A REVIEW OF THE LITERATURE AND AN ANALYSIS OF MORTALITY AND HOSPITALIZATION DATA TO EXAMINE PATTERNS OF INJURIES AMONG CANADIAN SENIORS

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IESOP Research Paper No. 12

January 1997

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Acknowledgments: This report was written for the Division of Aging Related Diseases, Cancer Bureau at LCDC of Health Canada. During this project, Dr. Raina was funded as a fellow by the R. Samuel McLaughlin Centre for Gerontological Health Research, Hamilton, and his research was supported by Health Canada's Seniors' Independence Research Program. In addition, we thank Drs. Larry Chambers and Steven Dukeshire for helpful comments.

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EXECUTIVE SUMMARY

Injury is a major cause of morbidity and mortality among seniors in Canada, resulting in large personal and economic costs. However, despite the importance injuries play in the health of seniors, with the exception of falls, there has been relatively little research aimed at understanding risk factors associated with injuries among this age group. Therefore, the purpose of this report is two-fold: a) to review the existing literature on the epidemiology of injuries among seniors and b) to examine in detail the epidemiology of injuries among Canadian seniors using data provided by the Health Statistics Division of Statistics Canada.

Literature review of the causes and risk factors of injuries among seniors

The most prevalent causes of injuries among seniors include falls, motor vehicle crashes, pedestrian related injuries, and self-inflicted injuries.

Falls

At least one third of people aged 65 and over will experience at least one fall, and 5% of all falls will result in injuries requiring hospital care or prolonged disability. Falls are also the sixth leading cause of death in seniors. Fall related mortality rates tend to increase with increasing age and are higher for senior men than for women, although women in this age group are more likely to experience falling. Risk factors associated with falling include living alone, decreased visual acuity, slowed protective reflexes, osteoporotic changes, chronic diseases, medication use, alcohol, and environmental factors (such as tripping over objects, improper use of aids, and poor lighting).

Motor vehicle crashes

Motor vehicle crashes (MVC) are the second leading cause of medical treatment and hospitalization after falls among seniors. The number of MVC declines with declining age. However, although seniors have a relatively low likelihood of crashing, they have a high rate of crashing per mile driven. Risk

factors associated with MVC include age, sex (men), slower reaction time, and decreased perceptual abilities.

Pedestrian related injuries

Although seniors are less likely than people in other age groups to experience a pedestrian related fatality or injury, seniors who are in pedestrian related crashes are more likely to die of their injuries. Risk factors associated with pedestrian injuries include physical inadequacies, decline in judgment, attitudes of other people, and ability to cope with changes in the traffic environment.

Self-inflicted injuries

Suicide represents the most common form of self-inflicted injury and senior men have the highest rate of suicide in the United States, a rate that is four to nine times higher than for senior women. Risk factors for suicide include chronic illness, depression, mental illness, social isolation, being widowed or divorced, sex (male), physical disorders of a metabolic/respiratory/ cardiovascular nature, and socio-economic status.

Other causes

Other causes of injury among seniors include burns, assaults, and suffocation/choking. However, there has been relatively little research of these other causes of injuries among seniors.

Study Objective

The purpose of this study is to describe mortality and hospitalization due to external causes of injury (E-codes from Ninth Revision of International Classification of Diseases) and nature of injury (N-codes from Ninth Revision of International Classification of Diseases) among Canadian seniors (65+).

Method

Data on mortality due to injuries among seniors was obtain from the vital statistics data base of the Health Statistics Division of Statistics Canada. Data on morbidity due to injuries among the elderly also was obtained from the Health Statistics Division of Statistics Canada and consisted of a count of patient discharges from hospital during the year. Both of these data bases covered the period from 1979-1991 for all ten provinces. Data was also obtained on hospital separation rates covering the period from 1984-1991 for all ten provinces.

Results

Mortality rates from injuries

The five leading causes of mortality from injuries among seniors were falls, motor vehicle crashes (MVC), self-inflicted, pedestrian, and choking. These five causes of mortality were responsible for 76% of all injury related deaths among senior males in Canada and 84% of injury related deaths among senior women. In all cases, the mortality rate for each type of injury was higher for men than for women, and in general, the mortality rate increased with increasing age.

Morbidity rates from injuries

Injuries resulting in the highest hospital separation rates were slightly different for men and women. For men, the leading causes of hospital separation rates were complications resulting from medical procedures, fractures of the lower limb, fractures other than the upper or lower limb, intracranial injuries, and fractures of the upper limb. For women, the leading causes of hospital separation rates were fracture of the lower limb, complications resulting from medical procedures, fractures other than the upper or lower limb, poisoning by drugs, and contusions/superficial injuries. Overall, hospital separation rates due to all types of fractures, complications resulting from medical procedures, and poisoning by drugs accounted for 78% and 83% of all diagnostic types of injury related hospital separations for senior men and women, respectively. Generally,

hospital separation rates increased with increasing age. However, there were differences in hospital separation rates over time. Hospital separation rates associated with complications due to medical procedures increased over the period from 1984-1991, while fractures remained stable over this time period, and hospital separation rates due to poisoning decreased.

Conclusions

Although injuries among Canadian seniors have decreased over the period from 1979-1991, this report highlights the fact that injuries still represent an important cause of death and hospitalization for this age group. Falls were the leading cause of injuries among seniors, while fractures and complications by medical procedures had the highest hospital separation rates. In general, external causes of injuries tended to be similar for senior men and women, although the rank order differed between the sexes. One very striking difference between the sexes was that senior men had rates of fatal injuries three times higher than women in the same age group. Age had an influence on injury related mortality and hospitalization rates, with increasing age generally leading to higher rates of mortality and hospitalization, although not for all types of injuries.

In general, with the exception of falls and MVC, relatively little is known about the etiology of injuries in the elderly. However, as this study has demonstrated, injuries play an important role in the health of seniors, pointing to the need for further research in the etiology of injuries in order to help develop effective means for preventing injuries among the senior population.

INTRODUCTION

Injury is one of the foremost causes of death and ill health in the western world (Baker et al, 1984). In 1985 the U.S. National Academy of Science declared, “Injury is probably the most under-recognized major health problem facing the world today, and the study of injury represents an unparalleled

opportunity for reducing morbidity and mortality and realizing significant savings in both financial and human terms -- all in return for relatively modest investment". The awareness of injury as a health problem has been growing since the above statement was made. Injury prevention has been included as a target in the health strategies of the World Health Organization (WHO, 1985), the European region (WHO, 1991), the United States (U.S. Department of Health and Human Services, 1983; McGinnis, 1989), and Canada (Health and Welfare Canada, 1988). Injury prevention has been included as a target in health strategies at the Canadian provincial levels as well, for example, one of the many goals addressed by the Ontario Premier's Council on Health Strategy was unintentional injury.

As the proportion of seniors in the western world is increasing, there is growing awareness of the implications this will have for society and for environmental planning. Thus, interest in injuries in seniors and concern about their safety in all types of environments is growing (Lucht, 1971; Winter, 1984). However, as pointed out by Yanik (1986), the problems for seniors in the area of unintentional injuries, except for falls, has received little attention, in contrast to other age groups (e.g. Haddon et al, 1961; Baker et a,l 1984; Evans, 1988; Williams and Carsten, 1989).

Injury is a problem of human and environmental interactions rather than simply a behavioural problem (Waller, 1985). In everyday speech, the terms "accident" and "injury" are often used interchangeably. However, before examining injuries in older adults, we should define injury and injury control. The term "injury" is from the Latin "in + jus" meaning not right (Baker et al, 1987) and refers to damage resulting from acute exposure to physical or chemical agents (Baker et al, 1984). The term "accident" is not used as a synonym for "injury" because "accident" implies randomness and unpredictability, as in "accidents happen" (Langely, 1988).

The science of injury draws its strengths from several disciplines such as epidemiology; biomechanics; physics; ergonomics; and the political, behavioural,

and medical sciences (Baker, 1989). The purpose of this multi- and trans-disciplinary science is to prevent or reduce the number of injuries without targeting the blame towards the victim (Wolf and Rivara, 1992). Most of the basic concepts in injury research and prevention have been in existence since 1920 (Haddon, 1980). Haddon postulated that injuries, like disease, can be understood by differentiating between the necessary and specific agents which are required for their occurrence. Injuries to a living organism can be produced only by some energy (agent) interchange, as first defined by an experimental psychologist, James Gibson, in 1961. This energy exchange may be mechanical, thermal, radiant, chemical, or electrical (Haddon, 1980). Therefore, one of the most practical and constructive methods of classifying causes of injury is according to the nature of the energy involved (Haddon, 1980).

It is important to note the difference between events that may cause injuries and the injuries themselves. An injury does not always follow an event. As a frame work for injury control, Haddon created a matrix for examining the causes and prevention strategies for injuries (Baker, 1984). This matrix has pre-event, event and post-event phases on one axis and host, environment, and agent on the other axis (Baker, 1984). The pre-event factors are associated with the probability of an injury incident occurring; event risk factors influence the likelihood, extent and severity of injury; and post-event risks are factors affecting outcome and recovery once the injury has occurred. In addition to providing a framework for analysing the causes of injuries, the matrix is useful in targeting injury prevention strategies.

Compared to other age groups, injury among seniors appears at first glance to be a relatively minor problem; however, when we consider all injury events, especially those with more severe outcomes, seniors account for a substantial proportion of injured people. In the United States, after age 45, injuries account for fewer deaths than several other health problems such as heart disease, cancer, and stroke. However, despite this decrease in proportion of deaths due to injury, the death rate from injuries is actually higher among

seniors than younger people (Baker et al, 1992). In absolute numbers, injuries remain important throughout life. For example, each year in the United States, about 30,000 people aged 65 or older die from injuries (Baker, et al., 1992) and in Canada, 3,644 seniors died from injuries in 1991 (Statistics Canada, 1991).

To better understand the prevalence of and risk factors associated with injuries in seniors, this review outlines the epidemiology of injuries in older adults (65+). Specifically, the review will focus on the prevalence and incidence of injuries in older adults, special populations at risk, known risk factors, and possible strategies for prevention.

Epidemiology of overall injuries in older adults

Injuries in Canada are a major cause of death and hospitalization for all ages. For the 65 and over age group, in 1966, 1976, and 1986, injuries ranked either fourth or fifth among deaths in Canada (Riley and Paddon, 1989). According to the Canadian General Social Survey (Statistics Canada, 1991), in 1987, among seniors age 65 and over, 70% of injuries occurred among women. Death rates among Canadian seniors due to injuries in 1987 (Statistics Canada, 1991) were 128/100,000 and 105/100,000 for males and females, respectively.

Injury related deaths represented only 2.3% of all deaths among seniors in 1987. Older people are more likely to die as a result of other chronic diseases such as ischemic heart disease or cancer (Statistics Canada, 1991). However, those injuries that do happen among seniors may have far reaching consequences not only for quality of life, but also for health care costs (Wilkins, 1989).

A comparison of mortality rates among five countries (Canada, Austria, England, Germany, and Japan) for the five leading causes of injuries in 1985 was examined by Riley and Paddon (1989). In this comparative analysis, Canadian seniors ranked third for mortality rates due to motor vehicle crashes after Austria and Japan. For the 75 years and over age group, the Canadian mortality rate for falls was 128 per 100,000, ranking Canada third. The highest rate for the 75 and

over age group was reported for Austria (239 per 100,000) and the lowest for Japan (38 per 100,000) (Riley and Paddon, 1989).

