



The Economic Burden of Poisoning in British Columbia

Ian Pike, PhD
Guanghong Han, PhD
Jacqueline Kinney, BSc
Dorry Smith, MSc



BC Injury Research and Prevention Unit
Centre for Community Child Health Research
Child and Family Research Institute
Vancouver, BC

The Economic Cost of Poisoning in British Columbia, Canada.

Pike, I., PhD^{1,2}, Han, G., PhD¹, Kinney, J., BSc¹, Smith, D., MPH¹

1 BC Injury Research and Prevention Unit, Vancouver, BC, Canada

2 Department of Paediatrics, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada

Abstract

Introduction: Unintentional poisoning is among the top three causes of death and hospitalization in BC, and is the leading cause of injury among certain populations. Policy makers are in need of better decision-making tools and more comprehensive information to assist them in allocating scarce resources more effectively in order to reduce this preventable injury.

Purpose: To estimate the economic burden of poisonings (fatal, hospitalized, attended by medical and paramedical professionals, but not hospitalized) through an examination of the human and economic costs of poisoning in BC for the year 2003.

Methods: The number of poisoning episodes in 2003 is described, including the seriousness of the poisoning event, the mechanism and nature of the poisoning, and the relative distributions by age group and sex. The approach taken with respect to the estimation of the economic cost of poisoning allows for the determination of 'opportunity costs' to society. By translating poisoning-related injury and premature death into direct and indirect costs, estimates can be made which is an approximation of what society would gain if the poisoning-related injuries and deaths associated with these costs were prevented.

Results: In 2003, poisoning resulted in 301 fatalities, 4,939 hospitalizations, 5,204 emergency department visits, and 24,829 poisonings or human exposures resulting in ambulance attendance, not transferred or a call to the BC DPIC. These sum to some 35,273 poisoning or human exposure events in BC in one year. As a fraction of all poisonings, fatalities accounted for less than 1.0% of the total, hospitalizations accounted for 14.0%, and emergency room treatments accounted for 14.8%. Nearly, three-quarters of all poisonings and/or human exposures (70.4%) resulted in ambulance attendance, not transferred, or a call to the BC DPIC which were treated on scene.

Poisonings that occurred in BC in 2003 cost the system \$53.5 million in direct healthcare costs: \$0.89 million for fatal poisonings; \$31.04 for poisoning hospitalizations; \$7.33 million for poisonings requiring emergency room treatment; and, \$14.26 million for poisonings that resulted in ambulance attendance, not transferred, and calls to the BC DPIC emergency/information line.

Using a 5% future discount rate, the discounted present value of future production lost due to premature mortality resulting from poisoning is estimated to be \$3.63 million based on a labour productivity growth rate of 1.1%. Of the \$3.63 million in mortality costs, \$2.39 million represents paid labour and \$1.24 million represents the estimate of

unpaid labour for those in and outside of the labour force (i.e. the value of household work).

The estimated value of production lost due to poisonings that result in short and long term disability in BC in 2003 is \$106.71 million. Of this total, \$83.16 million is attributed to poisonings that resulted in hospitalization, \$19.47 million to those treated in emergency departments, and \$0.45 million to those resulting in ambulance attendance, not transferred or calls to BC DPIC.

The total cost of poisoning in BC in 2003 is estimated to be \$160.23 million: \$53.5 million (33.4%) in direct costs and \$106.71 million (66.6%) in indirect costs. Hospital care expenditures represented the largest direct cost at \$31.03 million (19.4%) of the total economic burden. This was followed by direct costs for poisonings and human exposures treated on-site, either by ambulance paramedics or by BC DPIC emergency / information line (\$14.26 million, 8.9%), emergency room treatments (\$7.32 million, 4.6%), and fatalities (\$0.89 million, 0.6%).

With regard to the indirect cost components that were estimated for poisonings in BC in 2003, the value of lost production and disability following hospitalization represents the largest indirect cost, estimated at \$83.16 million (51.9% of total economic burden). This is followed by the value of lost production and disability following emergency room treatment, estimated at \$19.47 million (12.2% of total economic burden), the value of lost production due to poisoning death at \$3.63 million (2.3% of the total), and the value of lost production and disability related to poisoning and human exposure resulting in ambulance attendance, not transferred or calls to BC DPIC at \$0.45 million (0.3% of the total).

The value of productivity losses associated with poisoning, even for less severe events exceeds the costs associated with contact with, and treatment by the healthcare system. The disparity between healthcare spending and the value of lost productivity is most pronounced for fatal poisonings; some 80% of the total cost of fatal poisoning is attributable to lost productivity and 20% is attributable to healthcare spending. Similarly, 73% of the total costs of hospitalized poisonings and those treated in the ER, are attributable to losses in productivity, while 27% are attributable to direct healthcare spending. In stark contrast, only 3% of the total cost of poisonings treated on scene by an ambulance attendant or via a call to BC DPIC is attributable to the value of lost productivity. The remaining 97% is attributable to the direct cost of the ambulance and DPIC services.

The Economic Cost of Poisoning in British Columbia, Canada.

Pike, I., PhD^{1,2}, Han, G., PhD¹, Kinney, J., BSc¹, Smith, D., MPH¹

1 BC Injury Research and Prevention Unit, Vancouver, BC, Canada

2 Department of Paediatrics, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada

Introduction

Injury is the leading killer and disabler of Canadians in the prime of their lives and it kills more children and youth than all other causes combined. Injury also places a tremendous economic burden on Canada, conservatively estimated at \$14.7 billion annually in direct and indirect costs, with the province of British Columbia (BC) representing some \$2.6 billion of that total. Unintentional poisoning is among the top three causes of death and hospitalization in BC, and is the leading cause of injury among certain populations. Policy makers are in need of better decision-making tools and more comprehensive information to assist them in allocating scarce resources more effectively in order to reduce this preventable injury.

As part of a larger study on the cost of injury, the economic burden of unintentional poisoning in BC has been previously estimated at \$216 million annually (\$15 million direct costs; \$201 indirect costs), accounting for 10.5% of overall costs attributable to injury in 1998. Both direct and indirect costs were estimated, and allocated according to the incidence of injury types. While the study accounted for all direct and indirect costs and attributed it to injury type, there may, in some cases, be over or under estimations of the particular costs associated with any particular type of injury, especially those associated with non-hospitalized injuries. Data on non-hospitalized injuries were not available and were estimated using hospitalized injuries. As well, allocating the costs of certain health professionals (e.g. dentists, chiropractors) who are not normally directly involved in the treatment of poisoning may result in over estimations of the true costs related to poisoning. An understanding of the economic costs directly associated with all types and causes of poisoning is valuable in understanding priority areas for prevention and establishing reduction targets.

Purpose

The overall purpose of this study is to estimate the economic burden of poisonings in BC, including fatal poisonings, those that result in hospitalization, and those attended to by medical and paramedical professionals, but not hospitalized^a. The intention of this

^a Not hospitalized includes poisonings requiring contact with: BC Ambulance Service (whether transported or not), Hospital Emergency Department, and BC Drug and Poison Information Centre.

study is to undertake an examination of the human and economic costs of poisoning in BC for the year 2003, and to supply information on the magnitude of the problem based upon standard reporting units and methods¹. Determining the direct and indirect economic costs, together with the human toll that result from poisoning, provides important evidence for policy and program planning. Further, an understanding of these costs has potential implications not only for health care expenditures and resources, but also for society, employers, patients and families.

Methodology

I) Estimated Incidence of Poisoning in BC

The number of poisoning episodes in 2003 is described, including the seriousness of the poisoning event, the mechanism and nature of the poisoning, and the relative distributions by age group and sex. The International Classification of Diseases, 10th revision, Clinical Modification (ICD-10-CM) poisonings diagnoses codes were used: Unintentional poisoning X40-49; Suicide/attempt X60-69; Homicide/assault X85-90; undetermined Y10-19.

Estimated incidence counts and rates by age group and sex are presented for four mutually exclusive categories that reflect the severity of poisoning: i) fatal poisoning; ii) poisoning resulting in hospitalization with survival to discharge; iii) poisonings that were treated in a hospital emergency room and released without hospitalization^b; and, iv) poisonings and human exposures that resulted in ambulance attendance, not transferred to hospital and calls to BC DPIC emergency/information line.

In each case, estimated incidence counts and rates are stratified by:

- Sex and age group (males and females in the following age groups: < 15, 15-24, 25-44, 45-64, 65-74, 75+)
- Intent (unintentional, suicide, homicide, attempted suicide, assault and undetermined intent)
- Leading causes (Antiepileptic, anti-parkinsonism, psychotropic drugs; Non-opioid analgesics, antipyretics, and antirheumatics; Narcotics and psychodysleptics; Alcohol; Other gases and vapors/CO; Drugs acting on the autonomic nervous system; Pesticides; Organic solvents, halogenated hydrocarbons and their vapors; and, Other/Unspecified chemicals and noxious substances)

The estimates were developed from multiple data sources (BC Vital Statistics Agency, BC Injury Reporting System (BCIRS), Morbidity Database, Information Support, BC Ministry of Health, Emergency Department Injury Surveillance System (EDISS), BC Ambulance Service, BC DPIC and WorkSafe BC), all of which included data for the year 2003, with the exception of the BC Ambulance Service data which is from the 2005/2006 fiscal year. Data is assumed to represent a good estimate of the incidence of poisonings

^b For this study, incidence and rates of poisonings in BC that were treated in hospital emergency rooms were estimated from the Emergency Department Injury Surveillance System (EDISS) data which ran at 10 hospitals throughout BC for the period 2000/01-2002/03.

in BC in 2003. Population and age group rates were calculated using the population of BC for the year 2003 as reported by BC Stats (<http://www.bcstats.gov.bc.ca/>).

II) Estimated Economic Burden of Poisoning in BC

The approach taken in this study with respect to the estimation of the economic cost related to poisoning in BC allows for the determination of 'opportunity costs'^c to society. By translating poisoning-related injury and premature death into direct and indirect costs^{2 3 4}, estimates can be made which is an approximation of what society would gain if the poisoning-related injuries and deaths associated with these costs were prevented.

A Framework for Measuring the Cost of Poisoning in BC

Total economic costs associated with poisoning are captured by two main categories: direct and indirect costs.

Direct Costs

Direct costs are defined as the value of goods and services for which payment was made and resources used in treatment, care and rehabilitation related to illness or injury¹. In order to document the costs associated with poisoning, it is essential to have information on the complete episode associated with the poisoning events. This must cover the range of cases from those who die at the scene or at home, die upon arrival at hospital, are dealt with completely in a hospital setting to those which encompass institutional, ambulatory, rehabilitation, home care and other related costs over long periods of recovery or, in extreme cases, during the remaining period of an individuals' life expectancy.

The direct cost components related to poisoning in this study are organized and divided into four mutually exclusive categories to reflect the severity of poisoning; i) fatal poisonings; ii) poisoning resulting in hospitalization with survival to discharge; iii) poisonings that were treated in a hospital emergency room and released without hospitalization; and, iv) poisoning and human exposure-related events resulting in ambulance attendance, not transferred to hospital or calls to BC DPIC emergency/information line which did not result in ambulance attendance. The total direct cost of poisoning is estimated by the sum of the costs in these four categories.

The data related to the poisonings that resulted in ambulance attendance but not transferred were limited to annual totals and costs. For the purposes of this analysis, these data were assumed to be distributed by age group and sex in a fashion similar to those contacting the BC DPIC emergency/information line.

Direct cost components included in this study for each severity category are listed in Table 1. Costs related to mental health and/or psychological services, and other direct costs borne by patients, family or other payers are not included. To the extent that these costs exist, then the current study represents a conservative estimate of the costs of poisoning in BC.

^c For this study, opportunity cost is the value of opportunities forgone because of an intervention, action or health outcome (i.e. the direct and indirect costs of poisoning).

Table 1. Direct Costs of Poisoning in BC

| Fatalities | Hospitalizations | Emergency Room Treatments | Ambulance attended but not transferred and BCDPIC |
|---|--|---|---|
| <ul style="list-style-type: none"> • Coroner’s Service • Ambulance Service (attendance and transportation, pharmaceuticals, medical supplies) • Emergency Room (physician care, pharmaceuticals, medical supplies) • Hospital Care (physician care, pharmaceuticals, medical supplies) • WorkSafe BC (survivors’ benefits) • Additional direct health care costs (other health spending, capital, public health, health research) | <ul style="list-style-type: none"> • Ambulance Service (attendance and transportation, pharmaceuticals, medical supplies) • Emergency Room (physician care, pharmaceuticals, medical supplies) • Hospital Care (physician care, pharmaceuticals, medical supplies) • WorkSafe BC (short-term, and long-term disability benefits) • Additional direct health care costs (other health spending, capital, public health, health research) | <ul style="list-style-type: none"> • Ambulance Service (attendance and transportation, pharmaceuticals, medical supplies) • Emergency Room (physician care, pharmaceuticals, medical supplies) • Additional direct health care costs (other health spending, capital, public health, health research) • WorkSafe BC (short-term, and long-term disability benefits) | <ul style="list-style-type: none"> • Ambulance Service (attendance, pharmaceuticals, medical supplies) • BCDPIC (emergency/information call line) |

Indirect Costs

Indirect costs are defined as the value of economic output lost because of illness, injury-related work disability, or premature death^{24 56}. To the extent that poisonings prevent or deter individuals from producing goods and services in the marketplace, the public sector, or the household, the value of these losses is a cost borne by society. The indirect cost components in this study are organized and divided into four mutually exclusive categories to reflect the severity of poisoning: i) fatal poisonings; ii) poisoning resulting in hospitalization with survival to discharge; iii) poisonings that were treated in a hospital emergency room and released without hospitalization; and, iv) poisoning and human exposure-related events resulting in ambulance attendance, not transferred to hospital or calls to BC DPIC emergency/information line which did not result in ambulance attendance. The total indirect cost of poisoning is estimated by the sum of the costs in these four categories. Poisonings and human exposure-related events that resulted in emergency room treatment, or ambulance attendance, not transferred or calls to BC DPIC are assumed not to have deterred individuals from producing goods and services in the marketplace, the public sector, or the household, for extended periods of time, and so are assumed to have minimal concomitant indirect costs, confined to short term disability/absence from work.

