Injury Data 101: How do we describe the burden of an injury?

This factsheet is the third in a series on injury and injury data in British Columbia (BC). Visit injuryresearch.bc.ca/data for more information on data in BC.

There are many ways to present injury data—it can be helpful to pay attention to these two principles:

1. **Keep it simple:** Present the story as clearly as possible.
2. **Know your audience:** This determines both the level of complexity of how you should present the data, as well as which components of the data you present.

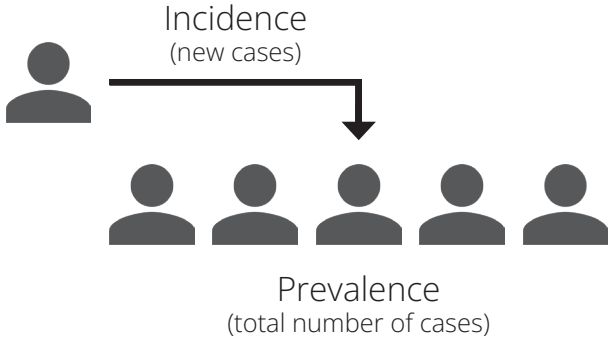
- Injury data are mostly captured using administrative datasets.
- **Injury deaths** are usually presented by calendar year: January 1st to December 31st.
- **Injury hospitalizations** are usually presented by fiscal year: April 1st to March 31st.

Frequency and rate

Frequency, or occurrence, describes the number of cases or events.

In injury prevention, frequency usually refers to new cases – incidence – rather than prevalence.

- **Incidence** is the number of **new cases** occurring in a population during a defined time period.
- **Prevalence** is the **total number of all cases** in a population during a defined time period.



For example:

- The number of hospitalizations for brain injury in BC for 2022 = incidence of brain injury
- The number of people living with brain injury in BC for 2022 = prevalence of brain injury

Rate is a measure of the frequency of an event during a defined time period within a defined population.

Rates are used to compare the frequency of injury with other time periods or other populations.

A rate is calculated by dividing the frequency of injury by the total population.

$$\text{Rate} = \frac{\text{Frequency}}{\text{Population}} \times 100{,}000$$

Injury rates are often expressed as the number of cases or events per 100,000 population, but can be presented as per 1,000,000, per 100, per 10, etc., depending on the scale of the issue.

Populations can be defined by different attributes, such as geographic area or age, during a specific time period.

Examples:

- Residents of BC in 2020
- Children ages 0-14 years in Prince George in 2020
- Cyclists in Vancouver in 2010
- Women in the workforce in Canada in 2000

To calculate a rate, you need

- a **numerator** – the frequency
- a **denominator** – the population of interest

Choosing a denominator is not always easy. Not all population numbers are readily available, and not all injury data are population-based. The denominator may also influence how the information is interpreted.

The best denominator accurately reflects the population at risk.

Example: to measure the rate of cycling injuries in a specific area, the denominator could be:

- the total population
- the number of people who own bicycles
- the number of active cyclists
- the total number of kilometres cycled

The number of active cyclists or the total distance travelled may be the best reflections of the population at risk. Unfortunately, this information may not be available.

The Canadian Hospital Injury Reporting and Prevention Program (CHIRPP) is a hospital-based surveillance system collecting information on injuries seen in the emergency department. BC Children's Hospital is a provincial facility based in Vancouver. The CHIRPP data from BC Children's Hospital are not considered to be population based, as the hospital's emergency department does not receive all pediatric patients within a defined geographic area.

Age Specific Rates

Age specific rates are calculated for a specific age group within a specific population. They are true rates as they are based on the actual population of this age group for the area, and can be used to **make comparisons with other age groups for the same area.**

Comparing Age Specific Rates
Who is at higher risk of a fall-related injury: children 0-4 years old or young adults 25-29 years old?

Infants and toddlers ages 0 to 4 years

- Frequency = 261 cases
- Population = 226,952 infants & toddlers
- **Age specific rate = 115 per 100,000 population** (=261/226,952 x 100,000)
- For every 100,000 infants & toddlers in BC in 2019/20, 115 were hospitalized for a fall-related injury.

Young adults aged 25 to 29 years

- Frequency =267 cases
- Population = 354,580 young adults
- **Age specific rate = 75.3 per 100,000 population**
- (=267/354,580 x 100,000)
- For every 100,000 adults 25 to 29 years of age in BC in 2019/20, 75 were hospitalized for a fall-related injury.

Interpretation: Although the frequency of fall-related hospitalizations was similar for infants & toddlers and young adults, proportionally, more infants & toddlers are being hurt from falls than young adults. Therefore, infants & toddlers are at higher risk of a fall-related injury than young adults.

