that there will be a shift in the etiology of falls, with falls in the home increasing, but other types of falls decreasing sufficiently to allow a drop in the overall rate of falls in general. Current political movements in BC are encouraging the elderly to remain in the home as long as possible and reducing the number of long-term care facilities. This will undoubtedly affect future rates and numbers of falls in the home.

Future Projections for Selected Types of Fall-related Injuries

Similar trend patterns were observed for intracranial injuries, fractures of the lower limbs and fractures of the upper limbs. Notable and significant increases in the rates of intracranial injuries are expected among males 80 years old and over, while the rates among females will remain mostly stable, with a slight, but not significant, decrease. For fractures of the lower limb, a significant increase is expected for males and females aged 80 years and over. Finally, the rates of fractures of the upper limb will decrease significantly among males 75-79 years old, and remain stable among males 80 years old and over. By contrast, the rates will decrease among females 65-74 years old, and will remain stable among females 75 years old and over.

CONSIDERATIONS FOR PREVENTION

Consideration 1: Develop a provincial-coordinated program of fall surveillance to improve epidemiological research on falls and strategic planning of fall prevention. Such a program should be able to monitor high-risk groups based on a better understanding of the risk factors and conditions associated with the occurrence of falls.

Given the substantial contribution they make to the total burden of injuries among seniors in BC, and the increasingly aging population of the province, falls are clearly a necessary priority for prevention and control. There is a need for increased focus and coordination of efforts in this area (Scott & Gallagher, 1999). Similar to other categories of injury, there is also a need for collecting information related to the risk and occurrence of falls in a manner that facilitates and promotes evidence-based practice. The most current data primarily comes from mortality and hospital separations, and does not provide enough specificity to support planning strategies for falls prevention (Scott & Gallagher, 1999). Furthermore, as we have seen in this report, a high number of fall-related injuries were reported under the "unspecified" category. Thus, there is an urgent need for a coordinated fall-monitoring system that would provide specific information based on a better understanding of the risk factors and conditions associated with the occurrence of falls.

The etiology of a fall seems to be a combination of factors that reflect physical, cognitive, behavioural and social conditions operating alone or in conjunction with environmental hazards (O'Loughlin, Robitaille, Boivin, & Suissa, 1993; Speechley & Tinetti, 1991). Although no strict typology has been agreed upon, factors related to the risk of falls can be grouped into two general categories; intrinsic factors, and extrinsic factors. Intrinsic risk factors with strong to moderate scientific evidence include age-related decline, and involutional changes in sensory and musculoskeletal structure (which leads to decreased visual acuity, slowed protective reflexes and disturbances of balance and gait) (Carter et al., 2001). Added to these developmental changes are medical conditions: stroke, arthritis, and Parkinson's disease, as well as certain types of medication, such as sedatives and anti-depressants (Fildes, 1994; Sattin, 1992; Nevitt, 1990). Extrinsic risk factors have rather low scientific support (Tinetti, Speechley, & Ginter, 1988; Campbell, Borrie, Spears, Jackson,

Brown & Fitzgerald, 1990). These include poor steps and stairway design and repair, inadequate lighting, slippery floors, obstructing furniture, unsecured mats and rugs, and lack of non-skid surfaces in bathtubs and bathrooms (Nevitt, 1990; Fildes, 1994; Sattin, 1992; Day, Kent & Fildes, 1994).

Social factors that may be correlated to the risk of injuries in general, and falls in particular, include the extent of social networks such as family and friends, which are fundamental to the health and well-being of older adults. For example, being married and having close social interactions were found to have a protective effect against physical disability (Mor et al., 1989; Roos & Havens 1991, Kaplan et al. 1993), institutionalization (Hickey, 1980), and the risk of mortality (Steinbach, 1992) in the elderly population. In general, it can be hypothesized that social factors interact with the physical environment, including housing and the surrounding neighbourhood, to influence the health of the elderly population. Studies have suggested that residing in a deteriorating city area creates greater isolation and anonymity among local residents, resulting in decreased visits from family members and friends (Krause, 1993).