Indirect cost components included in this study for each severity category are listed in Table 2. Other indirect costs borne by patients, family or friends who care for the patients are not included.

Table 2. Indirect Costs of Poisoning in BC

| Fatalities | Hospitalizations | Emergency Room Treatments |
|---|---|---|
| <ul style="list-style-type: none"> • Mortality Costs – the value of years of life lost due to premature death, accounting for: <ul style="list-style-type: none"> • Age- and sex-specific rates of life expectancy • Average annual earnings • Workforce participation rates • Value of unpaid work • Labour productivity growth | <ul style="list-style-type: none"> • Morbidity Costs – the value of activity days lost due to short-term and long-term disability, accounting for: <ul style="list-style-type: none"> • Average annual earnings • Workforce participation rates • Value of unpaid work • Discounting of future production | <ul style="list-style-type: none"> • Morbidity Costs – the value of activity days lost due to short-term and long-term disability, accounting for: <ul style="list-style-type: none"> • Average annual earnings • Workforce participation rates • Value of unpaid work • Discounting of future production |

Mortality Costs due to Poisoning

Poisoning mortality-related production losses were estimated as the product of the number of poisoning deaths in 2003 and the discounted present value of remaining potential lifetime production lost as a result of those deaths¹. The discounted present value of remaining potential of lifetime production was calculated for each age-group and sex. This calculation sums lost production in the year of death (2003) and all subsequent years that the individual would have been expected to live. This method accounts for age- and sex-specific rates of life expectancy⁷, average annual earnings⁸, workforce participation rates⁸, value of unpaid work⁹, as well as labour productivity growth and the discounting of future production¹. Because the future value of capital is less than its present worth, future production is discounted at a rate of 5%, which has been widely used in the literature¹.

The average value of unpaid work in 2003 was calculated using the replacement cost general method (housekeeper cost method), which uses a wage rate of a general housekeeper¹⁰. Calculations were made by age group and sex, and average values were calculated using work force participation data from BC Stats together with average wage rate. The value of production estimates for children less than 15 years of age is not available, and therefore final estimates do not account for mortality costs for this age group.

The resulting calculation provides the discounted present value of lost production as a result of poisoning deaths in BC in 2003.

Morbidity Costs due to Poisoning

The value of lost production due to short-term and long-term disability in BC in 2003 as a result of poisoning was calculated for both the workforce and household populations. Previous research has determined that the duration of work loss does not differ by whether an injury occurs on or off the job¹¹. This suggests that work loss estimates, provided by WorkSafe BC, can be credibly applied to estimate work loss associated with non-work related poisonings.

Finkelstein, et al (2006), quantified the work loss duration associated with a given injury that requires hospitalization, and determined that work loss is approximately 5 times longer for hospitalized injuries than for injuries not requiring hospitalization¹². Using this ratio, we can compute work loss durations for poisonings separately for hospitalized cases, as well as those treated in an emergency room, or those resulting in ambulance attendance, not transferred, or calls to BC DPIC.

As with the mortality calculations, the average value of unpaid work in 2003 was calculated using the replacement cost general method (housekeeper cost method), which uses a wage rate of a general housekeeper¹¹. Calculations were made by age group and sex, and average values were calculated using work force participation data from BC Stats together with average wage rate. The value of production estimates for children less than 15 years of age is not available, and therefore final estimates do not account for morbidity costs for this age group.

Results: Incidence of Poisoning in BC in 2003

Total Poisoning Incidence

Table 3 displays estimated incidence counts and rates for fatal poisonings, hospitalized poisonings, poisonings that were treated in a hospital emergency room and released without hospitalization and, poisonings and human exposure-related events resulting in ambulance attendance, not transferred, or calls to BC DPIC emergency/information line in BC by age group and sex. In 2003, poisoning resulted in 301 fatalities, 4,939 hospitalizations, 5,204 emergency department visits, and 24,829 poisonings or human exposures resulting in ambulance attendance, not transferred or a call to the BC DPIC. These sum to some 35,273 poisoning or human exposure events in BC in one year. As a fraction of all poisonings, fatalities accounted for less than 1.0% of the total, hospitalizations accounted for 14.0%, and emergency room treatments accounted for 14.8%. Nearly, three-quarters of all poisonings and/or human exposures (70.4%) resulted in ambulance attendance, not transferred, or a call to the BC DPIC.

The overall incidence of poisoning among males (17,346) was somewhat less than that among females (17,927). However, males represented more than twice the number of poisoning fatalities than females (207 and 94, respectively), but only two-thirds the number of hospitalizations (1,956 and 2,983 respectively). Of the total poisonings in 2003, 43.4% (15,302) occurred among people under 15 years old, who also represented the highest rate of poisoning and human exposure (2,168.3 per 100,000). The majority of poisoning and human exposure events in the youngest age group were relatively minor,

and resulted in ambulance attendance, not transferred or calls to BC DPIC and treatment on site.

Table 3. Incidence Counts and Rates (per 100,000) of fatal, hospitalized and non-hospitalized Poisonings in BC in 2003 by Age and Sex

| | Fatalities | | Hospitalizations | | Emergency Room Treatment | | Ambulance, not transferred and BC DPIC calls | | Total | |
|---------------|------------|------|------------------|-------|----------------------------------|-------|--|---------|---------------------|---------|
| | Incidence | Rate | Incidence | Rate | Estimated Incidence ⁱ | Rate | Estimated Incidence ⁱⁱ | Rate | Estimated Incidence | Rate |
| Total | 301 | 7.3 | 4,939 | 119.1 | 5,204 | 125.5 | 24,829 | 598.8 | 35,273 | 850.7 |
| <15 | 0 | 0.0 | 249 | 35.3 | 928 | 131.5 | 14,125 | 2,001.5 | 15,302 | 2,168.3 |
| 15-24 | 24 | 4.2 | 1,088 | 192.3 | 1,357 | 239.9 | 2,264 | 400.2 | 4,733 | 836.6 |
| 25-44 | 135 | 10.9 | 1,903 | 153.7 | 1,814 | 146.5 | 5,278 | 426.3 | 9,130 | 737.5 |
| 45-64 | 120 | 11.2 | 1,229 | 114.2 | 970 | 90.2 | 2,172 | 201.9 | 4,491 | 417.4 |
| 65-74 | 13 | 4.4 | 216 | 73.0 | 69 | 23.3 | 456 | 154.1 | 754 | 254.7 |
| 75+ | 9 | 3.4 | 254 | 95.8 | 66 | 24.9 | 534 | 201.4 | 863 | 325.4 |
| Male | 207 | 10.1 | 1,956 | 95.2 | 2,812 | 136.9 | 12,371 | 602.1 | 17,346 | 844.2 |
| <15 | 0 | 0.0 | 96 | 26.5 | 533 | 146.9 | 7,683 | 2,117.8 | 8,312 | 2,291.1 |
| 15-24 | 17 | 5.9 | 360 | 124.3 | 663 | 228.9 | 1,023 | 353.3 | 2,063 | 712.4 |
| 25-44 | 91 | 14.8 | 768 | 124.7 | 1,008 | 163.6 | 2,346 | 380.8 | 4,213 | 683.9 |
| 45-64 | 85 | 15.9 | 530 | 99.2 | 538 | 100.7 | 923 | 172.7 | 2,076 | 388.4 |
| 65-74 | 11 | 7.6 | 91 | 62.5 | 41 | 28.2 | 179 | 123.4 | 322 | 221.7 |
| 75+ | 3 | 2.8 | 111 | 104.5 | 29 | 27.3 | 216 | 203.2 | 359 | 337.9 |
| Female | 94 | 4.5 | 2,983 | 142.6 | 2,392 | 114.3 | 12,458 | 595.5 | 17,927 | 857.0 |
| <15 | 0 | 0.0 | 153 | 44.6 | 396 | 115.5 | 6,442 | 1,878.6 | 6,991 | 2,038.6 |
| 15-24 | 7 | 2.5 | 728 | 263.7 | 694 | 251.4 | 1,240 | 449.3 | 2,669 | 967.0 |
| 25-44 | 44 | 7.1 | 1,135 | 182.5 | 805 | 129.4 | 2,931 | 471.4 | 4,915 | 790.4 |
| 45-64 | 35 | 6.5 | 699 | 129.1 | 429 | 79.2 | 1,249 | 230.7 | 2,412 | 445.4 |
| 65-74 | 2 | 1.3 | 125 | 83.0 | 31 | 20.6 | 277 | 183.8 | 435 | 288.7 |
| 75+ | 6 | 3.8 | 37 | 23.3 | 37 | 23.3 | 107 | 67.3 | 187 | 117.6 |

i Incidence and rates of poisonings in BC that were treated in hospital emergency rooms were estimated from the Emergency Department Injury Surveillance System (EDISS) data which ran at 10 hospitals throughout BC for the period 2000/01-2002/03.

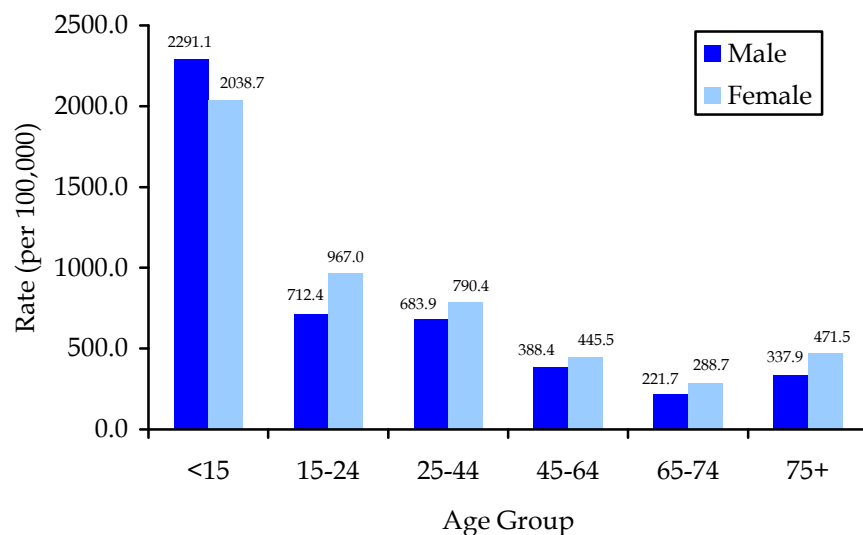
ii Total incidence and rates for poisonings in BC that resulted in ambulance attendance, not transferred, or a call to the BC DPIC by sex are accurate. Distributions by age group were recalculated to match fatal, hospitalized and ER data, and so represent estimates of the actual distribution by age group.

In contrast, people in the 15-24 year old age group had the highest rate of poisonings that required hospital treatment (either emergency room or admission) (239.9 and 192.3 per 100,000, respectively), while those in the 25-44 and 45-64 year old age groups were most likely to die as a result of poisoning (10.9 and 11.2 per 100,000, respectively). The higher fatality rates in these two age groups suggest that, unlike chronic conditions (e.g. cardiovascular disease, diabetes, osteoarthritis) which disproportionately affect the

elderly, poisonings are more likely to impact younger adults during their peak earning years.

Figure 1 illustrates the rate of fatal, hospitalized, emergency room treated, and ambulance attended, not transferred and calls to BC DPIC poisoning and human exposure events per 100,000 by age group and sex. The distribution across the age groups reflects the impact of poisonings and human exposures in the younger age groups, particularly among children and youth under age 15. In this youngest age group, the rate among males is 12% higher than females, contrary to all other ages, where females have higher rates than males. The most pronounced difference is in the 15-24 year old age group, where females have a 36% higher rate than males, driven particularly by the higher rates of hospitalizations and emergency room treatments among females.

Figure 1. Incidence Rates (per 100,000) of Poisonings in BC in 2003 by Age Group and Sex (n = 35,273)

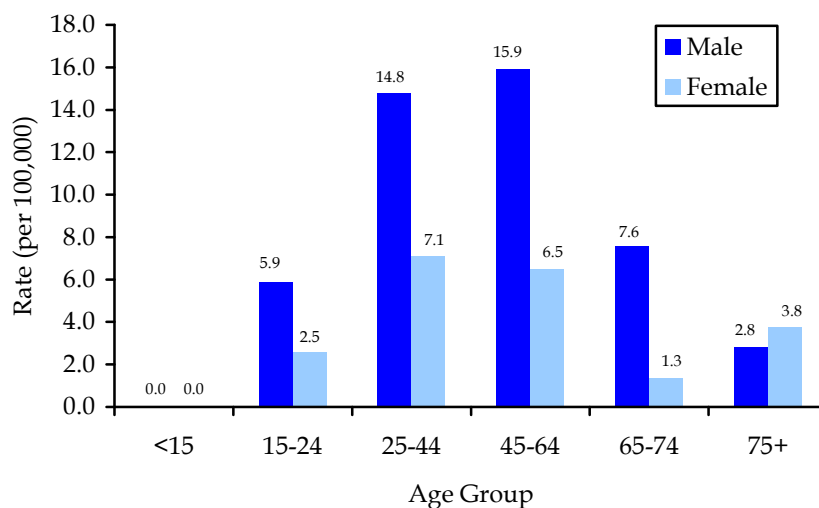


The following section further examines poisonings by age group and sex patterns, taking into account severity (fatalities, hospitalizations, emergency room treatments), intent (unintentional, suicide, suicide attempt, homicide, assault, undetermined), and leading causes (Antiepileptic, anti-parkinsonism, psychotropic drugs; Non-opioid analgesics, antipyretics, and antirheumatics; Narcotics and psychodysleptics; Alcohol; Other gases and vapors/CO; Drugs acting on the autonomic nervous system; Pesticides; Organic solvents, halogenated hydrocarbons and their vapors; and, Other/Unspecified chemicals and noxious substances).