Injury rates in Canada, the United States, and other developed countries vary with age and gender (Baker et al., 1992). According to U.S. data, the most striking differences between men and women is observed among fatal injuries: men in general have rates 2.5 times higher than women in both the 65-74 and 75+ age groups. Although the absolute numbers of injuries resulting in hospitalizations is larger for persons aged 65-74, the hospitalization and mortality rates for injuries are greater for those in the age group 75 and older (Baker et al., 1992). Similar patterns of mortality and hospitalization rates for injuries among seniors have been observed in Canada (Riley and Paddon, 1989). An examination of the percentage of deaths and hospitalization for all conditions showed that the highest percentage of deaths and hospital days were among Canadian seniors aged 65 and over (Riley and Paddon, 1989). The percentage of deaths and hospital discharges due to injuries was higher among Canadian women aged 65 and over (39.5%) than men (14.8%) in the same age group. This study also highlighted that an average length of stay in hospital for 75+ due to all types of causes of injuries was 38.9 and 47.1 days for men and women, respectively. Among seniors, the four leading causes of mortality for injuries identified in the literature are falls, motor vehicle crashes (MVC), suffocation, and fire and flames, whereas, the four leading causes of hospitalization for injuries are falls, drugs, MVC, and poisoning (Baker et al., 1992; Wolf and Rivara, 1992; Riley and Paddon, 1989; Lilley et al., 1995; Wilkins, 1989).

An important aspect of the impact of injury is economic cost. The estimated lifetime economic cost of injury, derived from the costs of medical treatment and rehabilitation, and indirect costs associated with life years lost, including the loss of earnings due to short and long term disability and death was US$5.1 billion for 2.1 million older persons injured in the United States in 1985 (Rice et al., 1989). Using the model of Rice et al (1989), the Canadian Laboratory Centre for Disease Control (LCDC) undertook a major study of the cost of illness

in Canada. This study examined the costs associated with illness in all ages and concluded that direct and indirect costs associated with all types of injuries was $10 billion in 1986 for all age groups and injuries were ranked second only behind cardiovascular disease in terms of cost (Wigle et al., 1991). However, to our knowledge, there is no published data specifically examining the direct and indirect costs associated with all types of injuries for Canadian seniors. However, according to U.S. data (Rice et al., 1989; Baker et al., 1992), the direct costs for the delivery of health care services to injured seniors was US$2.8 billion, which is estimated to be 56% of the total lifetime costs. Indirect costs for morbidity and mortality were estimated to be US$1.8 billion and US$441 million, respectively. In contrast to other ages, the economic burden of injury for seniors was greater for women than men.

In addition to economic costs, one of the very important consequences of injuries is changes in lifestyle. Injuries among seniors may mean the difference between dependency that requires institutionalization and independent living in the community of choice (Wolf and Rivara, 1992; Lilley et al., 1995). In Washington State, 20% of seniors who entered a hospital for an injury were moved to a nursing home or intermediate care facility, rather than their own private homes.

SPECIFIC CAUSES OF INJURIES

Given the limitations of routinely collected and published statistics, such as those cited above, specific studies researching the issues of injuries in older adults typically provide a richer source of information. Thus, this section will focus on studies specific to injuries in older adults and examines seniors' injuries by their most important external causes.

Epidemiology of falls

The Kellog International Work Group defined a fall as "an event which

results in a person's coming to rest inadvertently on the ground or other lower level and other than as a consequence of the following: sustaining a violent blow; loss of consciousness; sudden onset of paralysis, as in a stroke; or an epileptic seizure" (Kellog International Work Group, 1987). However, the above described definition of falls is clinically or research oriented and is not easily usable in public health settings; is subjective and thus allows differences in interpretation for each study setting; and is likely to miss a large number of falls.

Canada's population is aging. The baby-boom generation will soon become the elderly population and this segment of society is growing. In 1992, more than 3.4 million Canadians were over the age of 65, a number that represents nearly 12% of the total national population (Statistics Canada, 1994). By 2021 this number is expected to be over 5 million. Based upon existing studies of populations in this age group, it has been estimated that up to one-third of persons aged 65 and over will experience at least one fall.

Falls, wherever encountered, represent a significant risk. The consequences of falls are social, physical, psychological, economical, and sometimes fatal. Falling is the sixth leading cause of death among seniors, and it is estimated that 5% of falls will result in injuries requiring hospital care or prolonged disability (Tinetti et al., 1988). In addition, falls may enhance less quantifiable problems such as lack of self confidence and fear of recurrences. The changes in lifestyle due to fear and lack of confidence may have a negative impact on the quality of life for seniors (Commodore, 1995). According to Nelson and Murlidhar (1990) and Tinetti and Speechely (1989), 25% of seniors over 70 and 35% of those over 75 in the community fall annually, and 50% of those falls are repeated. Fifty percent of institutionalized seniors fall each year in the U.S., and nursing homes have reported an average of 1,600 falls per 1,000 patients (Tinetti and Speechley, 1989).

In 1989, falls accounted for 65% of all injury related hospital separations, 72% of injury related days of hospital care, and 56% deaths for those aged 65 and over in Canada (Riley, 1992). In Canada, the fall related mortality rate in

1989 for men aged 85 and over was 20 times higher than the rate for men in the 65-74 age group (Riley, 1992). For women aged 85 and over, the rate was 44 times higher than the rate for women aged 65-74. Riley (1992) also showed that the age-specfic mortality rates for falls were higher for men than women and the rates for 85 and older remained stable from 1980 to 1989. However, the rates declined for both men and women in the 65 to 74 and 75 to 84 age groups over this period.

Fall related hospital separation rates were higher in the 65 and older age group than for any other age group (Riley, 1992). Hospital separations show the same pattern with age as mortality rates. The highest rates were observed in those aged 85 and over and the lowest rates were in the age group 65-74. However, hospital separation rates were higher among women aged 65 and older than men in the same age group. For both men and women, the most common type of fall related injury which required hospitalization was fracture of the hip (Riley, 1992). Similar types of mortality and hospitalization rates resulting from falls have been observed in other developed countries as well (see Lilley et al., 1995 for more details).

While the full extent, nature, and consequences of unintentional injuries among seniors is not well documented, it is generally agreed that considerable under-reporting exists, particularly for those seniors living in their own homes. For falls resulting in minor or no injuries, denial may occur, and consultation, if sought at all, may be with a variety of different contact persons ranging from visitors, family members, home care professionals, family physicians, or hospital emergency room personnel. As a result, those individuals at risk for an initial fall or prone to repeated falls often are only identified after a major injury or complication is discovered (Commodore, 1995).

Risk factors of falls

A variety of different factors are known to be associated with increased risk of falls among seniors (Sattin, 1992; Waller, 1978; Commodore, 1995; Lilley

et al., 1995; Archea, 1985; Baker et al., 1985; Macdonald, et al., 1982; Macdonald, 1985; Mossey, 1985; Rubenstein, et al., 1988; Tinetti, et al., 1988). These factors can be grouped into two general categories; host and environmental factors. Host factors are comprised of characteristics such as increased age, female sex, and living alone. Factors related to the normal aging process such as decreased visual acuity, slowed protective reflexes, and osteoporotic changes are also included among the host factors (Felson, et al. 1989; Grisso, et al., 1991; Lord, et al., 1991; Lord, et al., 1991). In addition to these aging related changes is the risk due to chronic diseases (Sattin, 1992; Kapoor, 1987; Lilley, 1995) such as cerebrovascular, cardiovascular, and neurologic disorders. In a recent population based study (Satin, et al., 1990), the most common concurrent medical conditions associated with a fall which resulted in an injury were fainting or syncope (16%), conduction disorder (15%), chronic ischemic heart disease (9.3%), anemia (8.7%), diabetes (8.3%), and hypertensive disease (8.2%).

Problems with gait and balance have also been reported to be associated with falls among older persons (King, et al., 1995; Issacs, 1985; Nevitt, et al., 1989; Ring, et al., 1988). These pathologies in gait and balance may be related to change in age, disease, or medication use (Rubenstein, et al., 1988). Medication usage has been considered to be a particularly serious risk factor for falls in seniors (Macdonald, et al., 1982; Macdonald, 1985; Ray et al., 1989). For example, Ray et al (1989) estimated that 14% of hip fractures in seniors were attributable to current use of psychotropic medications. These medications may act by decreasing alertness, affecting judgment, compromising neuromuscular function, or causing dizziness and syncope.

Alcohol use is also considered a risk factor in fall related injury. Alcohol acts as a depressant on the central nervous system and may increase the risk of injury due to falling by affecting balance and cognition (Perrine, 1973). Alcohol use has been frequently associated with falls in persons less than 65 years of age, but most studies have not shown an association for older persons (Sattin,

1992). It has been suggested that this lack of an association between alcohol use and falls in seniors may be due to the survival bias, because heavy alcohol use is strongly associated with premature mortality from a variety of causes (Rankin, et al., 1986). However, although alcohol use is not associated with falls or fall related injuries among older persons, the chronic use of alcohol interferes with tissue regeneration and immune function, thereby possibly slowing the recovery process.

The environment has been implicated in one third to one half of all falls or fall related injuries (Lucht, 1971; Schelp et al., 1986; Waller, 1978). Environmental factors that have been associated with falls in seniors include both indoor and outdoor risks. Indoor risks include throw rugs, loose carpets, slippery floors, door jambs, cords and wires on the floor, cluttered hallways and rooms, low-lying objects such as toys or pets, low beds and toilet seats, poorly maintained walking aids and equipment, and poorly lighted and poorly designed stairways. Outdoor risks include stairs, low-lying objects, icy walkways, and cracked sidewalks (Rubenstein, et al., 1988; Sattin, 1992).

There has been great progress over the last decade in clarifying and understanding the causes of falls. However, we understand little about the most effective ways of preventing or averting their occurrence. More work is required to determine which interventions can help decrease the risk of fall or fall related injury, how environmental risk factors are modified by the aging process, and other host related factors. A system should be implemented to monitor fall related injury events on an ongoing basis (Lilley, et al., 1995). A surveillance system for falls should collect data that are representative of a defined population and data from such a monitoring system then can be used to determine the need for public health programs and to assess their effectiveness (Lilley, et al., 1995).

Epidemiology of Motor Vehicle Crashes (MVC)

Involvement in motor vehicle crashes steadily declines with age, both in absolute numbers of collision and in age-specific collision rates (Williams, et al.,

1989). Compared with 40 year old drivers, 80 year old drivers are less than half as likely to have motor vehicle crashes (MVC) whereas 18 year old drivers have more than twice the risk (Baker, et al., 1992). The reductions in crash involvement with advancing age appear to result from a decline in annual miles driven by seniors (Baker, et al. 1992; Foley, et al., 1995). When expressed as the number of collisions per million miles driven, the relationship between MVC rate and age graphically describes a U-shaped pattern in which the risks of crash involvement is lowest for drivers 40-55 years old and is highest for both the youngest and the oldest drivers. Crash rates start increasing at about age 70 and more sharply after age 80 (Williams, et al., 1989; Hogue, 1982). Consequently, when the number of miles driven is considered, drivers aged 65 and older have the second highest MVC rates after young adults.

In general, motor vehicle crashes are the second leading cause of medical treatment and hospitalizations after falls in Canada (Riley and Paddon, 1989). In 1987, motor vehicle crashes among Canadian men and women over 65 years of age were 19 per 100,00 and 9 per 100,000 respectively (Riley and Paddon, 1989). Motor vehicle crash related death rates in other countries such as New Zealand and the United States were 26.6 and 21 per 100,000 population respectively for combined data from 1980 to 1986 (Langlois, et al., 1995).

Older adults are more frequently admitted to hospital and die from less severe injuries caused by MVC than younger persons. According to a study by Baranick et al. (1986), the rate of hospital admissions for MVC trauma were 116 per 1000 emergency room visits for ages 65-74 and 248 per 1000 for age 75+, which are two and four times higher than the rates of admissions for all other ages. Types of injuries which are rarely fatal in younger adults result in significantly higher mortality for ages 70 and older (Fife, et al., 1984).

Risk factors of MVC

As with other types of injuries, certain risk factors predispose a senior to motor vehicle crashes. Studies have shown that age and sex are related to MVC

(Baker, et al., 1992). Among people over the age of 65, the perception of and time to react to the hazards of the road and the ability to read road signs declines with age (Lilley, et al., 1995). Seniors are more likely to be part of intersection and turning type of crashes and head on collisions in urban areas (Cerelli, 1989). On the other hand, fewer senior drivers are included in single vehicle crashes or cited for dangerous driving, driving too fast, or drinking and driving (Cerelli, 1989; Olson, et al., 1986). In general, senior men are more likely to be injured in motor vehicle crashes than women, especially with increasing age. Men are known to drive more than women (Planek et al., 1971), and there may also be a change in the mode of transport with age and, therefore, a shift in the type of exposure.