Age Standardized Rates

Age standardized rates are used to **make comparisons between populations across different geographic regions**. As these are calculated based on a standard population, they account for differences in population composition, such as higher or lower proportions of youth or older adults. Age standardized rates are not true rates, as they are not based on the actual population of the area.

To calculate an age standardized rate (AAR), an age specific rate (ASR) for each age group is first calculated by dividing the number of cases by the respective population, and then multiplying by 100,000. Each ASR is then multiplied by the proportion of the standard population belonging to the particular age group. The AAR is obtained by adding the resulting numbers: AAR = Sum of (age specific frequency / age specific population x 100,000 * standard population)

Comparing Age Standardized Rates
In the fiscal year 2019/20, Fraser Health was seen to have a higher number of fall-related hospitalizations as compared to Island Health. Are people in Fraser Health at a higher risk for fall-related hospitalizations?

Fraser Health	Island Health
• Cases = 6,771 • Residents = 1,915,012 • Rate = 353.6 cases per 100,000 population (=6,771/1,915,012 X 100,000) • But, the proportion of residents ages 75 years and older is 6.7% • **Age standardized rate* = 358.8 per 100,000**	• Cases = 4,303 • Residents = 861,039 • Rate = 499.8 cases per 100,000 population (=4,303/861,039 X 100,000) • But, the proportion of residents ages 75 years and older is 10.0% • **Age standardized rate* = 377.6 per 100,000**

**Age-standardized rates calculated by Injury Data Online Tool (iDOT) using the BC 2011 population as the standard population*

Interpretation: While there were over 2,000 more fall-related injury hospitalizations in Fraser Health in 2019/20, the hospitalization rate was higher in Island Health as there were fewer residents. However, older adults are known to be at greater risk of falling than the general population. Therefore, if the regions have different population structures, hospitalization rates are not a fair comparison. Island Health was seen to have a similar age standardized fall-related hospitalization rate as Fraser Health, taking the higher proportion of older adults in Island Health into account.

Rates for injury deaths and hospitalizations are available from iDOT. Age specific rates are calculated by selecting "Rate per 100,000 Population" and breakdown by "Age Group", while age standardized rates are calculated by selecting "Age Standardized Rate per 100,000 Population" and including all age groups except "Unknown". Note: age standardized rates cannot be broken down by age group.

Other statistical metrics

Statistical metrics each tell part of the story. Each measure has advantages and disadvantages, and can be misleading if taken by itself. As such, many different statistical metrics are often used to tell a story.

- Raw counts are important for resource and personnel allocation (we need $X to handle Y cases)
- Raw rates are important for determining risk
- Age standardized rates are important when comparing regions with different age demographics

The burden of injury can also be presented as a comparison to other causes of death or disability, such as cardiovascular disease or diabetes, or as a comparison across populations or over time.

Other ways to describe the burden of injury in terms of death or disability include:

- Potential Years of Life Lost (PYLL)
- Preventable Years of Life Lost (PrYLL)
- Disability-Adjusted Life Years (DALYs)

PYLL

From ages 1 to 44 years, injuries account for approximately 40% of all Potential Years of Life Lost (PYLL).

The PYLL, or potential number of years of life lost, are higher for young people who have many years of life left to live, and lower for older people who have already lived many years of life.

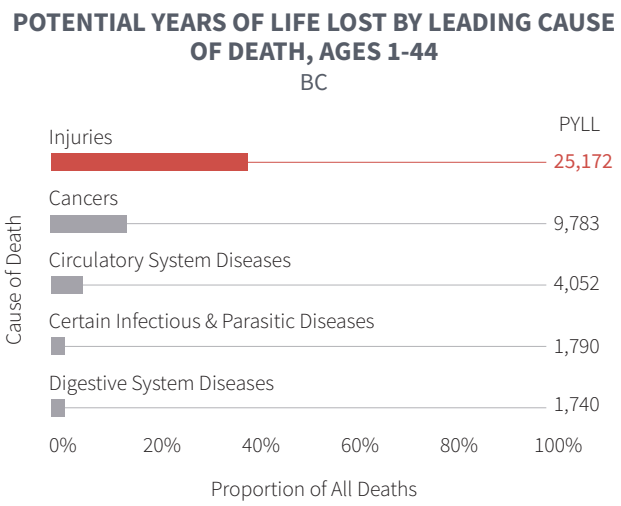
PrYLL

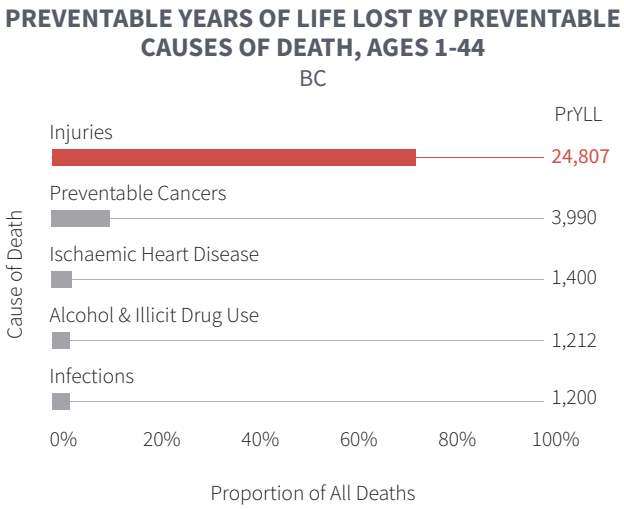
From 1 to 44-years-old, injuries account for over 70% of all Preventable Years of Life Lost (PrYLL).