Age Group and Sex Patterns

Figure 2a illustrates that males had more than double the rate of fatal poisonings than females for all age groups with the exception of those aged 75 years and older, and those under 15 years where no poisoning fatalities were recorded during 2003. Overall, males represented 76% of poisoning fatalities. Rates in the 25-44 and 45-64 year old age groups were 52% and 59% higher, respectively, impacting males particularly during their peak earning years. Females represented 60% of all poisoning hospitalizations, and had the highest rates of poisoning hospitalizations at all age groups except those aged 75 years and older (Figure 2b). In the 15-24 and 25-44 year old age groups, rates among females were 54% and 31% higher than their male counterparts, respectively. Males represented 54% of poisoning-related emergency room treatments and had higher rates than females for all age groups, with the exception of the 15-24 year olds (Figure 2c).

Figure 2a. Incidence Rates (per 100,000) of Poisoning Fatalities in BC in 2003 by Age Group and Sex (n = 301)



The incidence of poisonings requiring emergency room treatments was higher among younger people when compared with fatalities and hospitalizations. Forty-three per cent of the poisonings requiring emergency room treatment occurred among young people under 25 years of age, while the incidence of poisonings resulting in hospitalization and death in the same age group was 27% and 8%, respectively. Finally, Figure 2d illustrates that 45% of all poisoning and human exposure events resulting in ambulance attendance, not transferred or a call to BC DPIC occurred among children and youth under age 15 years, and of those, males had a 13% higher rate than females. In contrast, females had higher rates than males at all other age groups (except over age 75 years), where females had 22% (15-24), 24% (25-44), 33% (45-64) and 49% (65-74) higher rates than same-age males.

Figure 2b. Incidence Rates (per 100,000) of Poisoning Hospitalizations in BC in 2003 by Age Group and Sex (n = 4,939)

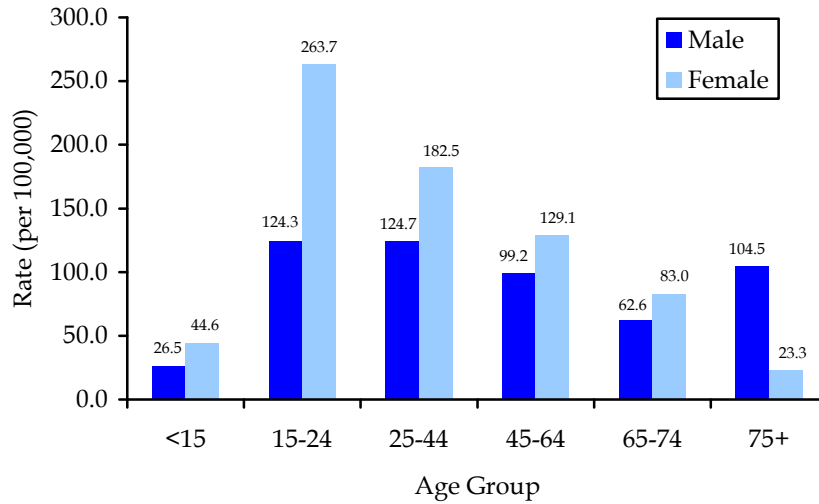


Figure 2c. Incidence Rates (per 100,000) of Poisoning Emergency Room Treatments in BC in 2003 by Age Group and Sex (n = 5,204)

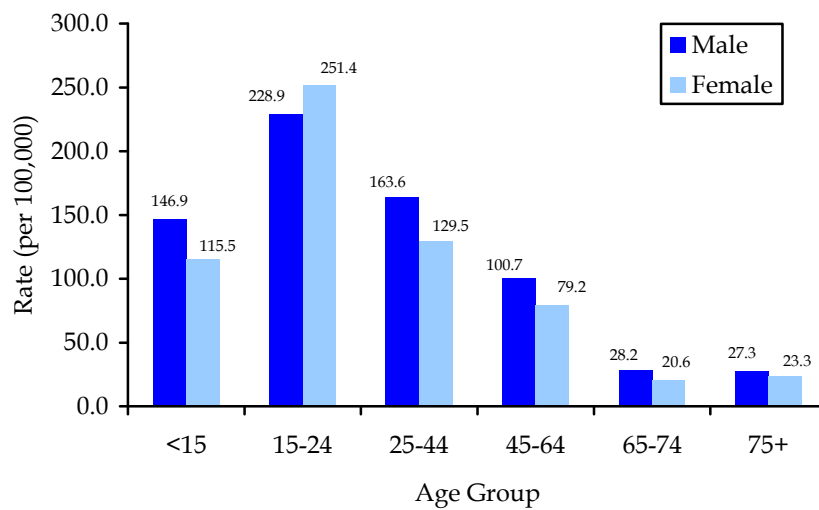
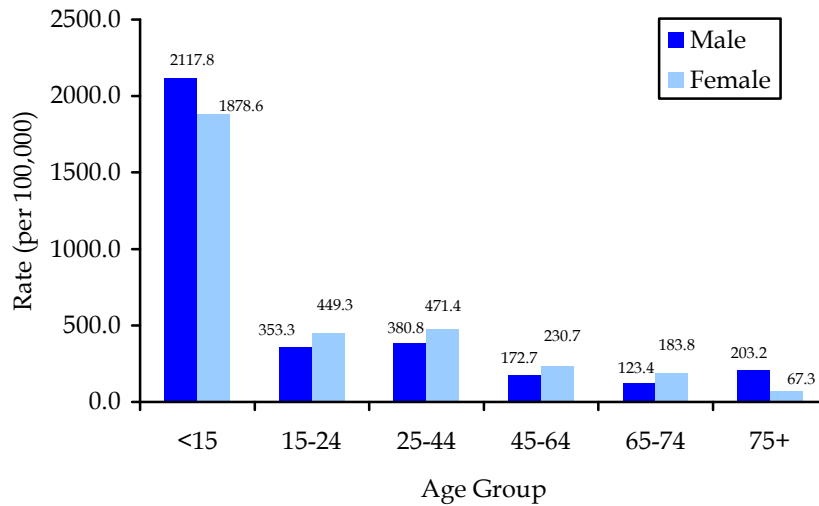


Figure 2d. Incidence Rates (per 100,000) of Poisoning and Human Exposure Resulting in Ambulance Attendance Not Transferred, or Calls to BC DPIC Emergency / Information Line (n = 24,829)



Intent

An important step in preventing poisoning injuries and fatalities is an understanding of the intent related to the poisoning event. The overall proportion of unintentional poisoning events was approximately 54%, but varied depending upon sex and the outcome related to the poisoning event. The majority of fatal poisonings (Figure 3a) and those leading to emergency room visits (Figure 3c) were unintentional (61% and 74%, respectively), while only 26% of poisoning hospitalizations (Figure 3b) were unintentional. Females demonstrated a higher proportion of poisoning-related suicide and attempted suicide (Figures 3a, 3b, 3c), while the proportion that was unintentionally poisoned was higher among males. Poisoning-related suicide fatalities and suicide attempts resulting in hospitalizations were approximately one-third higher among females (Figure 3b), while the proportion of suicide attempts resulting in emergency room treatment was some two-thirds higher than males (Figure 3c).

Data regarding intent related to poisoning and human exposure that resulted in ambulance attendance, not transferred to hospital or calls to BC DPIC was not available by sex. Figure 3d indicates, in total however, that the majority of poisoning and human exposure events were unintentional (71%). Nine per cent of poisoning and human exposure events were classed as intentional, with a total 3% (852) classified as attempted suicide.

Figure 3a. Poisoning Fatalities in BC in 2003 by Intent and Sex (n = 301)

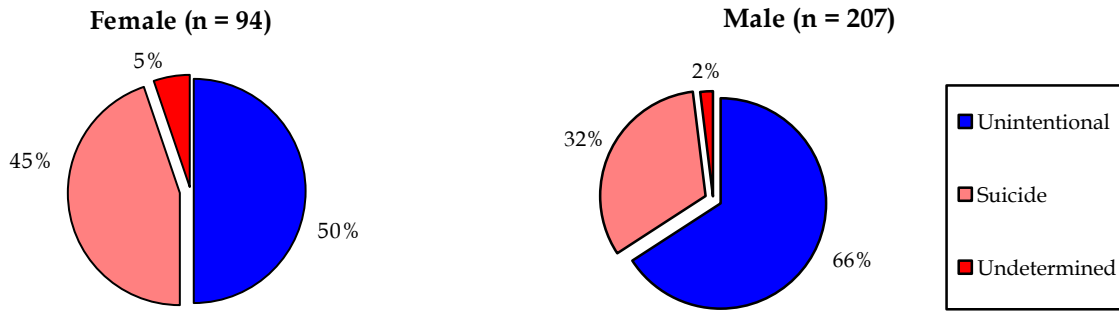


Figure 3b. Poisoning Hospitalizations in BC in 2003 by Intent and Sex (n = 4,939)

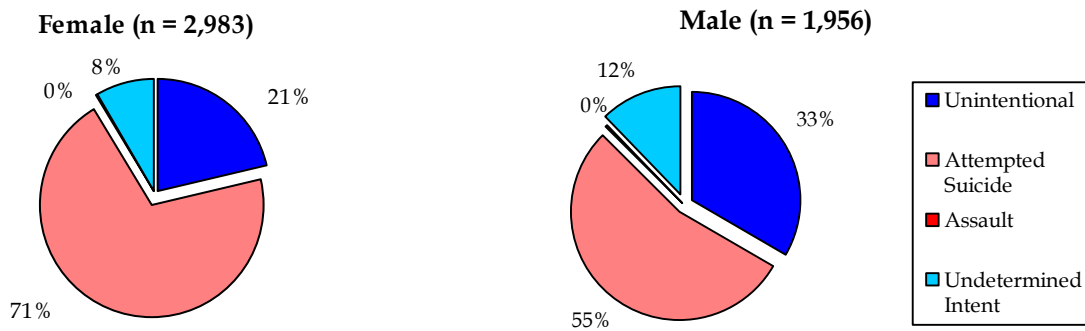


Figure 3c. Poisoning-related Emergency Room Treatments in BC in 2003 by Intent and Sex (n = 5,204)

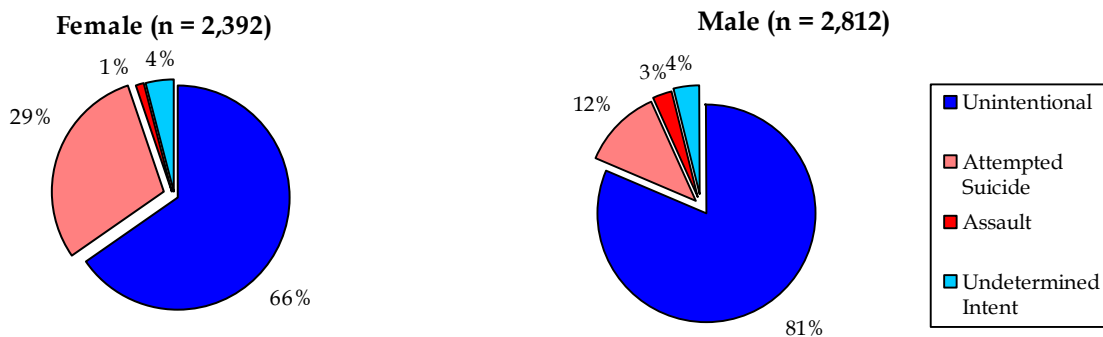
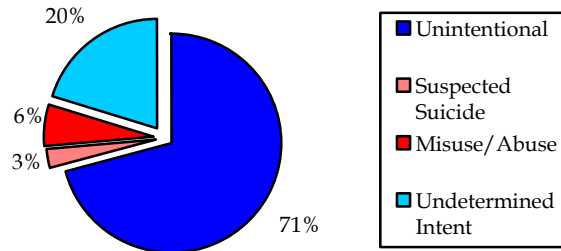


Figure 3d. Poisoning and Human Exposure Resulting in Ambulance Attendance not Transferred, or calls to BC DPIC Emergency / Information line (n = 24,829)



Figures 4a, 4b, and 4c, illustrate the incidence of poisonings by intent and age group in BC in 2003. Of the 301 fatalities (Figure 4a), 61% resulted from unintentional poisoning; half of those (33% of the total) among the 25-44 year old age group, and one-third (21% of total) among the 45-64 year olds. Suicide by poisoning represented 36% of the fatalities, and occurred in all age groups except children under 15 years old. The highest incidence of suicide occurred among those people age 45-64 years old (17% of total), followed by those ages 25-44 years (11% of total).