As a result of the growing proportion of drivers aged 65 years and older, public concern over their involvement in motor vehicle crashes has increased (Gresset, et al., 1994). Although this concern is not as pressing as for the youngest aged drivers, from a public health perspective, older drivers may constitute a high risk group because of their increased risk for medical conditions that may affect their driving skill (Williams, et al., 1989; Retchin, 1993).

Conflicting results have been reported in the literature describing the role of chronic medical conditions in MVC. Chronic health conditions such as diabetes, epilepsy, cardiovascular disease, and mental illness have been shown to have strong associations with driving cessations but little association with crash involvement (Marottoli, et al., 1994; Koepsell, et al., 1994). A recent study by Gesset, et al. (1994) conducted in the province of Quebec suggested that drivers of private vehicles with chronic conditions are not at increased risk for road crashes. However, this study did not examine the association between chronic conditions and the risk of fatal or severe crashes. On the other hand, several other recent studies of drivers with dementia of the Alzheimer's type report a nearly three fold increase in their rate of crashing after onset of symptoms, using both milage-based rates and driver-based rates (Cooper, et al., 1993; Dubinski, et al., 1992). Another study by McCloskey et al. (1994) found no clear evidence that ocular diseases or impaired visual acuity increased the risk of

a collision. Although there was no significant association between impaired hearing and collision, these authors found that subjects who used hearing aids while driving had about twice the risk of collision compared to drivers who were not hearing impaired.

Psychoactive drugs have been reported in several studies to be a risk factor for drivers involved in MVC (Honkanen, et al., 1980; MacPherson, et al., 1984; Skegg, et al., 1979), although a recent study by Foley et al. (1995) found no association between the total number of medications used and the risk for crashing. However, among seniors, users of medications for the treatment of gastrointestinal conditions and depression had high rates for crashing, but these estimates were not statistically significant. Except for the above described study, there is very little published information about the role of medications and motor vehicle crashes among older drivers, making it an issue that should be further investigated.

Alcohol does not appear to be a risk factor for MVC in older adults (Lilley, et al., 1995). Several studies report that drivers with a history of traffic violations and/or crashes may be at increased risk for crashes in their later life (Baker, et al., 1992). However, the role of this risk factor for MVC among older drivers has not been studied.

Prevention of injuries and death from MVC should be multidisciplinary and should include prevention of the occurrence of MVC, prevention of injury once a crash occurs, and prevention of adverse outcome after the injury has occurred. Prevention of injuries and crashes due to MVC requires intervention and surveillance at several levels, including federal, provincial and local, and involves changes in the host, the agent, and the environment (Hadder, et al., 1992).

Epidemiology of pedestrian related injuries

Despite the significant decrease in injuries and mortality from pedestrian injuries during the last decade or so, the number of pedestrian injuries among older individuals remains higher than for any other age group (Baker et al.,

1992). Pedestrian injuries are a serious problem in Canada and other industrialized countries. A total of 6,552 pedestrians in the United States in 1989 were reported killed (Baker, et al., 1992). These deaths accounted for 14.4% of all the motor vehicle crash deaths. Of pedestrians injured or killed in 1989 in the U. S., 8.4% were aged 65 or older. However, 22.4% of seniors who were involved in a pedestrian related crash died due to the injuries sustained. Thus, seniors are less likely than other pedestrians to be involved in a crash, but once in a crash they are more likely to be killed. In the United States, pedestrians 65 and older have a mortality rate of 4.7 per 100,000 population, nearly twice the rate for the overall population (Baker, et al., 1992). Similar types of pedestrian mortality rates have been observed in Canada as well (Riley and Paddon, 1989). In Canada, the pedestrian related mortality rates in 1987 among senior men and women were approximately 8 per 100,000 and 5 per 100,000 respectively (Riley and Paddon, 1989). The pedestrian death rate in Canadian senior men is 1.5 to 2 times as high as for women in the same age group, a pattern similar to the gender differences in other age-groups. Similar differences in male and female pedestrian death rates are observed in other countries such as the United States (Baker, et al., 1992).

Risk factors of pedestrian injuries

As a group, seniors suffer from a decline in health, vision, hearing, and speed of reaction (Lilley, et al.,1995). According to British Road Safety Officers, the most common issue facing senior pedestrians are physical inadequacies, decline in making appropriate judgements in shorter period of times, attitudes of other people, and ability to cope with changes in the traffic environment (Shepard, et al., 1974). A study from five hospitals in Melbourne, Australia, examined factors associated with motor vehicle injuries involving older pedestrians (Alexander et al., 1990). Victims were characterized by reduced road use skills associated with age and physical abilities. Older adults were more often injured because they failed to completely cross within allotted signal phase or

because they did not anticipate unexpected movements. Although decline in ability to move fast or reduced mobility appeared to be a problem at some locations, “inadequate appraisal” was identified as the major precipitating factor.

In general, there is a lack of epidemiologic data on risk factors for pedestrian injuries and fatalities in older adults. Most of the risk factors for pedestrian injuries have been studied in children, the other high risk group for pedestrian injuries. In children, male gender, low socioeconomic status, pedestrian action, and environmental factors have been identified as risk factors (Baker, et al., 1992; Lilley, et al., 1995). Few studies have specifically been designed to examine the effect of environmental factors on the risk of pedestrian injuries in older adults. Data for crosswalks, pedestrian signals, timing of lights, and right turn on red light are described adequately by Lilley et al. (1995) in their review of pedestrian injuries.

Prevention of pedestrian injuries, like MVC injuries, are complex and require multiple prevention strategies. Prevention efforts should be focused on factors such as stop light time to increase pedestrian crossing time, modified roadway markings, and safety education programs for seniors. In addition, stricter law enforcement related to jay-walking should be legislated.

Epidemiology of self-inflicted injuries

Within the broad definition of self-inflicted injuries, suicides are the most common type. Senior men have the highest rates of suicide in the United States with rates for those aged 85 and older at 67 per 100,000, two-to three fold greater than those of adolescents and young adults (Baker, et al., 1992). Rates in senior men are four to nine times higher than women, with highest rates among whites and lowest rates among blacks. In Canada, the mortality rate among senior men and women due to suicides were 28 per 100,000 and about 7 per 100,000 respectively (Riley and Paddon, 1989). Suicides were the second highest ranked cause of mortality among all types of injury rates after falls in Canadian men aged 65 and over (Riley and Paddon, 1989). These rates were

highest in the oldest men (80+) and have remained stable in the last decade.

Risk factors of self-inflicted injuries

Chronic illness, depression, mental illness, social isolation, marital status, gender, and socioeconomic status are a few of the risk factors which have been shown to be associated with suicide in the general population. Some studies suggest that older adult suicide victims have more physical disorders of metabolic, respiratory, and cardiovascular origin than older adults who do not attempt suicide (Sendbuehler, 1977). Chronic illness may alter a person's sense of self-worth as a result of increased isolation (Baker, et al., 1992). According to Hirst and associates (1985), depression is the most common mental health symptom in the over 65 age group and is a strong risk factor for suicide. Married people throughout their lives have the lowest rates of suicide (Baker, et al., 1992; Smith, et al., 1988). Widowed and divorced older adult men and women have rates of suicide that are two-to-threefold greater than the married in the same age group.

Prevention of suicides should focus on the high risk groups such as widowed and divorced. Prevention of suicides in seniors is one of the most neglected aspects of public health. More global, societal changes might be necessary to decrease suicide rates in seniors. The proper surveillance of aging related chronic conditions and mental health issues may help identify important risk factors which may then be targeted for prevention of suicides.

Other causes of injuries

This review has focused on the most common causes of injuries among the senior population. Other causes of injuries which may be important in a senior population are burns, assaults, and suffocation/choking. In the United States, burns are the fourth leading cause of injury death among seniors (Baker, et al., 1992). In Canada, mortality rates due to fire and flames are 6 and 3 per 100,000 for senior men and women respectively (Riley and Paddon, 1989;

Snelling, et al., 1992). The causes of burns which result in deaths are very different from those that result only in hospitalization, thus requiring very different prevention strategies (Baker, et al., 1992). Because the risk factors of burn injuries in seniors are likely to be the same as for other age groups, their impact on senior burn victims should be determined. For example, low socioeconomic status is one of the strongest risk factors for fatalities from residential fires in the general population and likely represents a strong risk factor for seniors (Baker, et al., 1992). Cigarettes are estimated to cause 45% of all fires and 22 to 56% of residential fire deaths in all ages, and therefore, their contribution to fire related deaths among seniors should be investigated (Baker et al., 1992).

As this review has documented, although we have learned much over the last decade about the causes of and nature of falls or motor vehicle crash related injuries; we still know little about other causes of injuries which may be of public health concern for seniors such as pedestrian injuries, assault, burns, and suicide.

In terms of prevention, there has been some effort made to prevent injuries in older adults, for example falls, however, we know very little about the effectiveness of these prevention programs. Understanding both the components associated with the increased risk of injuries through an appropriate surveillance system and the ways to modify the injury event through a multidisciplinary approach may lead to a reduction of injuries in older people. This understanding will provide public health professionals with the scientific base needed to institute effective injury prevention programs.

STUDY OBJECTIVE

The objective of this study was to describe the mortality and hospitalization due to external causes of injury (E-code) and nature of injury (N-code) among Canadian seniors (65+) population.

METHODS

Data on injury mortality were obtained from the vital statistics data base of the Health Statistics Division of Statistics Canada. The mortality time period studied was 1979 to 1991 and covered the ten provinces. Age-standardized mortality rates for senior men and women were calculated using the 1991 census population of Canada as the standard. Age-specific mortality rates for both sexes were also computed. The external causes of deaths due to injuries (E- codes) were based on the Ninth Revision of the International Classification of Disease (WHO, 1975). Causes of death due to injury were categorized according to the leading causes of injury death (Hader and Seliske, 1992; Riley and Paddon, 1989). The categories of E-codes used in this analysis are described in Table 1.

Table 1: Categories of external causes of injuries based on ICD-9 codes.

Categories of External Cause of Injury	E-Codes
Motor Vehicle Crashes (MVC)	E810-E813, E815-E819
Pedestrian Injuries	E814
Other Transport	E800-E807, E820-E825, E826-E845
Poisoning	E850-E869
Falls	E880-E888
Fires and Flames	E890-E899
Drowning	E910
Adverse Effects of Drug Use	E930-E949
Adverse Reactions to Medical Procedures	E870-E879
Self-Inflected Injury	E950-E959
Purposely-Inflicted Injury	E960-E978
Choking	E911-E915
Injury Intent Undetermined	E980-E989
Other	E900-E909, E916-E929, E990-E999

Hospital morbidity data were also supplied by the Health Statistics Division

of Statistics Canada. The data consist of a count of patient discharges during the year from general and allied special hospitals. Since a patient may be admitted to hospital and discharged several times during a year, the data are a count of discharges or separations rather than individual persons. Emergency room and outpatient data are not reported. The hospital separations data available for this analysis also covered the period 1979 to 1991 and ten provinces. The number of hospital separations were not available by the external cause of injury (E-codes) in this data set, therefore, only hospital separation rates by nature of injury (N-codes) sustained were calculated. Hospital morbidity data were also used to calculate the number of days stayed in hospital by E-codes and N-codes separately. The data for days stayed in the hospital covered the time period 1984 to 1991. Age-standardized hospital separation rates and days stayed in hospital rates for males and females used the 1991 census population of Canada as the standard. Age-specific hospital separation and days stayed in the hospital rates were also calculated.

Nature of injury (N-codes) were based on the Ninth Revision of the International Classification of Disease (WHO, 1975). Nature of injuries resulting in hospitalization were categorized reflecting leading types of injuries (Hader and Seliske, 1992; Riley and Paddon, 1989).