While not all deaths are considered to be preventable, such as from certain types of cancer or genetic conditions, nearly all injuries are considered to be preventable.

Using PrYLL instead of PYLL to describe the burden of injury, as compared to other causes of death, highlights that:

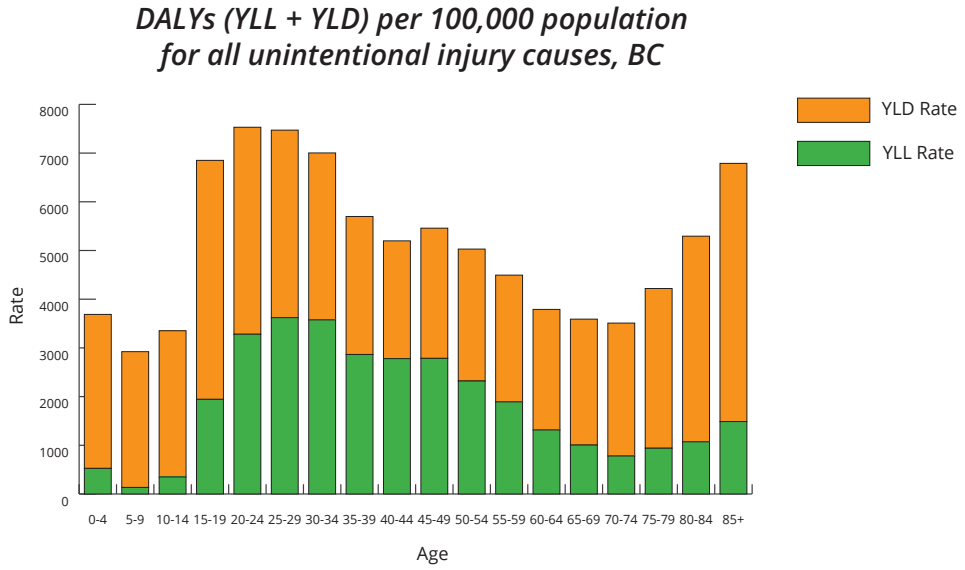
- injury is the leading cause of death among younger people
- injuries are preventable





DALY

Disability-Adjusted Life Years (DALYs) measure the loss of expected healthy life years as a total of years lived with disability (YLD) and years of life lost (YLL).



Using DALYs to describe the burden of injury highlights that:

- severe injury has a larger impact on the lives of younger people than older people
- severe injury results in a high burden to society

Economic burden of injury

The economic costs of injury are made up of:

- **Direct costs** to the health care system
- **Indirect costs** to society resulting from an individual's lost productivity and caregiving needs

Calculating the economic costs of injury is a lengthy and complicated undertaking. Health care costs include hospitalization, physician and health professional services, drugs, and rehabilitation. Indirect costs consider loss of earnings for those 15 to 64 years of age. Other information involved in the calculations includes wage rates, unemployment rates, and real wage growth rates.

Costs calculated are an underestimation as we cannot take into account the intangible costs experienced by the individual and others which are difficult to measure, such as loss of independence, reduced quality of life, physical and emotional pain and suffering.

Health care system costs

- Ambulance transportation
- Treatment in the emergency department
- Physician and specialist services
- Hospital costs
- Long-term medical and rehabilitation costs

Indirect costs

- Informal and formal caregiving
- Productivity losses (workforce, household)
- Loss of life

RESOURCES

BCIRPU Case for Injury Prevention: https://www.injuryresearch.bc.ca/injury-priorities/case-for-ip/

Cost of Injury: https://costofinjury.ca/

Potential Years of Life Lost and Preventable Years of Life Lost: A Primer: https://open.library.ubc.ca/media/stream/pdf/52387/1.0396148/5

Disability-Adjusted Life Years (DALYs): A Primer: https://open.library.ubc.ca/media/stream/pdf/52387/1.0396147/5

Injury Data Online Tool (iDOT): https://www.injuryresearch.bc.ca/idot/

REFERENCES

A Dictionary of Epidemiology. Third Edition. Ed John M. Last. A Handbook Sponsored by the I.E.A. Oxford University Press. Toronto. 1995.pp.180

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