Figure 4a. Incidence of Poisoning Fatalities in BC in 2003 by Intent and Age Group (n = 301)

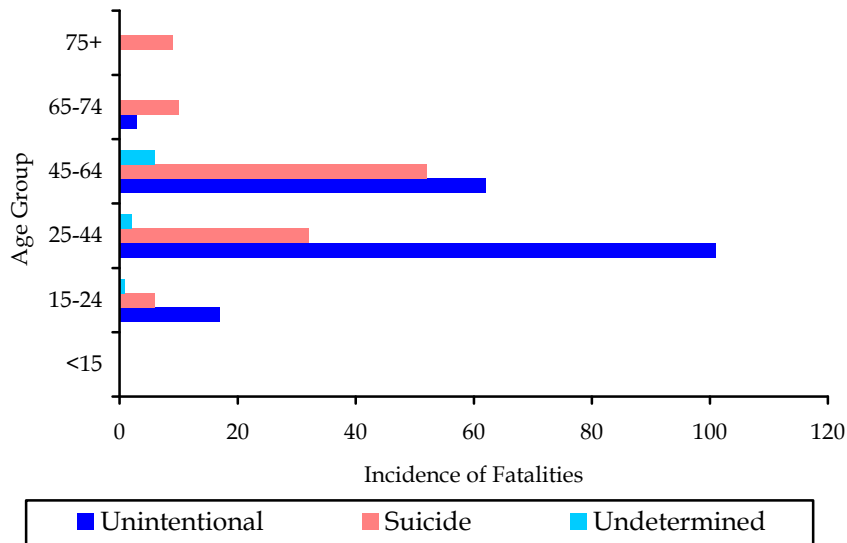


Figure 4b, illustrates that 64% of poisoning hospitalizations resulted from attempted suicides; 27% of which were among the 25-44 year old age group, 17% among the 15-24 year olds, and 15% in the 45-64 year age group. Unintentional poisoning resulted in hospitalization in 26% of the cases. Approximately 10% of the hospitalized cases were of unknown intent, and a very small number of cases (9 of 4,939) resulted from assault by poisoning.

Figure 4b. Incidence of Poisoning Hospitalizations in BC in 2003 by Intent and Age Group (n = 4,939)

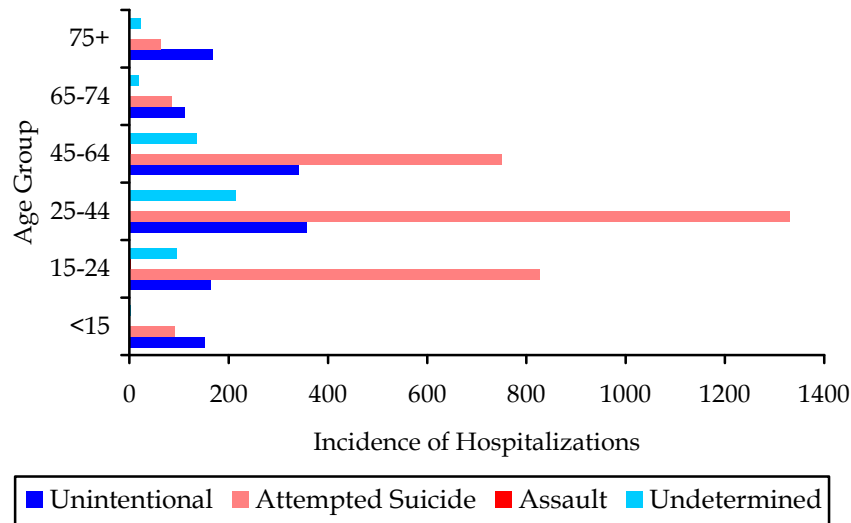
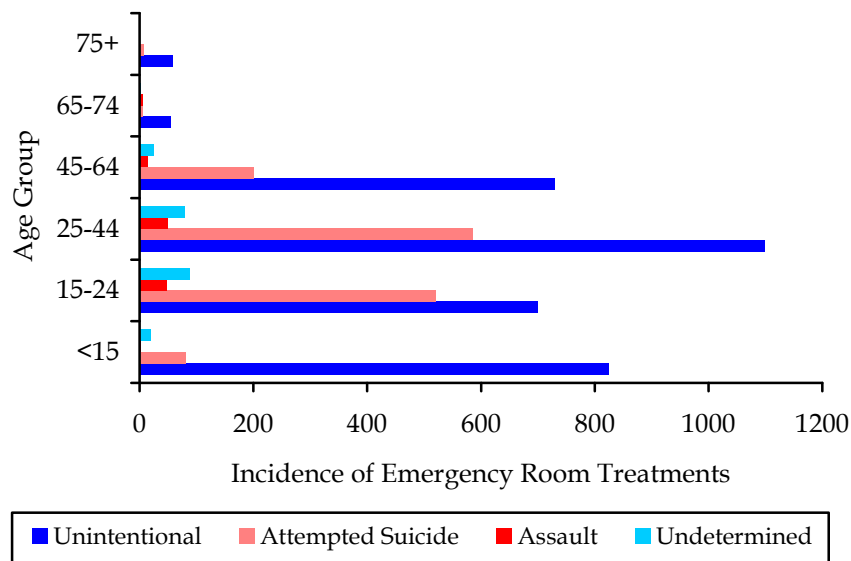


Figure 4c. Incidence of Poisoning Emergency Room Treatments in BC in 2003 by Intent and Age Group (n = 5,204)



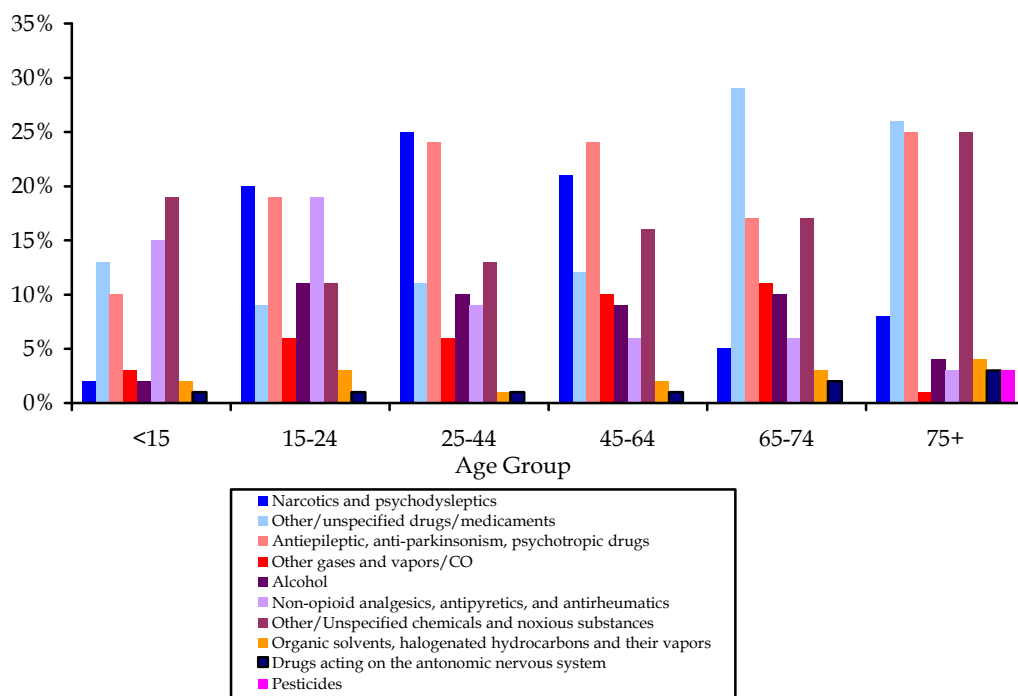
Of the 5,204 poisonings treated in emergency rooms (Figure 4c), two-thirds (67%) resulted from unintentional poisoning. The highest incidence of unintentional poisoning requiring emergency room treatment occurred in those age 25-44 years old (21%), followed by those under age 15 years (16%), 45-64 years old (14%), and those age 15-25 years old (13%). Suicide attempts by poisoning represented 27% of the emergency room treatments and occurred in all age groups. The highest incidence of suicide attempt occurred among those people age 25-44 years old (11% of total), followed by those ages 15-24 years (10% of total).

Data regarding intent by age group related to poisoning and human exposure that resulted in ambulance attendance, not transferred was not available. Data by intent and age group for calls to BC DPIC emergency / information line was categorized by different age groupings, but was categorized as 'unintentional' in 88% of the cases.

Type of Poison

Efforts to prevent poisoning injury and death depend in large measure on an understanding of the types of poisons that are involved. Figures 5a to 5d illustrate the types of poisons involved in deaths, hospitalizations, emergency room treatments, or treatments on scene by ambulance or a call to BC DPIC. Overall, ten categories of poisons were involved (Figure 5a). Using an arbitrary cut-off of 15% within each age group, the most prevalent types of poison included: Narcotics and psychodysleptics (15-24 yr, 20%; 25-44 yr, 25%; 45-64 yr, 21%), Unspecified drugs/medicaments (65-74 yr, 29%; 75+ yr, 26%),

Figure 5a. Poisoning in BC in 2003 by Type of Poison and Age Group (n = 35,273)



Antiepileptic, anti-parkinsonism, psychotropic drugs (15-24 yr, 19%; 25-44 yr, 24%; 45-64 yr, 24%; 65-74 yr, 17%; 75+ yr, 25%), Non-opioid analgesics, antipyretics, and antirheumatics (<15 yr, 15%; 15-24 yr, 19%), Unspecified chemicals and noxious substances (<15 yr, 19%; 45-64 yr, 16%; 65-74 yr, 17%; 75+ yr, 25%)

The type of poison also varied in terms of the severity of injury and the required health services treatment. Figure 5b illustrates that drugs and medications were the most prevalent types of poison leading to fatalities. Narcotics and psychodysleptics were responsible for fatal poisonings in 46% of the poisoning death in 15-24 year olds, 56% of the 25-44 year olds, and 47% of those in the 45-64 year age group. Poisoning death resulting from Unspecified drugs/ medicaments increased with age, and represented 39% and 44% in the two oldest age groups, respectively. Forty-four per cent of poisoning deaths among 75+ year olds was due to Antiepileptic, anti-parkinsonism, psychotropic drugs.

Figure 5b. Death due to Poisoning in BC in 2003 by Type of Poison and Age Group (n = 301)

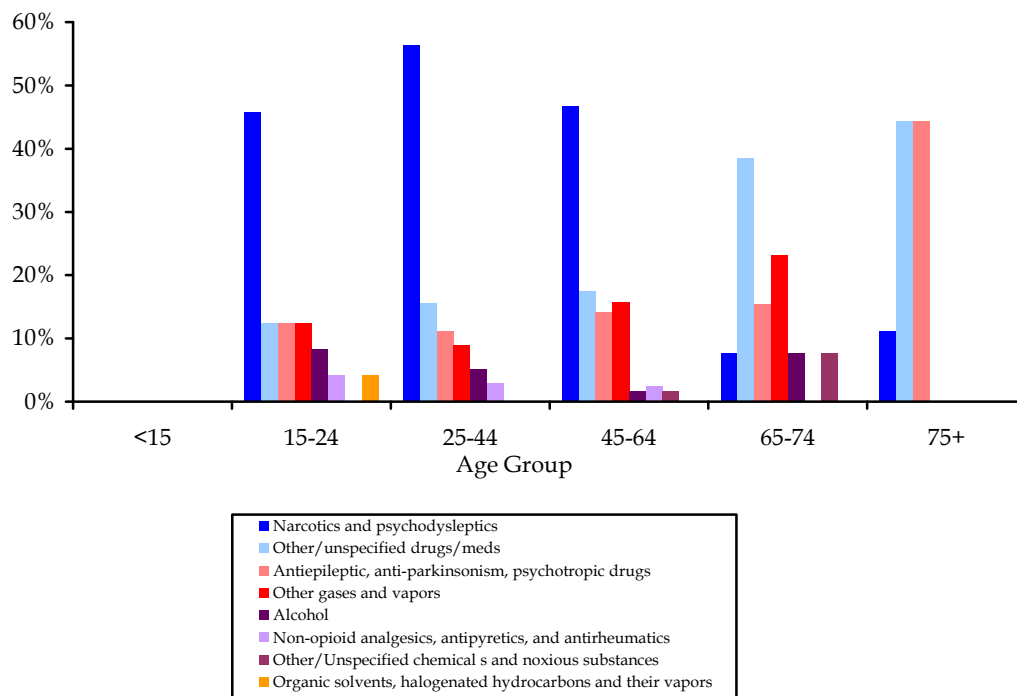


Figure 5c illustrates that drugs and medications were the most prevalent types of poison leading to hospitalizations, particularly Antiepileptic, anti-parkinsonism, psychotropic drugs, which accounted for 24% to 50% of hospitalizations (<15 yr, 24%; 15-24 yr, 33%; 25-44 yr, 46%; 45-64 yr, 50%; 65-74 yr, 37%; 75+ yr, 32%). Poisoning hospitalization from Non-opioid analgesics, antipyretics, and antirheumatics was more prevalent among young people (<15 yr, 25%; 15-24 yr, 39%) and decreased with age, while poisoning from Unspecified drugs/meds was highest in the two older age groups (65-74 yr, 23%; 75+ yr, 34%). After age 25, Narcotics and psychodysleptics were responsible for between 10% and 14% of poisoning hospitalizations.