Table 2: Categories of type or nature of injury (N-codes) based on the ICD-9 codes

Categories of type of Injury	N-Codes
Fracture of upper limb	810-819
Fracture of lower limb	820-829
Other fractures	800-809
Dislocation & Sprains	830-849
Intracranial injuries	850-854
Internal injuries	860-869, 900-904
Wounds	870-887, 890-897
Late effects of injuries	905-909
Contusions and superficial injuries	910-924
Burns	910-924
Complications	958-959, 996-999
Poisoning by drugs	960-979, 995
Environmental injuries	980-989, 990-994
Other	925-939, 950-957

RESULTS

Mortality

Overall mortality rates by external causes of injury (E-code)

Age-standardized average annual mortality rates per 100,000 Canadian population (65+) by gender are shown in Table 3. The six leading causes of injury related deaths were the same for both sexes, however, the rank-order was slightly different (Table 3). For men, the first two leading causes of injury related deaths were falls (67.4 per 100,000) and self-inflicted injuries (28.5 per 100,000). However, for women, falls (54.2 per 100,000) and motor vehicle crashes (MVC) (9.4 per 100,000) were the top two causes of injury related deaths in Canada (Table 3). The next three leading causes of mortality due to injuries in Canadian senior (65+) men were MVC (19.2 per 100,000), other injuries (10.8 per 100,000), pedestrian (9.3 per 100,000) and choking (9.0 per 100,000); and for women self-inflicted injuries (7.1 per 100,000), choking (6.1 per 100,000), and pedestrian (5.2 per 100,000) (Table 3). As shown in Figure 1, deaths due to falls, MVC, pedestrian, self-inflicted and choking comprised 76% of all injury related deaths for men and 84% for women. The largest percentage of injury related deaths among Canadian seniors (65+) during the period 1979-91 was due to falls (36% and 57% for men and women, respectively).

Age-specific mortality rates

Next, we examined mortality rates for selected external causes of injuries by age groups and sex for Canada from 1979 to 1991. Age-specific mortality rates due to falls were highest in those 85 and older for both sexes (Figure 2). However, males had higher mortality rates due to falls in each of the five age-groups in Canada (Figure 2).

Age-specific mortality rates due to MVC in Canada were one and a half to three times higher among men than women in each of the five age groups (Figure 3). For men, the MVC mortality rates generally increased with increasing

age (Figure 3). The mortality rates due to pedestrian related injuries in each of the five age groups were highest for men (Figure 4). The pedestrian mortality rates also generally increased with increasing age among men (Figure 4). However, these rates doubled in the oldest age groups, 80-84 and 85+, as compared to the younger age groups (Figure 4).

The age-specific self-inflicted injury mortality rates were almost four times higher among men as compared to women in each of the five age groups (Figure 5). The self-inflicted injury mortality rates among women generally declined slightly with increasing age, whereas these rates generally increased slightly for men with advancing age (Figure 5).

The age-specific mortality due to choking and fire and flames by sex are shown in Figures 6 and 7 respectively.

Mortality trends over time

Age-standardized mortality rate trends for the period 1979 to 1991 for Canadians aged 65 and older by sex and selected external causes of injury are shown in Figures 8 to 12.

When the trends were examined over time, most injury related age standardized mortality rates were on the decline or were stable from 1979-1991. Mortality rates due to falls have generally declined for both sexes during these 13 years but the rates were consistently higher for males in Canada than for females (Figure 8). The mortality rate for men in 1979 was 77 per 100,000, compared to 61 per 100,000 in 1991. For women, the rates in 1979 and 1991 were 61 and 51 per 100,000, respectively (Figure 8).

The mortality rates for MVC for men aged 65 and older in Canada declined from 23 per 100,000 in 1979 to 17 per 100,000 in 1991 (Figure 9). However, during this 13 year period (1979-1991), the mortality rates due to MVC for women in the same age group have remained relatively stable (Figure 9).

Age standardized mortality rates between 1979 and 1991 for external

causes of injury such as pedestrian, self-inflicted, and fire and flames all show consistently higher rates for men than women (Figures 10-12). Death rates for pedestrian injuries and fire and flames declined for both men and women during this 13 year time period, however, the decline was sharper in men (Figures 10 and 12). On the other hand, death rates due to self-inflicted injuries have stayed consistent over the last 13 years for both men and women aged 65 and older (Figure 11).

Provincial differences in mortality rates

Age-standardized mortality rates for the three leading causes of injury related deaths were plotted by province for males and females aged 65 and over (Figures 13 and 14). For males, the age standardized mortality rate due to falls was highest in British Columbia (77 per 100,000) and lowest in Newfoundland at 34 per 100,000 (Figure 13). For females, highest and lowest fall related mortality rates were observed in Ontario (60 per 100,000) and Newfoundland (37 per 100,000) respectively. For both sexes, falls were the leading cause of death due to injuries in all 10 provinces (Figures 13 and 14).

Morbidity

Overall hospital separation rates by nature of injury (N-code)

Age-standardized average annual hospital separation rates per 100,000 population (65+) by gender and type of injury (N-code) are shown in Table 4. For men, the first two leading types of injury related hospital separations were complication resulting from medical procedures (575 per 100,000) and fractures of lower limb (571 per 100,000) (Table 4). For women, the order was reversed, with fractures of lower limb (1,136 per 100,000) first, followed by complications resulting from medical procedures (366 per 100,000) (Table 4). The next four leading diagnostic categories of hospital separations due to injuries for men were fractures other than upper or lower limb (244 per 100,000), poisoning by drugs (149 per 100,000), intracranial injuries (115 per 100,000) and fractures of upper

limb (95 per 100,000); and for women were fractures other than upper or lower limb (283 per 100,000), fracture of upper limb (264 per 100,000), poisoning by drugs (179 per 100,000) and contusions and superficial injuries (114 per 100,000) (Table 4). Hospital separations due to all types of fractures, complications resulting from medical procedures, and poisoning by drugs comprised 78% of all diagnostic types of injury related hospital separations for men and 83% for women. The largest percentage of hospital separations among Canadian senior women (65+) during the period 1979-91 was due to fractures of lower limb (43%) (Figure 15).

Age-specific hospital separation rates by nature of injury (N-code)

Next, we examined hospital separation rates for selected types of injuries by age groups and sex for Canada from 1979 to 1991. Age-specific hospital separation rates due to fractures of upper limb, fractures of lower limb and other fractures were highest in the 85 and older age group for both sexes (Figures 16, 17, and 18). Women tended to have higher separation rates due to all types of fractures in each of the five age-groups in Canada.

Age-specific hospital separation rates due to complications resulting from medical procedures in Canada were higher among men than women in each of the five age groups (Figure 19). The hospital separation rates due to poisoning by drugs in each of the five age groups were slightly higher for men and also increased with increasing age in both sexes (Figure 20). However, these rates doubled in those aged 80 and over as compared to those in the 65-69 age group (Figure 20).

Hospital separation trends over time

Age-standardized hospital separation rates for Canadians aged 65 and older by sex and selected types of injury over time are shown in Figures 21 to 24. The hospital separation rates for fractures of upper limb, fractures of lower limb,

and poisoning by drugs were higher in all 13 years for women aged 65 and older (Figures 21-23). The rates over time for fractures in both sexes remained relatively stable (Figures 21-22). However, there was sharp decline in hospital separation rates due to poisoning by drugs over these 13 years for both sexes (Figure 23).

Age-standardized hospital separation rates due to complications by medical procedures over past 13 years showed increasing trends by sex, unlike the other diagnostic categories of injury hospitalizations described above (Figure 24). The hospital separation rates have generally increased for both sexes during these 13 years but the rates were consistently higher for males aged 65 and older. The hospital separation rate for men in 1979 was 455 per 100,000, whereas this rate increased to 744 per 100,000 in 1991. For women, the rates in 1979 and 1991 were 282 and 488 per 100,000 respectively (Figure 24).

Provincial differences in hospital separation rates

Age-standardized hospital separation rates for four leading types of injury were plotted by province for males and females aged 65 and over (Figures 25 and 26). For males, complications resulting from medical procedures was the leading reason for hospitalizations in Newfoundland, Nova Scotia, New Brunswick, Ontario, Saskatchewan, Alberta, and British Columbia, whereas, fractures of lower limb was the leading reason of hospitalizations in Prince Edward Island, Quebec, and Manitoba (Figure 25). On the other hand, for females, fractures of lower limb was the number one reason for hospitalization in all 10 provinces (Figure 26). The lowest rate of hospitalization due to fractures of lower limb among females (65+) was observed in Quebec (940 per 100,000) and the highest rate in Alberta (1,291 per 100,000).

Days stay in hospital by external causes of injury (E-code)

In order to assess the burden of injuries on the health care system, we also examined rates related to the hospital days stayed per 100,000 population

by external causes of injuries (E-code) and nature of injuries (N-code).

Age-adjusted average annual rates for hospital days stayed per 100,000 population by external causes of injury are shown in Table 5. The six leading causes of hospital days stayed were same for both sexes. The top two leading causes of hospital days stay per 100,000 population among Canadian seniors were falls and adverse reactions to medical procedures.

For selected external causes of injury, age-specific rates are shown in Figures 27 to 31. Age-specific hospital days stay rates due to falls, adverse effects of medications, adverse reaction to medical procedures, and poisoning generally increased with increasing age. Age-specific rates for these causes were higher for women in all age groups except for MVC and adverse reactions to medical procedures (Figures 28 and 29).

The hospital days stay rates for seniors over time (1984-1991) are shown in Figures 32 to 36 for selected causes of injuries by gender. Generally, age-standardized hospital days stay rates declined in each of the selected external causes (Figure 32 to 35) except for adverse reactions to medical procedures (Figure 36) for both sexes. For adverse reactions to medical procedures, hospital days stay rates were one and half to two-fold higher for men than women in all 8 years (Figure 36).

Hospital days stay rates by nature of injury (N-code)

Age-standardized average annual rates for hospital days stayed per 100,000 population by nature of injury are shown in Table 6. The six leading types of injuries (N-code) of hospital days stay rates were same for both sexes except intracranial injuries (ranked 4th) among men and fractures of upper limb (4th) among women (Table 6). Fracture of lower limb was the number one reason for hospital days stay in both men (13,572 per 100,000) and women (35,316 per 100,000) (Table 6). Hospital days stay rates due to fracture of lower limb among women were almost three fold higher than for men. Complication by medical procedure also resulted in high hospital days stay rate in both sexes

(Table 6).

For selected types of injury, age-specific rates were calculated and are shown in Figures 37 to 40. Age-specific hospital days stay rates due to types of injuries such as fractures of upper limb, fracture of lower limb, poisoning by drugs and complication by medical procedures increased with an increasing age. Age-specific rates for selected causes were higher for women in all age groups except for complications due to medical procedures (Figure 39).

The hospital days stay rates for seniors over time (1984-1991) for selected types of injuries by gender are shown in Figures 41 to 44. Hospital days stay rates over time for injuries such as fractures of lower limb, fractures of upper limb, and poisoning by drugs showed a sharp decline (Figures 41, 42, and 44). On the other hand, rates due to complications by medical procedures during this 13 year period (1984-91) increased in both sexes and these rates were almost 1.5 times higher in men than women (Figure 43).

Table 7 highlights the average length of hospital stays in days by type of injury. This average was not calculated for external causes of injury because hospital separations by external causes were not available in this particular data set.

DISCUSSION

The analysis of mortality and hospitalizations from injuries highlights that despite decreases in injuries during the period 1979 to 1991, they still represent an important cause of death and hospitalizations in the senior population in Canada. Generally, among senior men and women, similar external causes and nature of injury as related to mortality and hospitalization rates emerge as being important. However, the rank order or degree of importance of these causes or

nature of injuries in determining death or hospitalization is substantially different between the two sexes. The most striking differences by sex were observed among fatal injuries: men aged 65+ tended to have rates three times higher than women in the same age group. Similar results have been reported by other investigators (Riley, et al., 1989; Baker, et al., 1992). Some of these observed differences in injury mortality and hospitalization between senior men and women may be due to behavioural (risk), social (isolation) and physiologic differences (e.g., osteoporosis) (Baker, et al., 1995).