Other social factors that may have an influence on the risk of injuries among seniors include social trends and attitudes towards seniors. Gallagher and Scott (1996) argued that there is a trend to keep seniors out of institutions and in their own homes as long as possible. Community-dwelling seniors are more independently mobile due to technological advances in walker devices, motorized wheelchairs, and scooters (Gallagher & Scott, 1996). Unfortnuately, most Canadian cities are not yet designed or maintained to accommodate the use of these mobility aids, and the combination of advanced age, disability, and increased independence in unsafe environments may put seniors at greater risk for falls (Gallagher & Scott, 1996).

Consideration 2: Create and promote coordinated regional policies for falls prevention, based on current knowledge and successful utilizations of proven or promising interventions, to reduce falling among seniors and the elderly.

The current report presents a profile of fall-related injuries in BC. This profile can be used as an effective tool for educating and guiding fall-prevention efforts that are targeting this large, yet essentially, preventable problem. However, individuals implementing fall-prevention programs still need to determine the most suitable ones, depending on the circumstances. Scott, Dukeshire, Gallagher & Scanlan (2001) recently produced a timely and informative report outlining best practices for the prevention of falls among community-dwelling seniors. Recommendations in the best-practices guide stem from a systematic review of the fall-prevention literature. The guide can be used in conjunction with the profiles outlined in the current report to target problem areas in ways that have proven effective in the past.

The best-practices guide (Scott et al., 2001) highlights the need to work with communities in developing fall-prevention strategies. It is at the local level that needs and resources should be identified, data collected, community support garnered, and interventions implemented and evaluated. Regional policies should be defined based on informed consensus among various community stakeholders, health care providers, and legislative and public health agencies. Such a consensus also requires an effective system for disseminating information relevant for intervention at the community level. A coordinated fall-surveillance system cannot be effective without the appropriately shared knowledge of what works in the area of fall- prevention.

Consideration 3: Increase the support for research of the magnitude, etiology, biobehavioural and psychological determinants

of fall-related injuries among seniors.

In Canada, there is a projected increase in the population of seniors aged 65 and over, rising from the current 13% to 23% of the total population by 2031 (Elliot, Hunt, & Hutchinson, 1996). This result underlines the need for increased focus on the prevention and control of injuries among seniors. Since falls form the bulk of unintentional injuries affecting seniors, it is clear that this must be an area of high priority for researchers, communities, government, and public-policy makers alike.

The review by Scott et al. (2001) provides a clear picture of the strategies available for fall-prevention, and the evidence for their effectiveness. However, large gaps remain in the research examining this growing area. For example, Scott et al. (2001) identify the following issues: there is little research examining the impact and effectiveness of fall-prevention strategies for individuals of different genders, as well as cultural, racial, and economic backgrounds; there is also a lack of knowledge on how to reduce the barriers to acceptance of fall-prevention programs, and ultimately, compliance with them.

In addition to the gaps identified above, problems still remain with the fall-related research that is currently available. Based on a recent review of the literature by Carter et al. (2001), one of the major limitations in falls research is inconsistency of approach to measure key dependent and independent variables such as cognition, vision, balance and strength. In addition, there are wide variations across studies in the definitions for falls and their severity. Furthermore, reporting falls data is sometimes prospective, sometimes short-term retrospective, and sometimes long-term retrospective.

Meta-analysis of intervention trials would be most beneficial given that absolute fall rates are low and studies must be very large to have sufficient power to detect differences between groups in fall rates after intervention. Collaborative research from multiple centres is needed. Randomized controlled trials are also essential. Nevertheless, future studies should also attempt to guarantee equal group distribution by cognition, vision, other medical conditions, drug use, previous activity levels and environmental hazards. Stratified randomization might be used for this purpose (Carter et al., 2001).

Consideration 1: Develop a provincial coordinated program of fall surveillance to improve epidemiological research on falls and strategic planning of fall prevention.

Consideration 2: Create and promote coordinated regional policies for fall-prevention, based on current knowledge and successful utilizations of proven or promising interventions, to reduce falling among seniors and the elderly.

Consideration 3: Increase the support for research of the magnitude, etiology, biobehavioural and psychological determinants of fall-related injuries among seniors.

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