Figure 5c. Hospitalization due to Poisoning in BC in 2003 by Type of Poison and Age Group (n = 4,939)

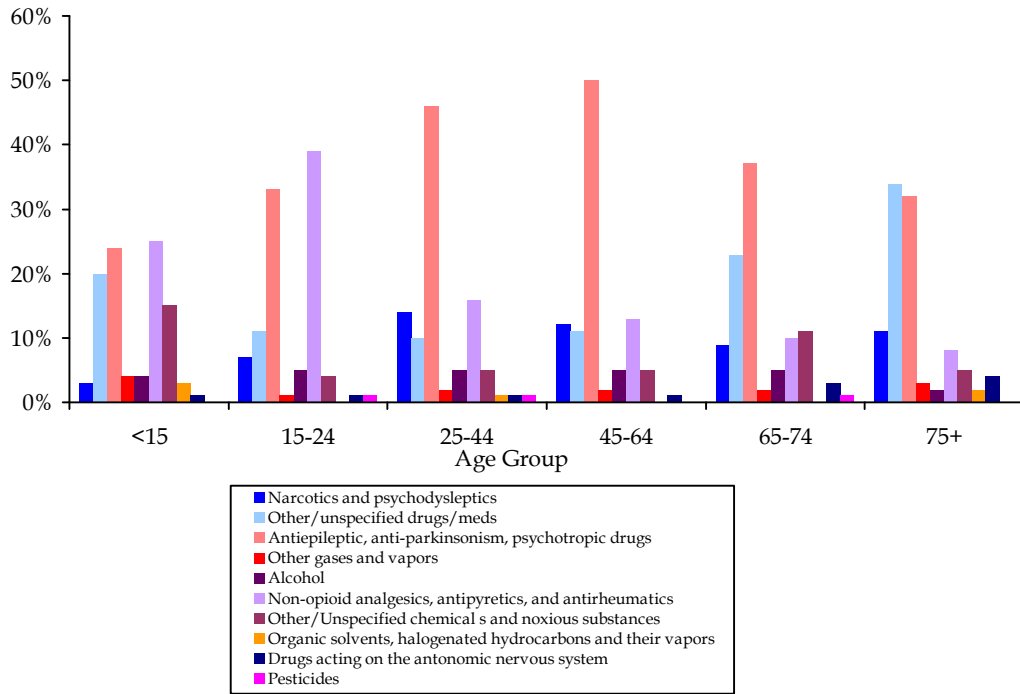


Figure 5d. Emergency Room Treatment due to Poisoning in BC in 2003 by Type of Poison and Age Group (n = 5,204)

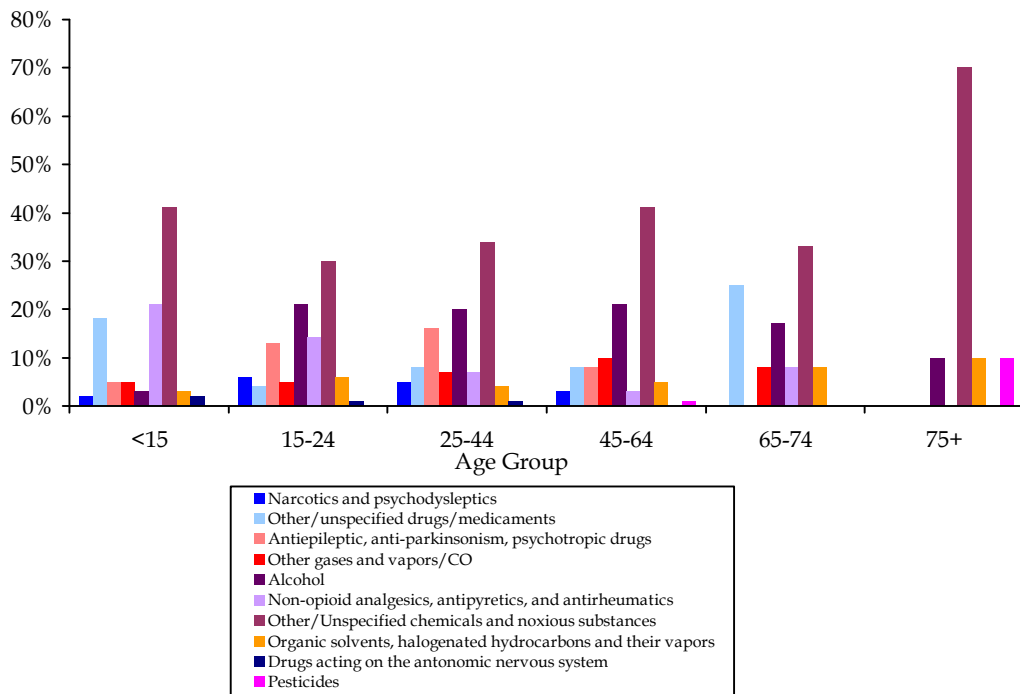


Figure 5d illustrates that Unspecified chemicals and noxious substances are the most prevalent reason for emergency room treatment of poisoning (<15 yr, 41%; 15-24 yr, 30%; 25-44 yr, 34%; 45-64 yr, 41%; 65-74 yr, 33%; 75+ yr, 70%), followed by Alcohol (15-24 yr, 21%; 25-44 yr, 20%; 45-64 yr, 21%; 65-74 yr, 17%). Unspecified drugs/medicaments accounted for 18% of the poisoning emergency room treatments in the <15 year old age group, and 25% in the 65-74 age group. Finally, Non-opioid analgesics, antipyretics, and antirheumatics accounted for 21% and 14% in the two youngest age groups, respectively.

Results: Economic Burden of Poisoning in BC in 2003

Direct Costs

Each year, poisoning injuries impose a significant economic burden on the health care system in BC. For some poisoning events, medical and rehabilitation treatments may persist for months and years following the initial injury. This section combines poisoning incidence counts from the previous section with unit costs of medical treatment and related healthcare costs to estimate the total direct costs related to poisonings that occurred in BC in 2003. Due to data limitations, the costs presented are those associated with healthcare costs; data required to estimate costs for any mental health and psychological treatment, beyond those provided within the hospital care system, or other direct costs assumed by the patient, family or friends, were not available.

The direct cost components related to poisoning are organized and divided into four mutually exclusive categories that reflect the severity of poisoning: i) fatal poisonings; ii) poisoning resulting in hospitalization with survival to discharge; iii) poisonings that were treated in a hospital emergency room and released without hospitalization; and, iv) poisonings and human exposure events resulting in ambulance attendance, not transferred and poisoning-related calls to BC DPIC. The total direct cost of poisoning is estimated by the sum of the costs in these four mutually exclusive categories. All cost estimates are presented in 2003 dollars.

Table 4 presents the total healthcare costs for poisoning injuries in BC in 2003 by age group and sex. Corresponding unit cost estimates are presented in Appendix I, Tables 4a - 4d. Poisonings that occurred in BC in 2003 cost the system \$53.5 million in direct healthcare costs: \$0.89 million for fatal poisonings; \$31.04 million for poisoning hospitalizations; \$7.33 million for poisonings requiring emergency room treatment; and, \$14.26 million for poisonings that resulted in ambulance attendance, not transferred, and calls to the BC DPIC emergency/information line.

Table 4. Total Direct Costs of Poisonings in BC in 2003 by Age and Sex (2003 dollars)

| | Fatalities | Hospitalizations | Emergency Room Treatments | Ambulance, not transferred and BC DPIC | Total |
|---------------|------------------|---------------------|------------------------------|--|---------------------|
| Total | \$888,359 | \$31,035,800 | \$7,328,249 | \$14,260,555 | \$53,512,963 |
| <15 | 0 | 1,564,672 | 1,306,805 | 8,112,949 | 10,984,427 |
| 15-24 | 70,833 | 6,836,799 | 1,910,921 | 1,300,207 | 10,118,760 |
| 25-44 | 398,433 | 11,958,114 | 2,554,467 | 3,031,158 | 17,942,172 |
| 45-64 | 354,163 | 7,722,818 | 1,365,950 | 1,247,438 | 10,690,369 |
| 65-74 | 38,368 | 1,357,306 | 97,165 | 262,005 | 1,754,844 |
| 75+ | 26,562 | 1,596,091 | 92,941 | 306,797 | 2,022,391 |
| Male | \$610,931 | \$12,291,157 | \$3,959,846 | \$7,105,427 | \$23,967,361 |
| <15 | 0 | 603,247 | 750,568 | 4,412,973 | 5,766,788 |
| 15-24 | 50,173 | 2,262,176 | 933,634 | 587,824 | 3,833,807 |
| 25-44 | 268,574 | 4,825,976 | 1,419,461 | 1,347,454 | 7,861,464 |
| 45-64 | 250,865 | 3,330,426 | 757,609 | 530,146 | 4,869,046 |
| 65-74 | 32,465 | 571,828 | 57,736 | 103,084 | 765,113 |
| 75+ | 8,854 | 697,504 | 40,838 | 123,946 | 871,142 |
| Female | \$277,428 | \$18,744,643 | \$3,368,403 | \$7,155,128 | \$29,545,602 |
| <15 | 0 | 961,425 | 557,645 | 3,699,976 | 5,219,046 |
| 15-24 | 20,660 | 4,574,623 | 977,288 | 712,383 | 6,284,953 |
| 25-44 | 129,860 | 7,132,139 | 1,133,597 | 1,683,704 | 10,079,300 |
| 45-64 | 103,298 | 4,392,392 | 604,116 | 717,292 | 5,817,098 |
| 65-74 | 5,903 | 785,478 | 43,654 | 158,921 | 993,956 |
| 75+ | 17,708 | 23,708 | 52,103 | 57,514 | 151,033 |

Figure 6 compares the relative distribution of poisoning incidence to the distribution of direct health care costs across the four mutually exclusive 'severity' categories. Poisoning hospitalizations, which accounted for 14% of all poisonings in 2003, represented 57% of poisoning-related costs. In contrast, ambulance attended, not transferred and calls to BC DPIC which accounted for 70% of all poisonings in 2003, represented 27% of the total costs. Fatalities and emergency room treatments together represented 16% of the incidence and 16% of the poisoning-related costs. Not only are poisoning hospitalizations more costly in the short term, but may require long term rehabilitation, mental health and psychological services, further contributing to the overall economic burden. This is particularly plausible given the high incidence of attempted suicides resulting in hospitalization, which would in all likelihood require longer term mental health and psychological services.

Figure 6. Distribution of Poisoning Incidence and Direct Healthcare Costs in BC in 2003 by Severity (n = 35,273)

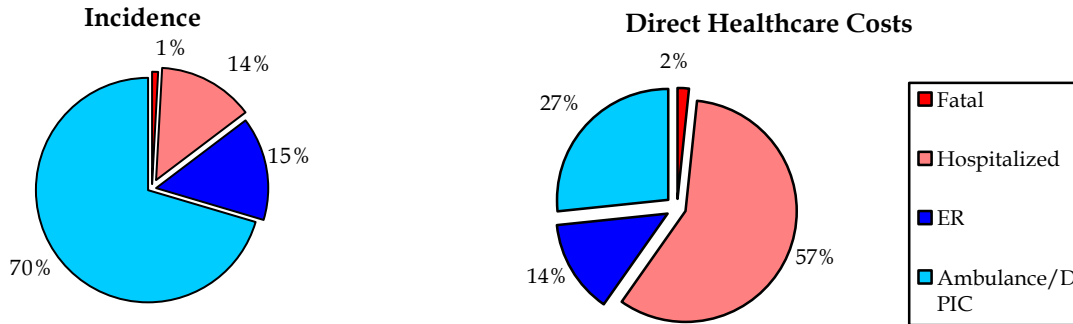


Figure 7 compares the relative distribution of poisoning incidence to the distribution of direct health care costs across the four mutually exclusive categories by sex. Males accounted for \$23.97 million, or approximately 45% of all healthcare costs related to poisoning in BC in 2003, while females accounted for \$29.55 million, or approximately 55% of all healthcare costs. This cost distribution differs from the incidence distribution reported in the previous section, where females accounted for 51% of all poisoning-related injuries.

Figure 7. Distribution of Poisoning Incidence and Direct Healthcare Costs in BC in 2003 by Sex (n = 35,273)

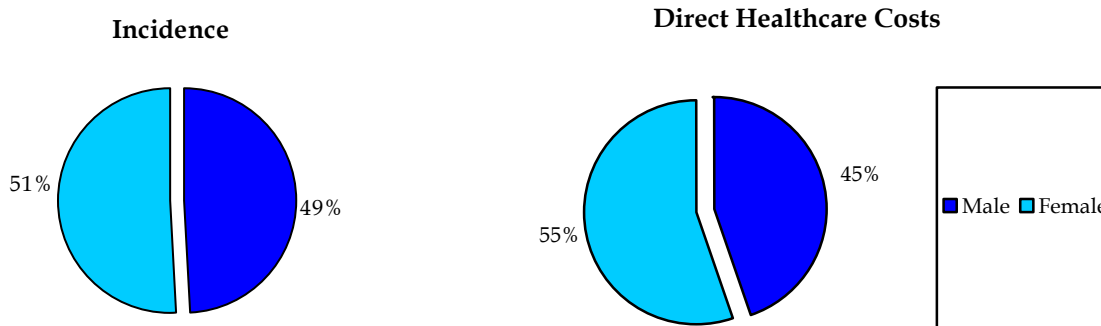
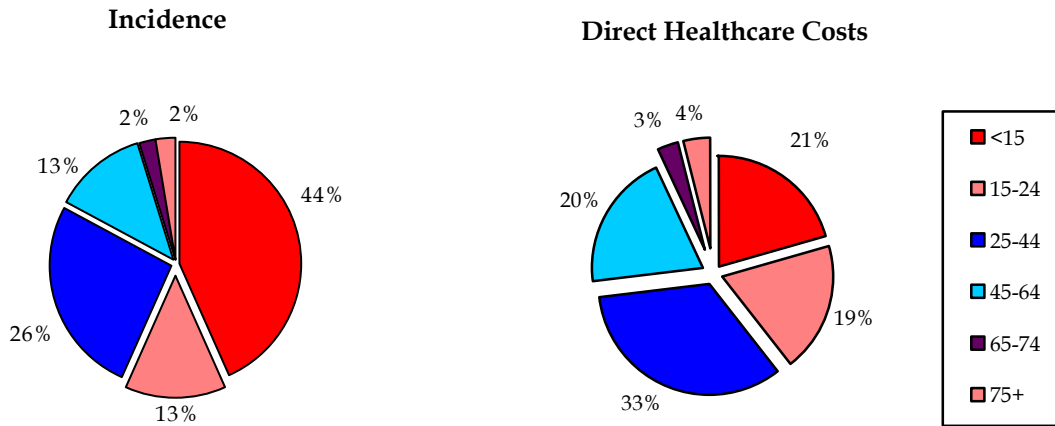