Age is another important demographic factor affecting injury related mortality and hospitalization rates. Several causes and types of injuries increase or decrease with age in relation to mortality and hospitalization. This is highlighted in the present study and also by other investigators (e.g., Riley, 1992). For example, when fall related mortality was examined by age groups, men tended to have higher mortality in each of the five age groups than did women. However, these rates were substantially higher in the older age group (85+) as compared to the younger age group (65-69) for both sexes. Perhaps it would be a mistake to view older (65+) persons as a homogeneous group. Clarifying the reasons for such heterogeneity remains an important and challenging area of injury research that will significantly affect primary and secondary preventive care in seniors.

Seniors generally had the highest rates of mortality and hospital days stay due to falls. The physical vulnerability of seniors often results in more severe fractures and longer periods for recovery. For example, chronic conditions such as osteoporosis and age related changes in the central nervous system which affect gait and balance may contribute to the severity of injuries and recovery period.

For those aged 65 and older, fractures of lower limb are the leading cause of hospitalization and these rates have stayed relatively stable in this population over the last 13 years. However, it is worthy to note that complications by medical procedures are on the increase in Canada, whereas every other cause

or nature of injury has decreased over the last decade. Further research should examine the reasons for the rise in the hospital separations and rate of hospital stay due to complications by medical procedures.

The decline in fall and MVC related mortality and hospital stay over the last decade can be attributed to the understanding of etiology of these causes of injuries and may be due to implementation of preventive programs. However, still little is known about the etiology of other types of injuries such as pedestrian injuries, assault, iatrogenic injuries, and suicides, pointing to the need for further research in these areas.

Table 3: Age standardized* average annual mortality rates per 100,000 population aged 65 and over by sex and external cause of injury, 1979-1991

Categories of External Cause of Injury	Male	Rank	Female	Rank
Motor Vehicle Crashes (MVC)	19.2	3	9.4	2
Pedestrian Injuries	9.3	4	5.2	5
Other Traffic	2.9		0.5	
Poisoning	3.1		1.9	
Falls	67.4	1	54.2	1
Fires and Flames	6.4		3.0	
Drowning	3.0		1.0	
Adverse Effects of Drug Use	0.8		0.7	
Adverse Reactions to Medical Procedures	4.0		2.7	
Self-Inflicted Injury	28.5	2	7.1	3
Purposely-Inflicted Injury	2.3		1.1	
Choking	9.0	5	6.1	4
Injury Intent Undetermined	4.0		2.0	
Other	10.8		3.6	

*Standardized to 1991 Canadian population

Table 4: Age standardized* average annual hospital separation rates per 100,000 population aged 65 and over by sex and nature of injury (N-code), 1979-1991

Nature of Injury	Male	Rank	Female	Rank
Fracture of upper limb	95.1	6	264.0	4
Fracture of lower limb	570.5	2	1136.4	1
Other fractures	244.3	3	283.5	3
Dislocation & Sprains	81.6		84.8	
Intracranial injuries	115.1	5	81.9	
Internal injuries	31.1		13.9	
Wounds	83.0		50.0	
Late effects of injuries	35.2		49.6	
Contusions and superficial injuries	92.7		114.0	6
Burns	25.5		16.5	
Complications by medical procedures	575.0	1	365.9	2
Poisoning by drugs	148.5	4	179.1	5
Environmental injuries	34.9		19.7	
Other	51.1		46.6	

*Standardized to 1991 Canadian population

Table 5: Age standardized* average annual rates for hospital days stay per 100,000 population aged 65 and over by sex and external cause of injury, 1984-1991

Categories of External Cause of Injury	Male	Rank	Female	Rank
Motor Vehicle Crashes (MVC)	2083.7	5	2008.1	5
Pedestrian Injuries	72.1		14.7	
Other Traffic	879.1		610.7	
Poisoning	2456.9	4	2992.8	4
Falls	57418.5	1	80483.2	1
Fires and Flames	470.6		212.9	
Drowning	11.4		4.3	
Adverse Effects of Drug Use	9292.1	3	10963.3	3
Adverse Reactions to Medical Procedures	24301.2	2	17488.5	2
Self-Inflected Injury	662.8		615.7	
Purposely-Inflicted Injury	574.4		238.6	
Choking	492.9		392.9	
Injury Intent Undetermined	1001.6		856.5	
Other	8462.9		13397.2	

*Standardized to 1991 Canadian population

Table 6: Age standardized* average annual hospital days stay rates per 100,000 population aged 65 and over by sex and nature of injury (N-code), 1984-1991

Nature of Injury	Male	Rank	Female	Rank
Fracture of upper limb	1198.8		3383.4	4
Fracture of lower limb	15231.8	1	32613.6	1
Other fractures	4098.6	3	5715.1	2
Dislocation and Sprains	638.2		819.8	
Intracranial injuries	1499.8	4	1069.4	
Internal injuries	385.8		207.5	
Wounds	529.1		456.1	
Late effects of injuries	1292.3	5	2658.5	5
Contusions and superficial injuries	828.9		1204.7	
Burns	552.4		350.1	
Complications by medical procedures	6622.3	2	5528.5	3
Poisoning by drugs	1240.3	6	1545.1	6
Environmental injuries	314.4		187.4	
Other	482.1		449.7	

*Standardized to 1991 Canadian population

Table 7: Average length of hospital stay in days for aged 65 and over by sex and nature of injury (N-code), 1979-1991

Nature of Injury	Male	Rank	Female	Rank
Fracture of upper limb	7.8		8.7	
Fracture of lower limb	17.1	2	19.3	2
Other fractures	10.8	4	13.7	4
Dislocation and Sprains	4.9		6.5	
Intracranial injuries	8.6	5	8.9	6
Internal injuries	8.0	6	9.9	5
Wounds	4.0		6.2	
Late effects of injuries	24.0	1	39.5	1
Contusions and superficial injuries	5.6		7.3	
Burns	14.2	3	14.2	3
Complications by medical procedures	7.4		9.9	5
Poisoning by drugs	5.4		5.8	
Environmental injuries	5.9		6.5	
Other	6.2		6.6	

Figure 1: Percentage of deaths due to injuries among seniors (65+) by sex and selected external causes, Canada, 1979-1991

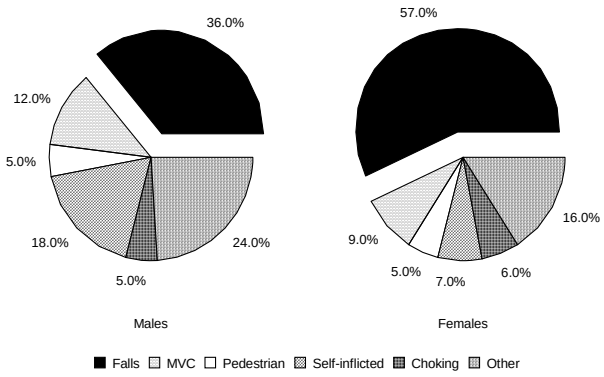


Figure 2: Average annual age-specific mortality rates due to falls for Canada by sex, 1979-1991

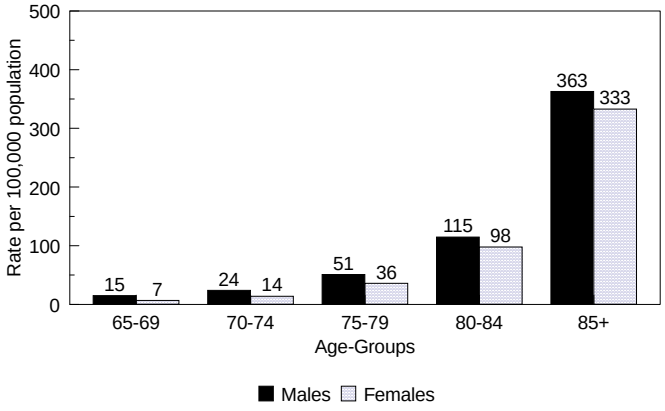


Figure 3: Average annual age-specific mortality rates due to MVC for Canada by sex, 1979-1991

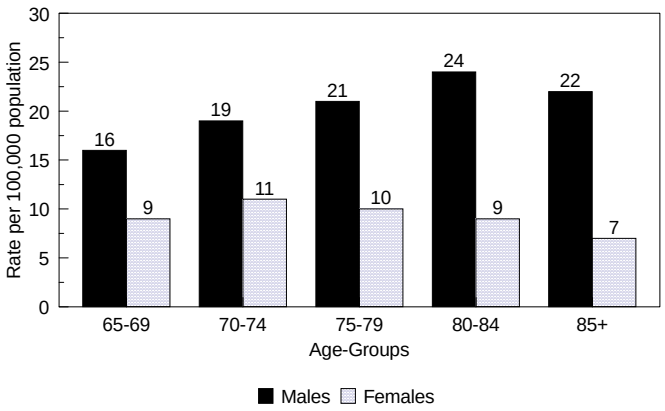


Figure 4: Average annual age-specific mortality rates due to pedestrian injuries for Canada by sex, 1979-1991

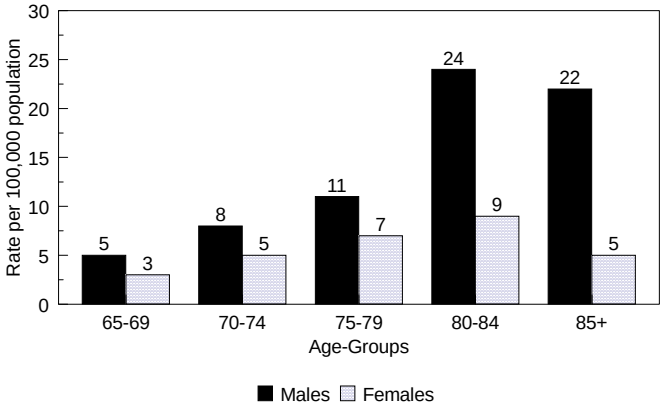


Figure 5: Average annual age-specific mortality rates due to self-inflicted injuries for Canada by sex, 1979-1991

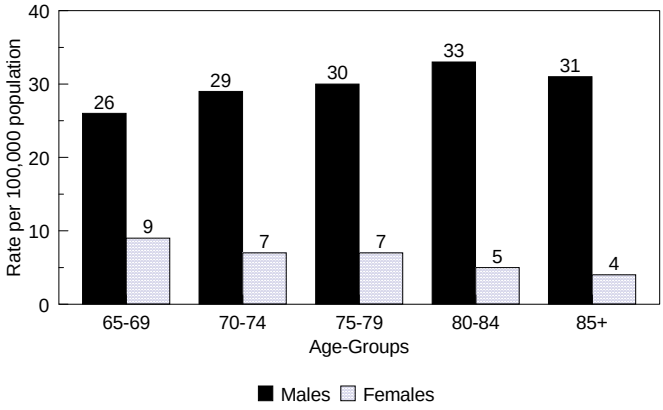


Figure 6: Average annual age-specific mortality rates due to choking
for Canada by sex, 1979-1991

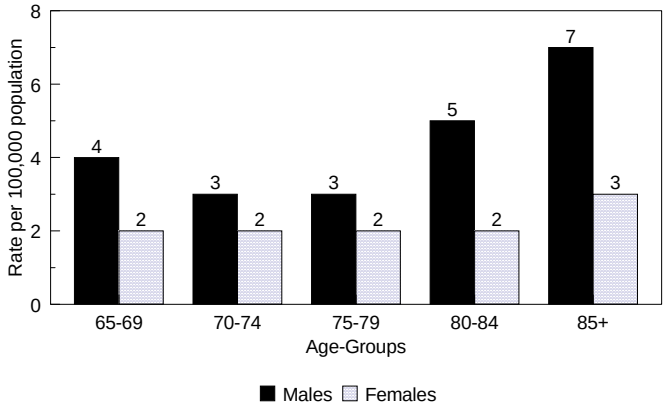


Figure 7: Average annual age-specific mortality rates due to fire and flames
for Canada by sex, 1979-1991