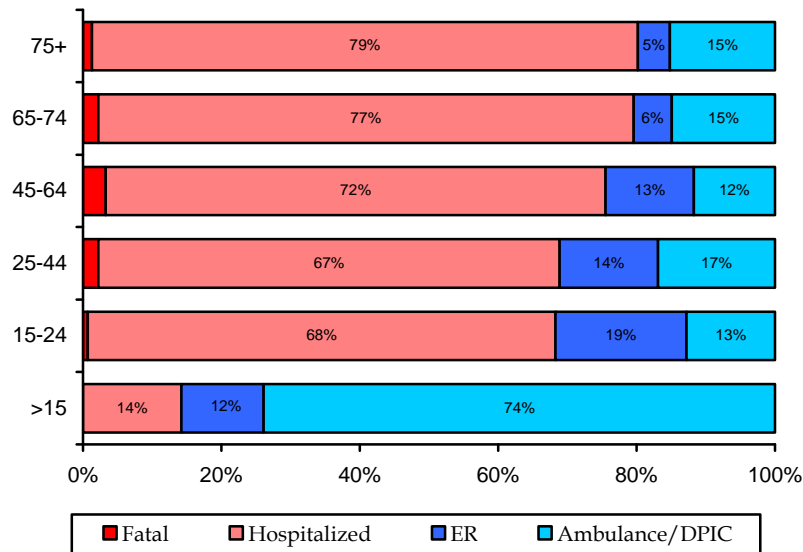
Figure 8 compares the distribution of poisoning incidence to the distribution of total poisoning-related direct healthcare costs by age group. Those aged 25-44 account for \$19.94 million, or approximately one-third of poisoning-related injury costs. This age group represents 30% of the BC population and accounted for 26% of all poisonings. In contrast, those under age 15 years (representing 18% of the BC population) accounted for 44% of poisoning-related injuries but approximately 21% (or \$10.98 million) of the poisoning-related direct healthcare costs.

Figure 8. Distribution of Poisoning Incidence and Direct Healthcare Costs in BC in 2003 by Age Group (n = 35,273)



In Figure 9, two-thirds or more of poisoning-related direct healthcare costs among people over the age of 15 years result from hospitalization costs, which increase as age increases (68% - 79%). In contrast, only 14% of the healthcare costs for poisonings among people under age 15 years result from hospitalization costs. In the youngest age group, three-quarters of all poisoning costs are attributable to relatively minor events, resulting from ambulance attendance, not transferred or calls to BC DPIC. After age 15, the relative costs associated with poisoning related ER visits decreases with age (19% to 5%). Costs related to fatal poisonings are relatively small, ranging from 1% to 3% in people over age 15 years.

Figure 9. Distribution of Poisoning Direct Healthcare Costs in BC in 2003 by Age Group and Poisoning Severity (n = 35,273)



Age Group and Sex Patterns

Figures 10a – 10d show the direct costs of poisoning in BC for 2003 by age group and sex. For all age groups between 15 and 74 years, females account for a greater percentage of poisoning-related costs than males (Figure 10a). Poisoning costs for females aged 15-24 years (\$6.28 million) and 25-44 years (\$10.08 million) are 64% and 28% higher than poisoning related costs for same-age males. However, for those over age 75 years, males account for a greater proportion of the costs than females. Poisoning related costs among males age 75 years and older (\$0.87 million) are almost six times higher than for same-age females (\$0.15 million).

Figures 10b, 10c and 10d show direct costs of poisoning-related fatal, hospitalized, and ambulance attended, not transferred and calls to BC DPIC. For fatal poisonings, direct costs for males are higher than females for all age groups younger than 75 years, and reflect the higher incidence of fatal poisonings among males. However, the cost of fatal poisonings among females over age 75 years is twice that of males (Figure 10b).

In Figure 10c, females account for higher poisoning hospitalization costs than males at all age groups, with the exception of those older than 75 years; females accounting for 59% of all poisoning related hospitalization costs. Costs for females in the 15-24 age group is more than double that of same-age males (\$4.57 million v. \$2.26 million), and 48% higher than males in the 25-44 year olds (\$7.13 million v. \$4.83 million). In contrast, males over age 75 years account for significantly higher costs than females (\$0.70 million v. \$0.02 million).

Figure 10a. Total Direct Healthcare Costs (\$M) of Poisoning in BC in 2003 by Age Group and Sex (n = 35,273)

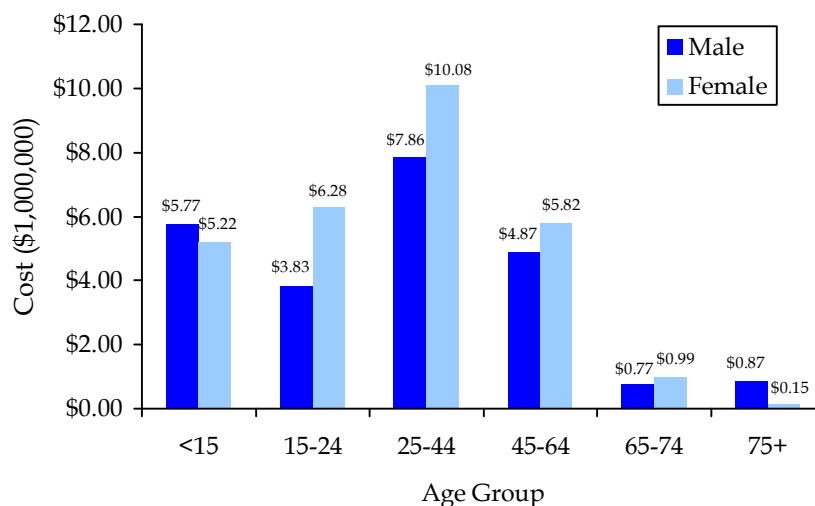


Figure 10b. Total Direct Healthcare Costs (\$M) of Poisoning Deaths in BC in 2003 by Age Group and Sex (n = 301)

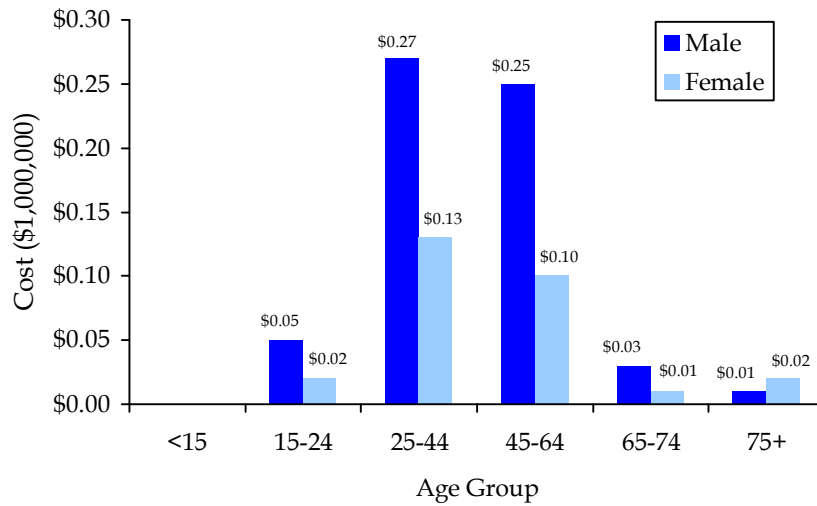
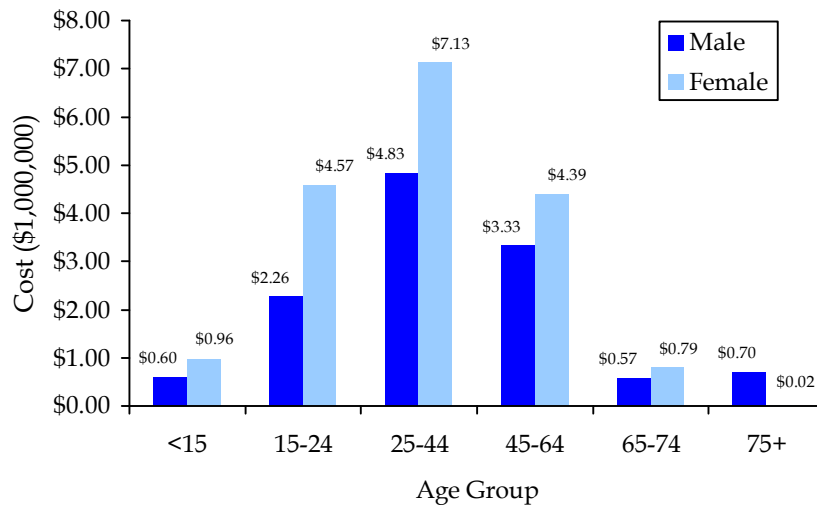
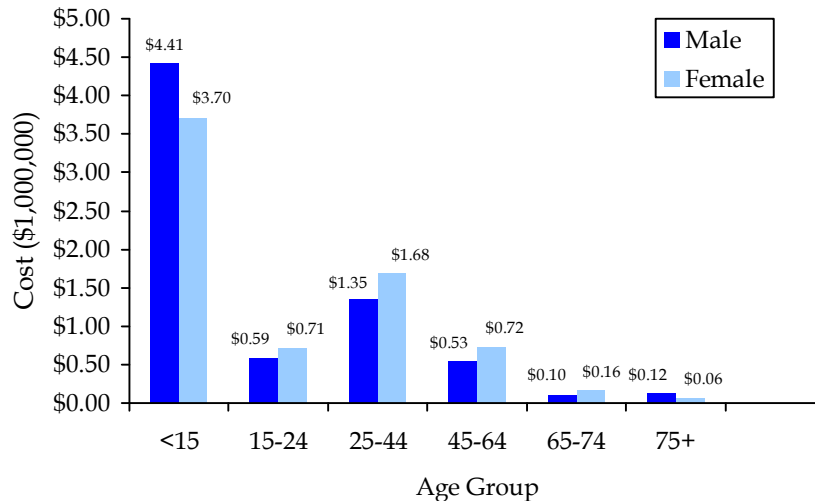


Figure 10c. Total Direct Healthcare Costs (\$M) of Poisoning Hospitalizations in BC in 2003 by Age Group and Sex (n = 4,939)



For the costs of poisoning and human exposures resulting in ambulance attendance, not transferred or calls to BC DPIC (Figure 10d), the oldest and youngest males have higher direct costs than same-age females, with the most marked difference occurring in the youngest age group. Males under age 15 years account for 31% of the total costs in the category and are 19% than same-age females (\$4.41 million v. \$3.70 million). The youngest males and females together account for 57% (\$8.11 million) of all costs in the category. Between ages 15 and 65, females account for a greater proportion of the costs than males at all age groups, while males over 75 years have higher costs.

Figure 10d. Total Direct Healthcare Costs (\$M) of Poisoning and Human Exposure Resulting in Ambulance Attendance Not Transferred, or Calls to BC DPIC Emergency / Information Line (n = 24,829)



Indirect Costs

Table 5 indicates the total indirect costs of poisonings in BC in 2003 by age group and sex. Using a 5% future discount rate, the discounted present value of future production lost due to premature mortality resulting from poisoning in BC in 2003 is estimated to be \$3.63 million based on a labour productivity growth rate of 1.1%. Of the \$3.63 million in mortality costs, \$2.39 million represents paid labour and \$1.24 million represents the estimate of unpaid labour for those in and outside of the labour force (i.e. the value of household work). Males account for 63% (\$2.3 million) of the total value of lost production due to premature death from poisoning, and among males those aged 25 to 44 years account for 48% (\$1.1 million) of that amount. In total, individuals who died between the age of 25 and 44 years account for half of all indirect poisoning mortality costs.

The estimated value of production lost due to poisonings that result in short and long term disability in BC in 2003 is \$106.71 million. Of this total, \$83.16 million is attributed to poisonings that resulted in hospitalization, \$19.47 million to those treated in emergency departments, and \$0.45 million to those resulting in ambulance attendance, not transferred or calls to BC DPIC. Of the total disability due to poisoning, people between the ages of 25 and 44 years accounted for 20% of the lost production costs. Females accounted for two-thirds of the estimated total value of production lost due to poisoning disability, and females between the age of 25 and 44 years old accounted for 13.6% (\$14.49 million) of the total.

Table 5. Total Indirect Costs of Poisonings in BC in 2003 by Age and Sex (2003 dollars)

| | Fatalities | Hospitalizations | Emergency Room Treatments | Ambulance, not transferred and BC DPIC | Total |
|---------------|--------------------|----------------------|------------------------------|--|----------------------|
| Total | \$3,634,164 | \$ 83,156,491 | \$ 19,469,825 | \$ 454,183 | \$106,714,663 |
| <15 | | | | | |
| 15-24 | \$311,869 | \$ 11,370,080 | \$ 1,214,886 | \$ 103,111 | \$12,999,946 |
| 25-44 | \$1,805,830 | \$ 18,852,932 | \$ 1,571,044 | \$ 237,831 | \$22,467,637 |
| 45-64 | \$1,379,107 | \$ 10,873,798 | \$ 750,627 | \$ 88,887 | \$13,092,419 |
| 65-74 | \$116,514 | \$ 1,607,185 | \$ 45,984 | \$ 15,867 | \$1,785,550 |
| 75+ | \$20,844 | \$ 799,969 | \$ 39,671 | \$ 8,488 | \$868,972 |
| Male | \$2,306,153 | \$ 24,775,788 | \$ 8,290,689 | \$ 157,900 | \$35,530,530 |
| <15 | | | | | |
| 15-24 | \$190,367 | \$ 2,618,561 | \$ 445,018 | \$ 34,333 | \$3,288,279 |
| 25-44 | \$1,104,754 | \$ 6,056,232 | \$ 733,510 | \$ 85,358 | \$7,979,854 |
| 45-64 | \$898,558 | \$ 3,639,320 | \$ 340,903 | \$ 29,243 | \$4,908,024 |
| 65-74 | \$91,630 | \$ 492,384 | \$ 20,472 | \$ 4,469 | \$608,955 |
| 75+ | \$20,844 | \$ 500,949 | \$ 12,077 | \$ 4,498 | \$538,368 |
| Female | \$1,328,012 | \$ 58,380,703 | \$ 11,179,135 | \$ 296,283 | \$71,184,133 |
| <15 | | | | | |
| 15-24 | \$121,502 | \$ 8,751,519 | \$ 769,867 | \$ 68,778 | \$9,711,666 |
| 25-44 | \$701,077 | \$ 12,796,701 | \$ 837,534 | \$ 152,473 | \$14,487,785 |
| 45-64 | \$480,549 | \$ 7,234,478 | \$ 409,724 | \$ 59,644 | \$8,184,395 |
| 65-74 | \$24,883 | \$ 1,114,801 | \$ 25,513 | \$ 11,398 | \$1,176,595 |
| 75+ | \$0 | \$ 299,020 | \$ 27,593 | \$ 3,990 | \$330,603 |

Figure 11 compares the relative distribution of poisoning incidence to the distribution of indirect health care costs across the four mutually exclusive 'severity' categories. Poisoning hospitalizations, which accounted for 14% of all poisonings in 2003, represented 79% of poisoning-related indirect costs. In contrast, ambulance attended, not transferred and calls to BC DPIC accounted for 70% of all poisonings in 2003, and represented less than 1% of the total indirect costs. Fatalities, and emergency room treatments together represented 16% of the incidence and 21% of the poisoning-related indirect costs. Not only are poisoning hospitalizations more costly in terms of the direct healthcare costs, but represent a huge amount (\$83.16 million) in indirect costs resulting from lost productivity and disability.

Figure 11. Distribution of Poisoning Incidence and Indirect Healthcare Costs in BC in 2003 by Severity (n = 35,273)

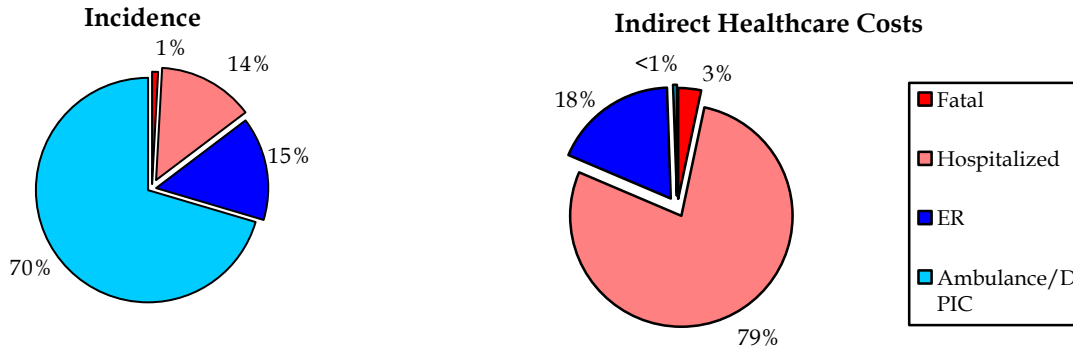


Figure 12 compares the relative distribution of poisoning incidence to the distribution of indirect health care costs by sex. Females accounted for \$71.18 million, or approximately 67% of all indirect healthcare costs related to poisoning in BC in 2003, while males accounted for \$35.53 million, or approximately 33% of all indirect healthcare costs. This cost distribution differs markedly from the incidence distribution, where females accounted for 51% of all poisoning-related injuries.

Figure 12. Distribution of Poisoning Incidence and Indirect Healthcare Costs in BC in 2003 by Sex (n = 35,273)

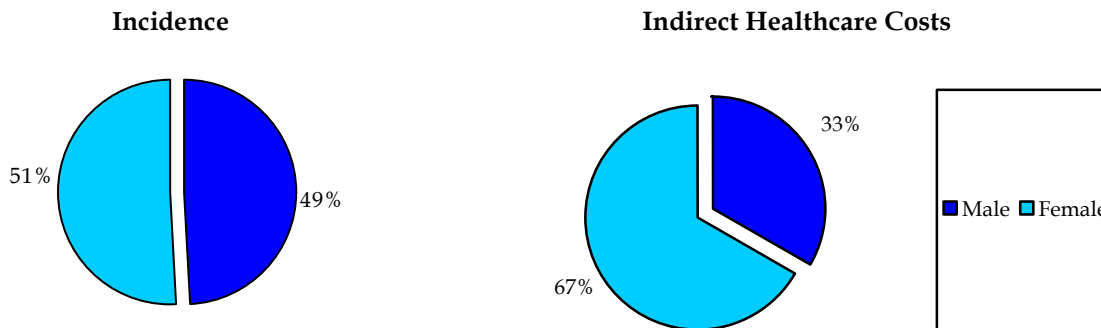
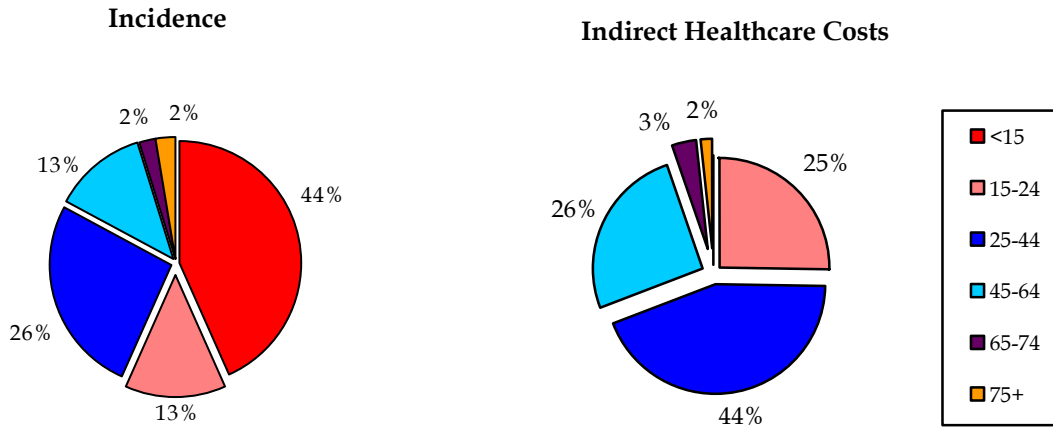


Figure 13 compares the distribution of poisoning incidence to the distribution of total poisoning-related indirect healthcare costs by age group. Those aged 25-44 account for \$22.47 million, or approximately 44% of poisoning-related death and disability costs. This age group represents 30% of the BC population and accounted for 26% of all poisonings. Those age 15-24 years old and 45-64 years old (representing 14% and 26% of the BC population, respectively) accounted for 13% and 13% of poisoning-related

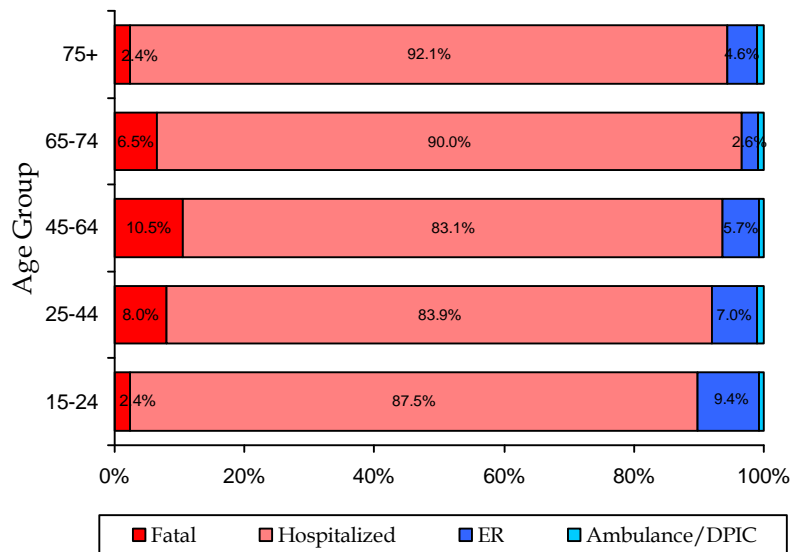
injuries, respectively, but approximately 25% and 26% (or \$12.99 million and \$13.09 million) of the poisoning-related indirect healthcare costs.

Figure 13. Distribution of Poisoning Incidence and Indirect Healthcare Costs in BC in 2003 by Age Group (n = 35,273)



In Figure 14, 80% or more of poisoning-related lost production and disability costs among people over the age of 15 years result from those who were hospitalized (range: \$0.80 million to \$18.85 million). The lost production costs resulting from poisoning fatalities are most pronounced in the 45-64 year and 25-44 year age groups (\$1.4 and \$1.8 million, respectively), reflecting the impact on people during their most productive years.

Figure 14. Distribution of Poisoning Indirect Healthcare Costs in BC in 2003 by Age Group and Poisoning Severity (n = 35,273)

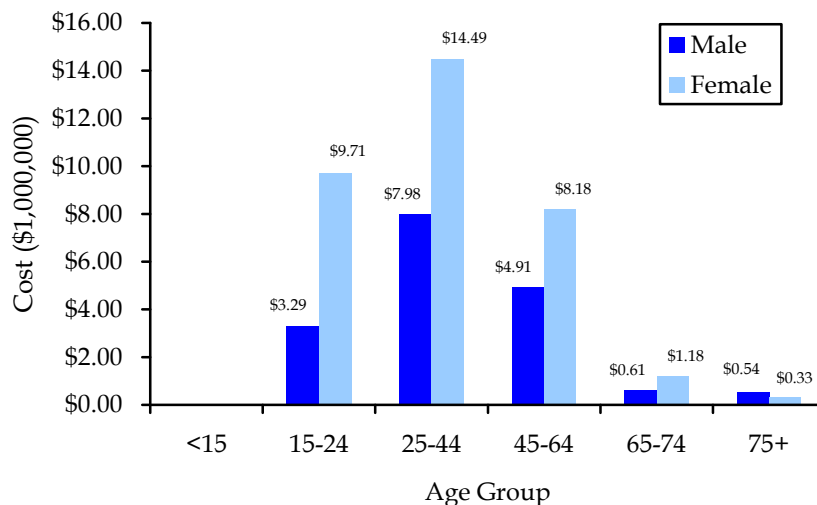


Age Group and Sex Patterns

Figures 15a - 15d show the indirect poisoning costs in BC for 2003 by age group and sex. For all age groups between 15 and 74 years, females account for a greater percentage of poisoning related costs than males (Figure 15a). Poisoning-attributable death and disability costs for females aged 15-24 years (\$9.71 million), 25-44 years (\$14.49 million) and 45-64 years (\$8.18 million) are 90%, 82% and 76% higher than poisoning related death and disability costs for same-age males. However, indirect poisoning related costs among males age 75 years and older (\$0.54 million) are marginally higher than for same-age females (\$0.33 million).

Figures 15b, 15c and 15d show poisoning related death and disability costs for males and females by age group. For fatal poisonings, costs for males are higher than females for all age groups, and reflect the higher incidence of fatal poisonings among males. The most marked difference between males and females is in the 25-44 year and 45-64 year age groups, where males account for 30% and 25%, respectively of the total indirect poisoning-related mortality costs (Figure 15b).

Figure 15a. Total Indirect Healthcare Costs (\$M) of Poisoning in BC in 2003 by Age Group and Sex (n = 35,273)



In Figure 15c, females account for higher indirect costs resulting from poisoning hospitalizations than males at all age groups, with the exception of those older than 75 years; females accounting for 70% of all poisoning related lost production and disability costs. Costs for females in the 15-24 age group is more than three times that of same-age males (\$8.75 million v. \$2.62 million), more than double that of males in the 25-44 year olds (\$12.80 million v. \$6.06 million), and double that of same-age males in the 45-64 year age group (\$7.23 million v. \$3.64 million). In contrast, males over age 75 years

account for marginally higher lost production and disability costs than females (\$0.50 million v. \$0.30 million).