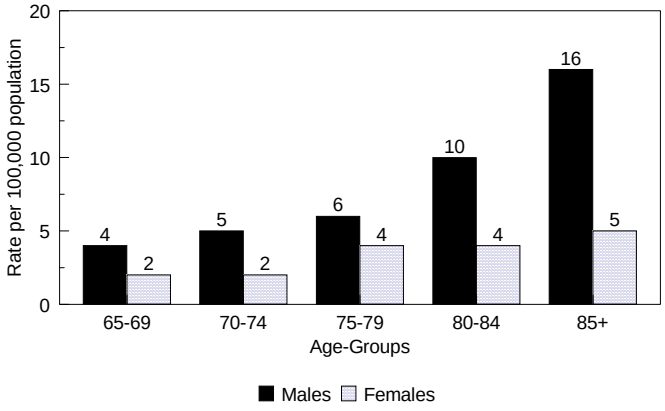
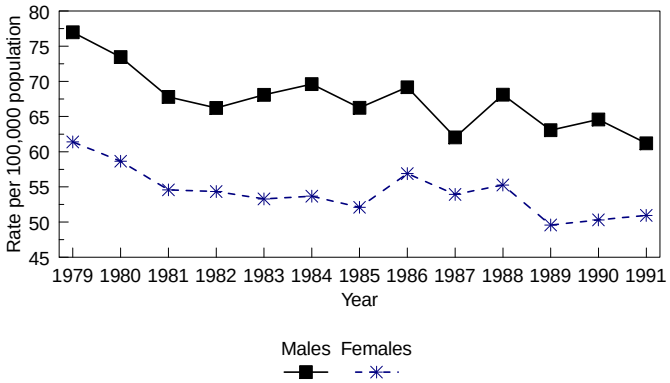


Figure 8: Deaths due to falls, age-standardized* mortality rates
by sex for seniors (65+), Canada, 1979-1991

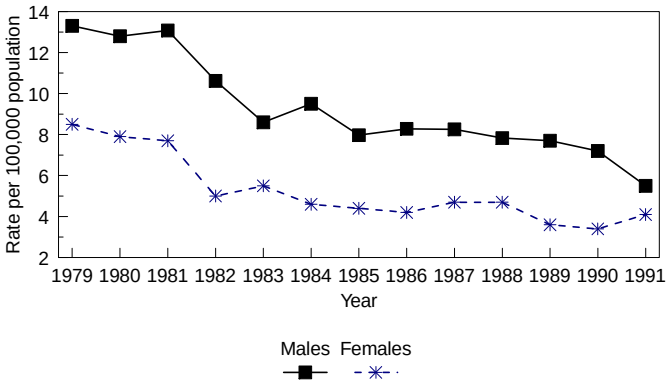


*Standardized to 1991 Canadian popuation

Figure 9: MVC deaths: age-standardized* mortality rates
by sex for seniors (65+), Canada, 1979-1991

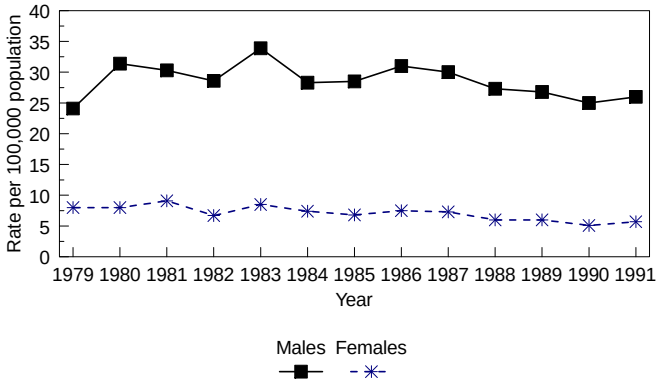
*Standardized to 1991 Canadian population

Figure 10: Pedestrian deaths: age-standardized* mortality rates
by sex for seniors (65+), Canada, 1979-1991



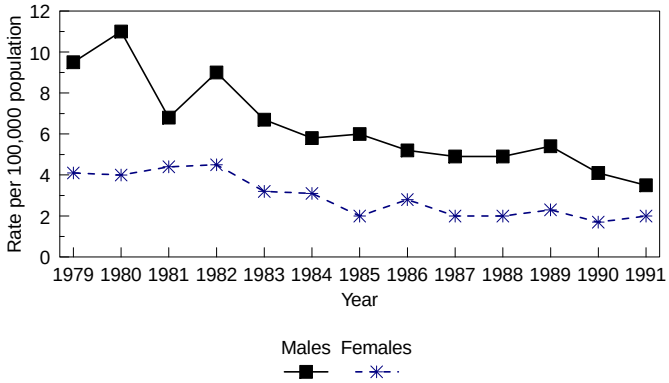
*Standardized to 1991 Canadian population

Figure 11: Self-inflicted deaths: age-standardized* mortality rates
by sex for seniors (65+), Canada, 1979-1991



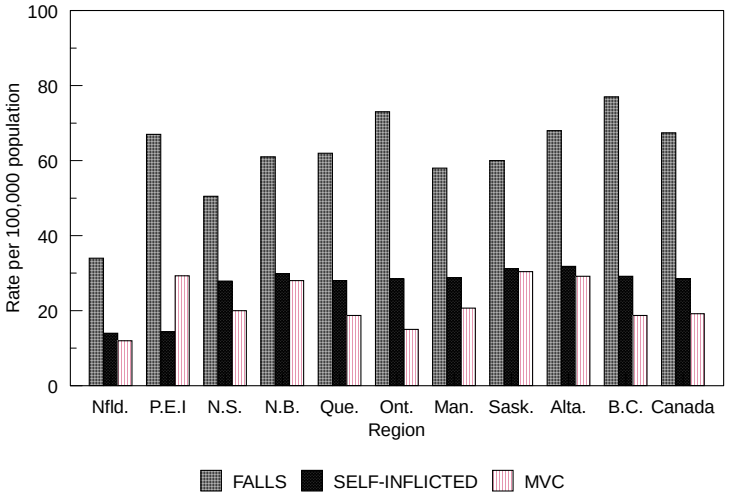
*Standardized to 1991 Canadian population

Figure 12: Fire & flame deaths: age-standardized* mortality rates
by sex for seniors (65+), Canada, 1979-1991



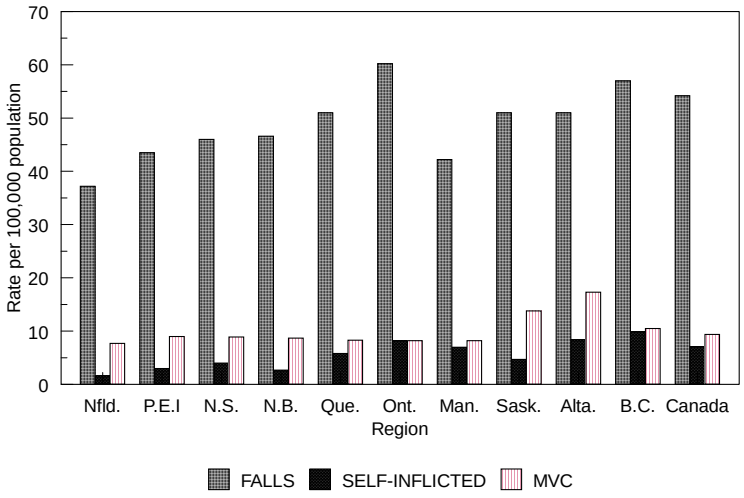
*Standardized to 1991 Canadian population

Figure 13: Average annual age-standardized* mortality rates due to selected causes of injury among males aged 65+ by provinces and Canada, 1979-1991



*Standardized to 1991 Canadian population

Figure 14: Average annual age-standardized* mortality rates due to selected causes of injury among females aged 65+ by provinces and Canada, 1979-1991



*Standardized to 1991 Canadian population

Figure 15: Percentage of hospital separations due to injuries among seniors (65+) by sex and selected types of injuries (N-code), Canada, 1979-1991

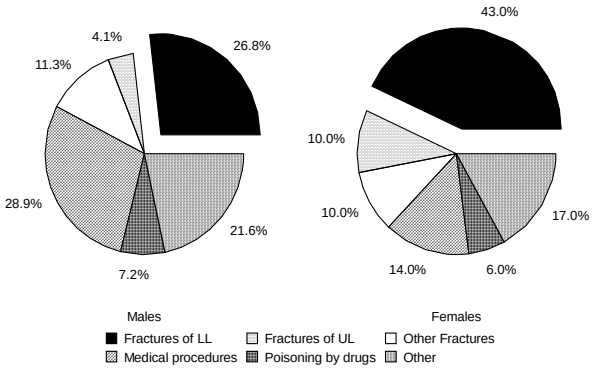


Figure 16: Average annual age-specific hospital separation rates due to fractures of upper limb for Canada by sex, 1979-1991

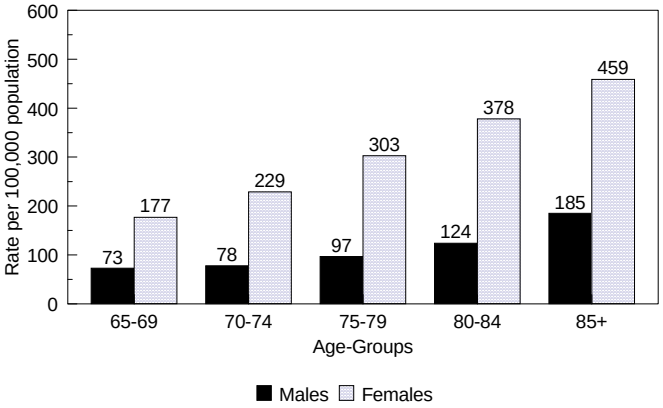


Figure 17: Average annual age-specific hospital separation rates due to fractures of lower limb for Canada by sex, 1979-1991

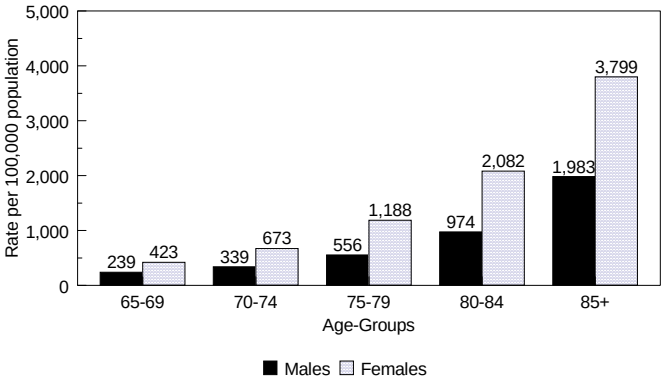


Figure 18: Average annual age-specific hospital separation rates due to fractures of other than upper or lower limbs for Canada by sex, 1979-1991

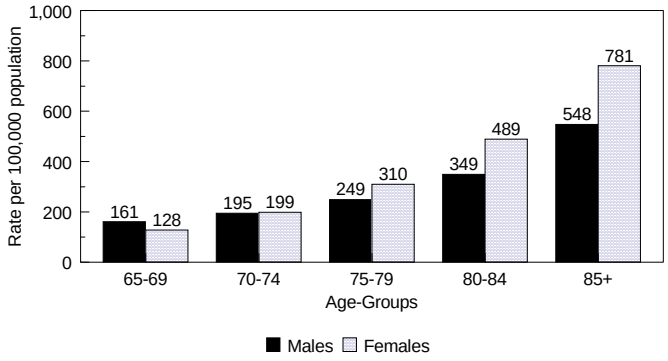


Figure 19:Average annual age-specific hospital separation rates due to complications by medical procedures for Canada by sex, 1979-1991

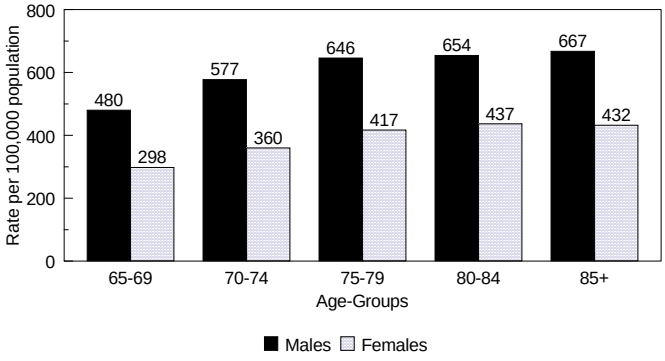


Figure 20: Average annual age-specific separation rates due to poisoning by drugs for Canada by sex, 1979-1991

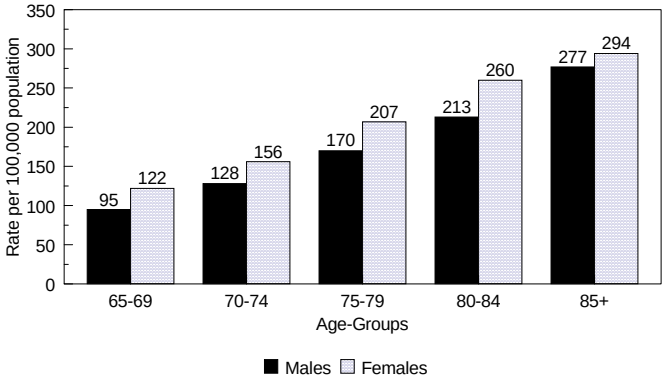
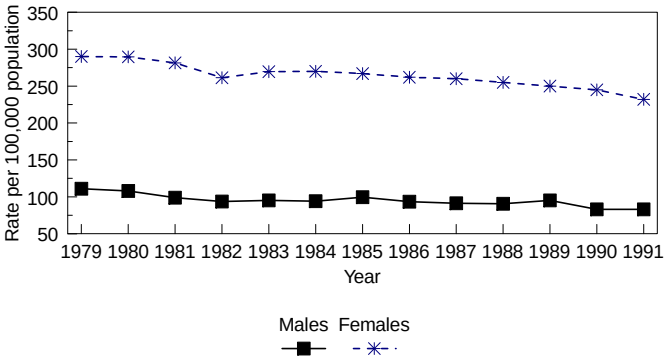
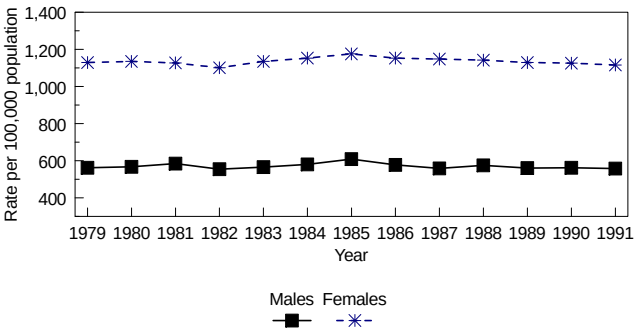


Figure 21: Fracture of upper limb related hospitalizations: age-standardized* hospital separation rates by sex for seniors (65+), Canada, 1979-1991



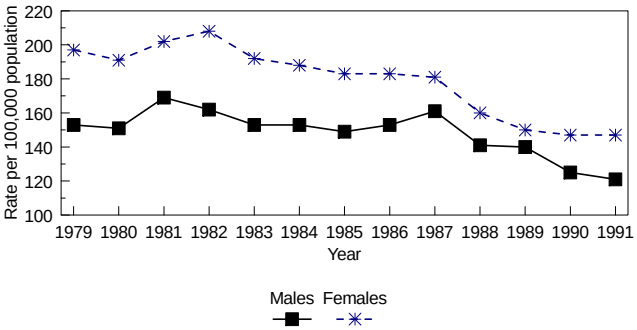
*Standardized to 1991 Canadian population

Figure 22: Fracture of lower limb related hospitalizations: age-standardized* hospital separation rates by sex for seniors (65+), Canada, 1979-1991



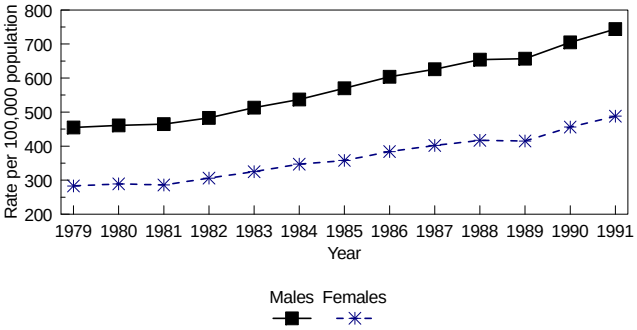
*Standardized to 1991 Canadian population

Figure 23: Poisoning by drugs related hospitalizations: age-standardized* hospital separation rates by sex for seniors (65+), Canada, 1979-1991



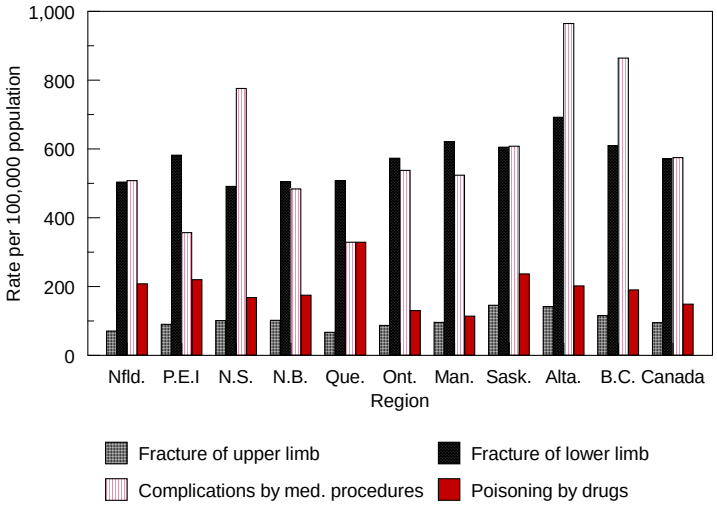
*Standardized to 1991 Canadian population

Figure 24: Complication by medical procedures related hospitalizations: age-standardized* hospital separation rates by sex for seniors (65+), Canada, 1979-1991



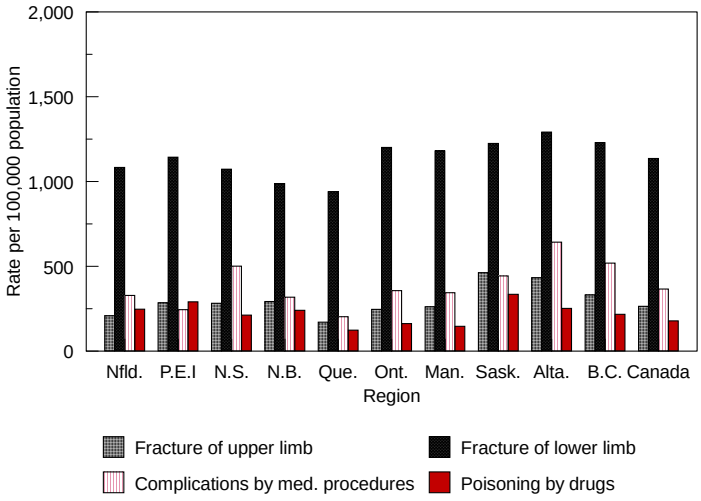
*Standardized to 1991 Canadian population

Figure 25: Average annual age-standardized* hospital separation rates due to selected types of injuries (N-code) among males aged 65+ by provinces and Canada, 1979-1991



*Standardized to 1991 Canadian population

Figure 26: Average annual age-standardized* hospital separation rates due to selected types of injuries (N-code) among females aged 65+ by provinces and Canada, 1979-1991



*Standardized to 1991 Canadian population

Figure 27: Average annual age-specific hospital days stay rate due to falls for Canada by sex, 1984-1991

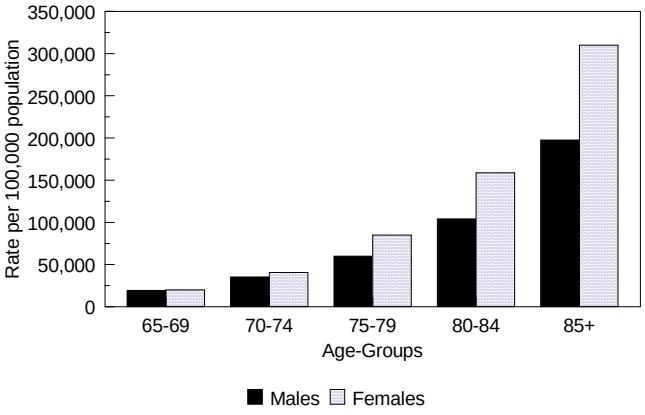


Figure 28: Average annual age-specific hospital days stay rate due to MVC for Canada by sex, 1984-1991

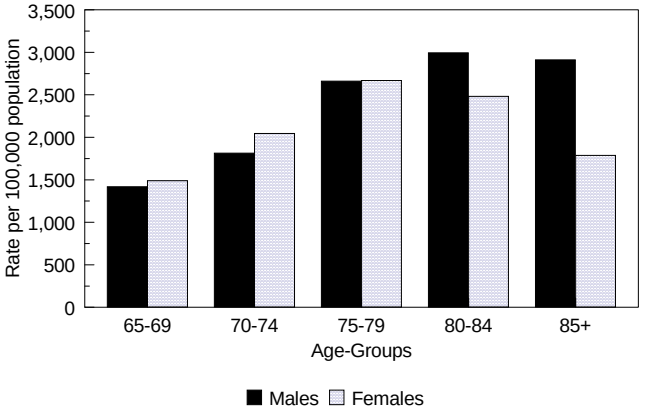


Figure 29: Average annual age-specific hospital days stay rate due to adverse reactions to medical procedures for Canada by sex, 1984-1991

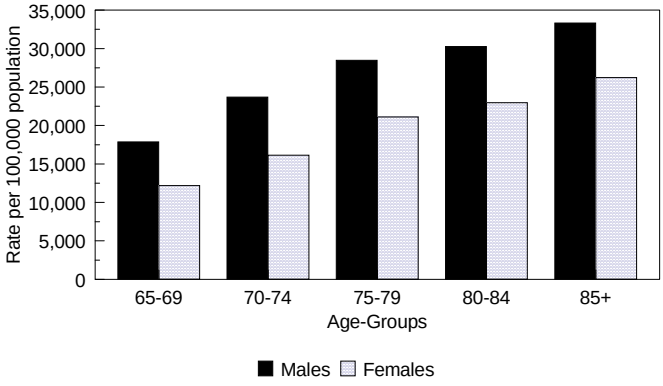


Figure 30: Average annual age-specific hospital days stay rates due to adverse effects of medications for Canada by sex, 1984-1991

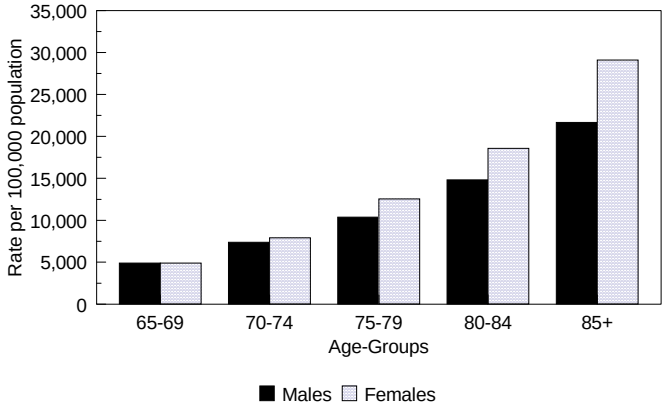


Figure 31: Average annual age-specific hospital days stay rate due to poisoning for Canada by sex, 1984-1991