Figure 15b. Total Indirect Healthcare Costs (\$M) of Poisoning Deaths in BC in 2003 by Age Group and Sex (n = 301)

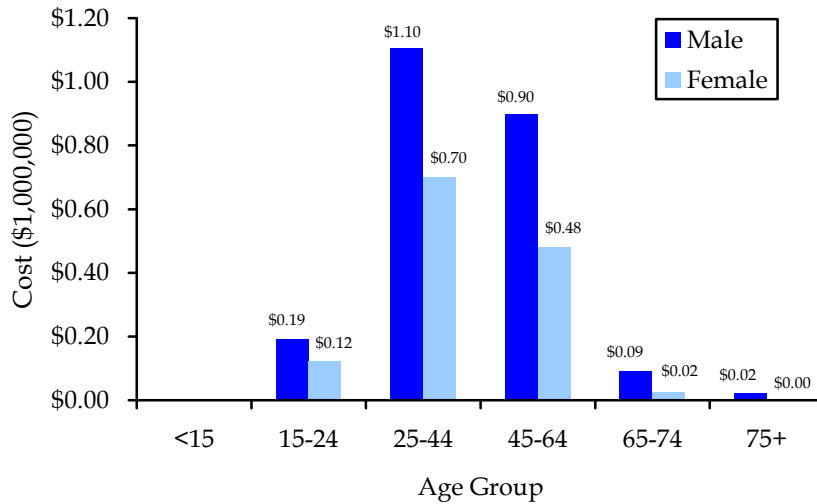
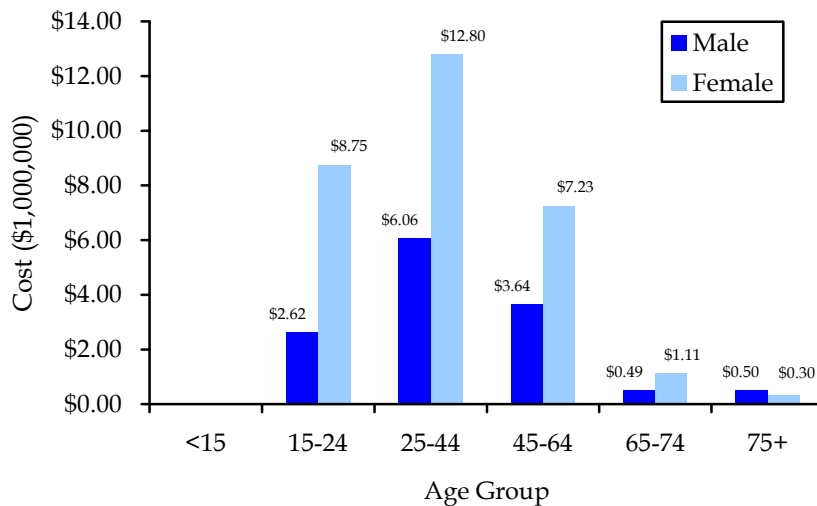


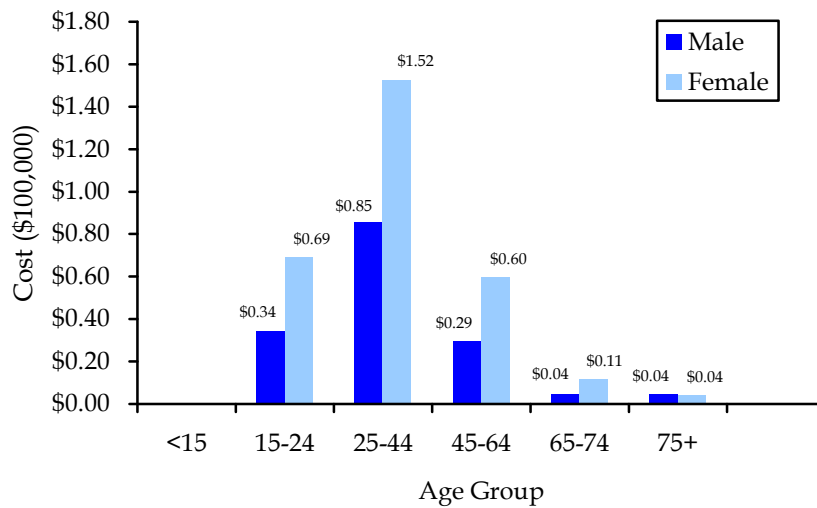
Figure 15c. Total Indirect Healthcare Costs (\$M) of Poisoning Hospitalizations in BC in 2003 by Age Group and Sex (n = 4,939)



For the indirect costs of poisoning and human exposures resulting in ambulance attendance, not transferred or calls to BC DPIC (Figure 15d), females have higher lost production and disability costs than same-age males at all age groups, with the most

marked difference occurring in the 15-24 year, 25-44 year and 45-64 year age groups. Females between ages 15-24 years account for 15% of the total costs in the category and are double those of same-age males (\$68,778 v. \$34,333). Women between ages 25 and 44 years account for one-third of the total costs in the category and are 79% higher than males (\$152,473 v. \$85,358), while females in the 45-64 year age group account for 13% of the total costs in the category and are double those of same-age males (\$59,644 v. \$29,243).

Figure 15d. Total Indirect Healthcare Costs (\$M) of Poisoning and Human Exposure Resulting in Ambulance Attendance Not Transferred, or Calls to BC DPIC Emergency / Information Line (n = 24,829)



Total Economic Burden

The total cost of poisoning in BC in 2003 is estimated to be \$160.23 million: \$53.5 million (33.4%) in direct costs and \$106.71 million (66.6%) in indirect costs.

The relative magnitude of the direct and indirect costs for poisoning events resulting in death, hospitalization, emergency room treatment, ambulance attendance, not transferred or calls to BC DPIC are given in Table 6. Hospital care expenditures represented the largest direct cost at \$31.03 million (19.4%) of the total economic burden. This was followed by direct costs for poisonings and human exposures treated on-site, either by ambulance paramedics or by BC DPIC emergency / information line (\$14.26 million, 8.9%), emergency room treatments (\$7.32 million, 4.6%), and fatalities (\$0.89 million, 0.6%).

With regard to the indirect cost components that were estimated for poisonings in BC in 2003, the value of lost production and disability following hospitalization represents the largest indirect cost, estimated at \$83.16 million (51.9% of total economic burden). This is followed by the value of lost production and disability following emergency room

treatment, estimated at \$19.47 million (12.2% of total economic burden), the value of lost production due to poisoning death at \$3.63 million (2.3% of the total), and the value of lost production and disability related to poisoning and human exposure resulting in ambulance attendance, not transferred or calls to BC DPIC at \$0.45 million (0.3% of the total).

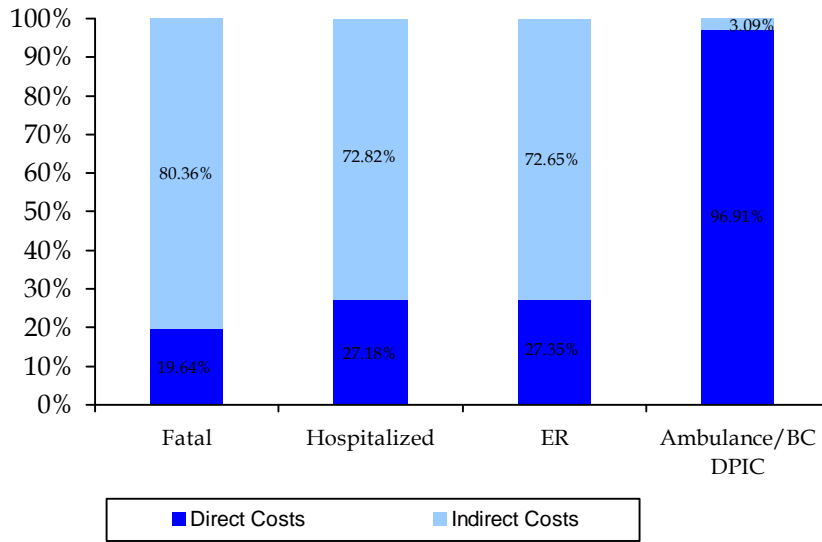
Table 6. Economic Burden of Poisoning in BC in 2003

| Cost Component | 2003 Poisoning Cost | % of Total |
|--|----------------------|---------------|
| Direct Costs | | |
| Fatalities | \$888,359 | 0.6% |
| Hospitalizations | \$31,035,800 | 19.4% |
| Emergency Room Treatments | \$7,328,249 | 4.6% |
| Ambulance, not transferred and BC DPIC | \$14,260,555 | 8.9% |
| Subtotal | \$53,512,963 | 33.4% |
| Indirect Costs | | |
| Fatalities | \$3,634,164 | 2.3% |
| Hospitalizations | \$83,156,491 | 51.9% |
| Emergency Room Treatments | \$19,469,825 | 12.2% |
| Ambulance, not transferred and BC DPIC | \$454,183 | 0.3% |
| Subtotal | \$106,714,663 | 66.6% |
| Total Cost of Poisoning | \$160,227,626 | 100.0% |

Figure 16 shows the distribution of direct and indirect (productivity loss) costs by poisoning severity (i.e. fatal, hospitalized, ER treated, ambulance attended, not transferred or calls to BC DPIC). The value of productivity losses associated with poisoning, even for less severe events exceeds the costs associated with contact with, and treatment by the healthcare system. The disparity between healthcare spending and the value of lost productivity is most pronounced for fatal poisonings; some 80% of the total cost of fatal poisoning is attributable to lost productivity and 20% is attributable to healthcare spending. Similarly, 73% of the total costs of hospitalized poisonings and those treated in the ER, are attributable to losses in productivity, while 27% are attributable to direct healthcare spending. In stark contrast, only 3% of the total cost of poisonings treated on scene by an ambulance attendant, or via a call to BC DPIC, is attributable to the value of lost productivity. The remaining 97% is attributable to the direct cost of the healthcare services.

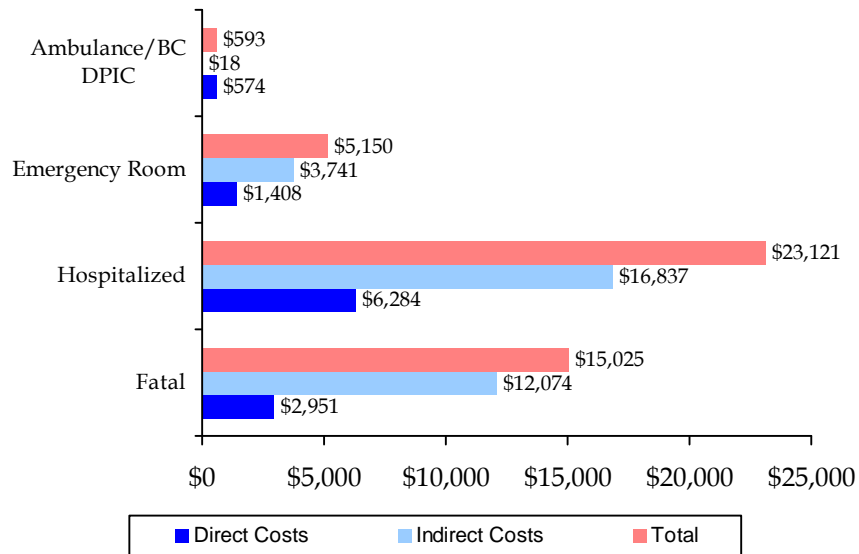
Figure 17 illustrates the unit costs per poisoning event by severity. Hospitalized cases represented 14% of the incidence, 71% of the total economic burden (19% direct costs and 52% indirect costs), and the highest per unit cost, at an estimated \$23,121 per event in direct (\$6,284) and indirect (\$16,837) costs. Fatalities represented less than 1% of the incidence and less than 3% of the economic burden, but the second highest per unit cost

Figure 16. Distribution of Direct (healthcare) and Indirect (productivity losses) Costs by Poisoning Severity (n = 35,273)



at \$15,025 (\$2,951 direct and \$12,074 indirect costs). Poisonings requiring emergency room treatment represented 15% of the incidence, 17% of the economic burden and resulted in a per unit cost of \$5,150 (\$1,408 direct and \$3,741 indirect costs). In contrast, poisonings treated on scene by ambulance or calls to BC DPIC represented 70% of the incidence and some 9% of the total economic burden (8.9% direct costs and 0.3% indirect costs), but only \$593 per event in direct (\$574) and indirect (\$18) costs.

Figure 17. Unit Cost of Direct (healthcare) and Indirect (productivity losses) Costs by Poisoning Severity (n = 35,273)



References

- ¹ Lane, R. & Desjardins, S. (2002). *Economic Burden of Illness in Canada, 1998*. Policy Research Division, Strategic Policy Directorate, Population and Public Health Branch, Health Canada.
- ² Rice, DP., Hodgson, TA., Kopstein, AN. (1985). The economic costs of illness: a replication and update. *Care Finance Rev.*, 7:61-80.
- ³ Rice, DP., Kelman, S., Miller, LS., et al. (1990). *The Economic Costs of Alcohol and drug Abuse and Mental Illness*. Contract 283-87-0007 for US Department of Health and Human Services, Alcohol, Drug Abuse and Mental Health Administration, Institute for health and Aging. San Francisco: University of California.
- ⁴ Kirschstein, R. (2000). *Disease-specific estimates of direct and indirect costs of illness and NIH support: fiscal year 2000 update*. Department of Health and Human Services, National Institute of health, Office of the Director.
- ⁵ Hodgson, TA., Meiners, M. (1982). Cost-of-illness methodology; a guide to current practices and procedures. *Millbank Q.* 60(3):429-62.
- ⁶ Canadian Institute for Health Information (2000). *National health expenditure trends (NHEX), 1975-2000*.
- ⁷ Statistics Canada. (Last modified: 2005-02-17). Life expectancy at birth, by sex, by province. <http://www40.statcan.ca/101/cst01/health26.htm>
- ⁸ BC Stats (December 19, 2003). Infoline: BC At A Glance... Issue: 03-51 <http://www.bcstats.gov.bc.ca/releases/info2003/in0351.pdf>
- ⁹ Chandler, B. (1994). *The value of household work in Canada, 1992*. Statistics Canada, Ministry of Industry. Ottawa, ON.
- ¹⁰ Hamdad, M. (2003). *Valuing Households' Unpaid Work in Canada, 1992 and 1998: Trends and Sources of Change*. Statistics Canada Economic Conference. May, 2003
- ¹¹ Finklestein, EA., Corso, PS., Miller, TR, et al. (2006). *The Incidence and Economic Burden of Injuries in the United States*. Oxford University Press, Inc. New York.