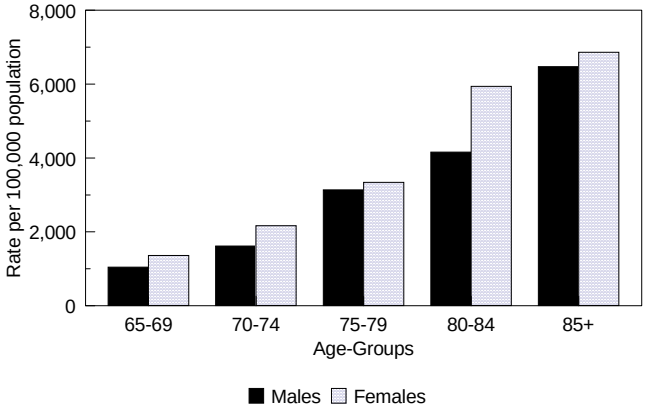
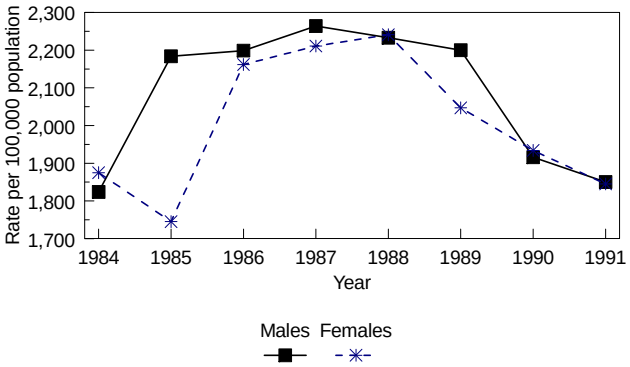
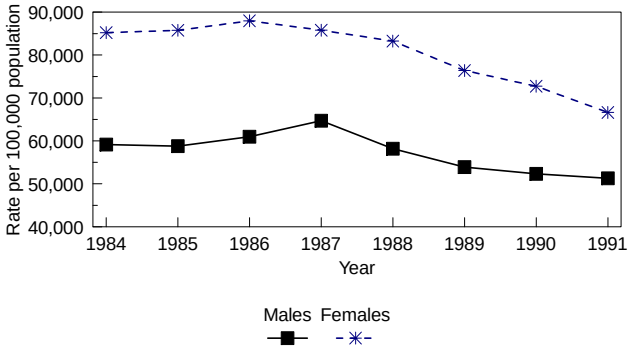


Figure 32: MVC related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



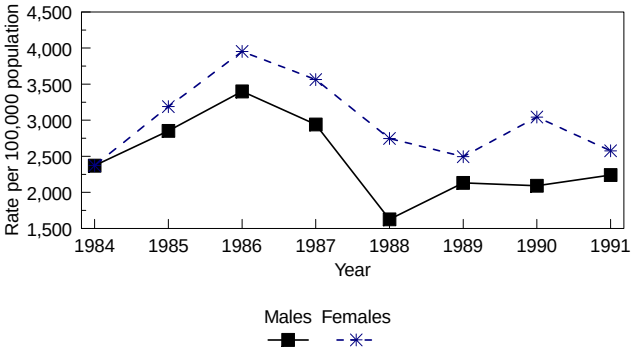
*Standardized to 1991 Canadian population

Figure 33: Falls related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



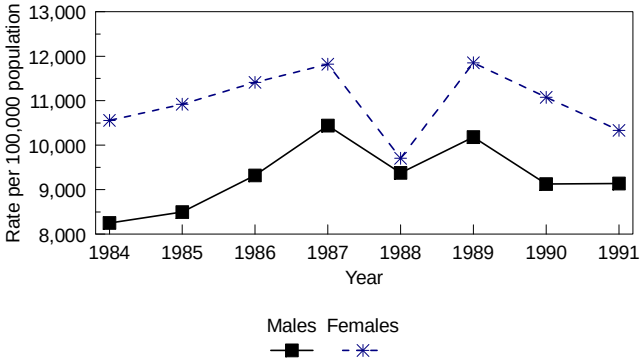
*Standardized to 1991 Canadian population

Figure 34: Poisoning related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



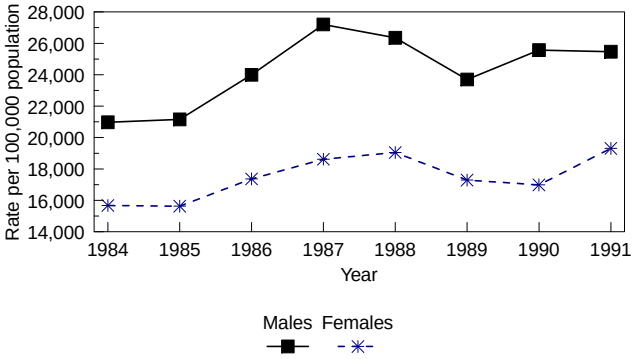
*Standardized to 1991 Canadian population

Figure 35: Adverse effects of medication related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



*Standardized to 1991 Canadian population

Figure 36: Adverse reactions to medical procedures related hospital days stay: age-standardized* rate for hospital days stay by sex for seniors (65+), Canada, 1984-1991



*Standardized to 1991 Canadian population

Figure 37: Average annual age-specific hospital days stay rate due to fractures of upper limb for Canada by sex, 1984-1991

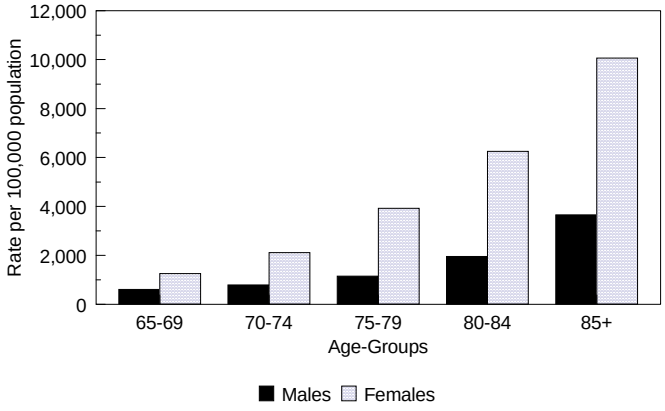


Figure 38: Average annual age-specific hospital days stay rate due to fractures of lower limb for Canada by sex, 1984-1991

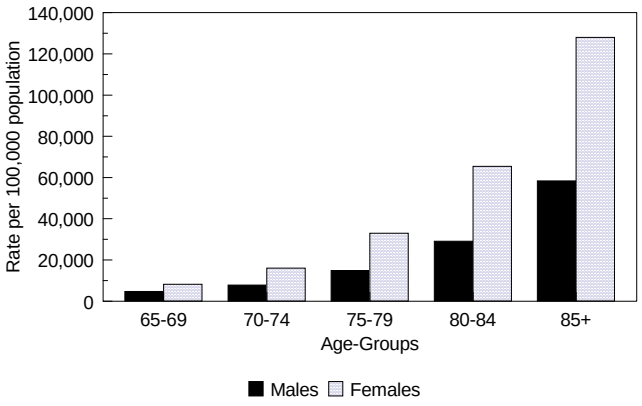


Figure 39: Average annual age-specific hospital days stay rate due to complications by medical procedures for Canada by sex, 1984-1991

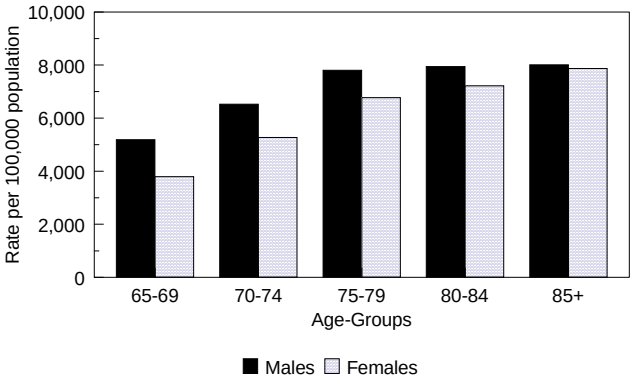


Figure 40: Average annual age-specific hospital days stay rate due to poisoning by drugs for Canada by sex, 1984-1991

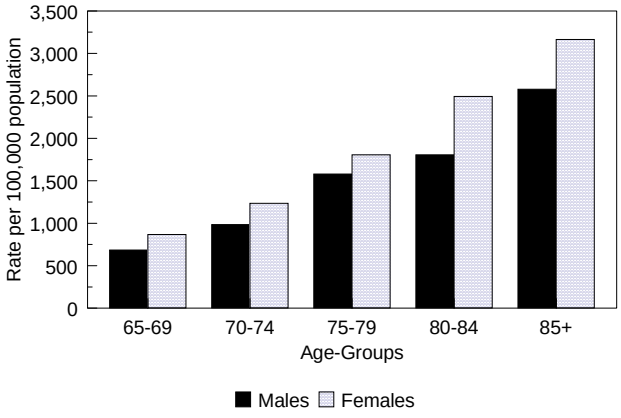
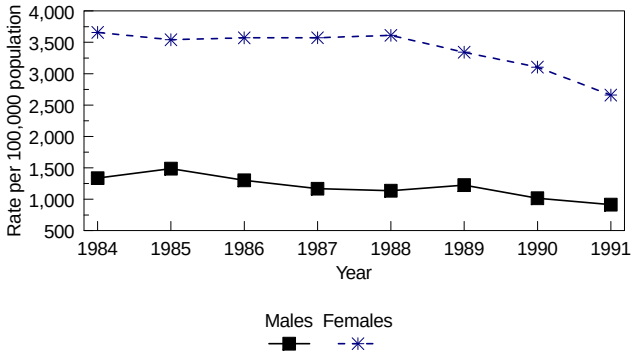
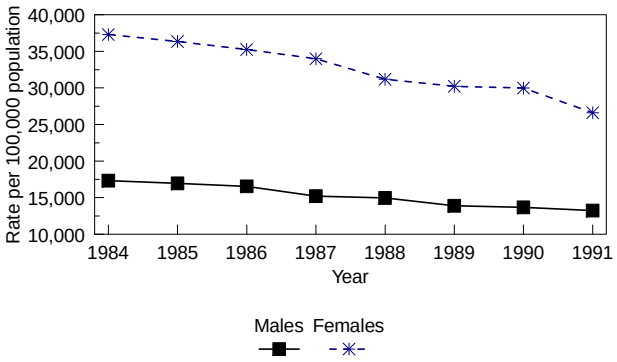


Figure 41: Fractures of upper limb related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



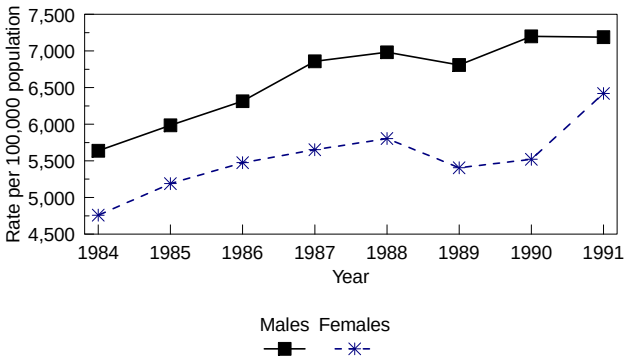
*Standardized to 1991 Canadian population

Figure 42: Fractures of lower limb related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



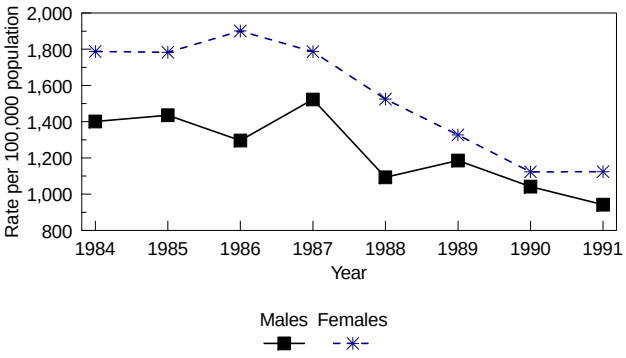
*Standardized to 1991 Canadian population

Figure 43: Complication by medical procedures related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



*Standardized to 1991 Canadian population

Figure 44: Poisoning by drugs related hospital days stay: age-standardized* hospital days stay rate by sex for seniors (65+), Canada, 1984-1991



*Standardized to 1991 Canadian population

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