Understanding Counts and Rates

NCDHHS Division of Public Health, Injury and Violence Prevention Branch (IVPB), Epidemiology, Surveillance, and Informatics (ESI) Unit

IVPB includes different types of data and statistics in our data resources, like counts, percentages, and rates.

This document helps to describe the differences between each of these data points, and why they are used.

Injury Counts

Injury counts show the total number of events or injuries.

Counts are a whole number. They are also sometimes called raw numbers.

- Counts are useful to understand how many injuries happened in NC and the number of injuries among specific groups or areas in the state.
- Counts are not adjusted to account for the size of groups or the time period of the data.

Injury Rates[1-2]

Injury rates are useful for comparing groups or trends over time.

Rates are the result of dividing one count by another.

- Rates are calculated over a specific period of time as:

$$\text{Injury Rate} = \frac{\text{the number of injuries for a group during a time period}}{\text{the total population for that group during the same time period}} \times \text{rate multiplier (e.g. per 100,000 population).}$$

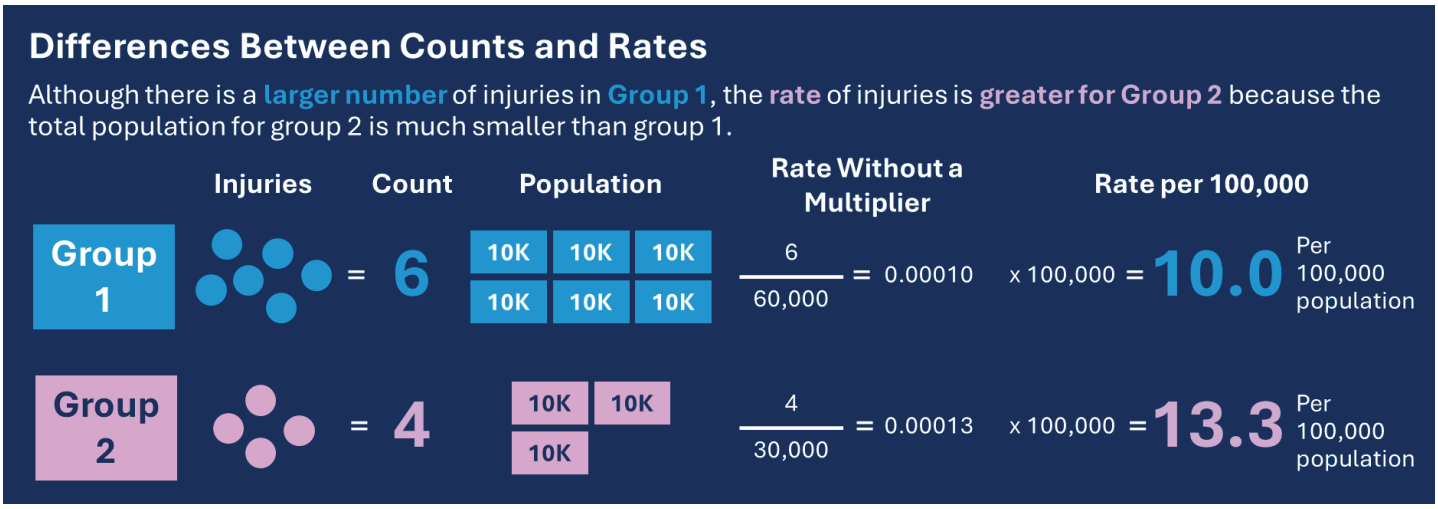
- Because rates account for the size of the full group and are over a specific time period, they provide a more realistic comparison between groups over that time frame.
    - Calculating rates that account for the size of the population allows us to compare injury rates in small populations to injury rates in large populations to understand different experiences between groups.

Some of the content in this brief was generated with assistance from ChatGPT. All content derived from ChatGPT was thoroughly reviewed, validated, and synthesized by IVPB staff to ensure accuracy and alignment with public health standards.

[1] *OpenAI. (2025). ChatGPT (August 12 version) [Large language model]. https://chat.openai.com*

[2] *NC State Center for Health Statistics. (2013). Statistics primer: Understanding age-adjusted death rates (2nd ed.). North Carolina Department of Health and Human Services. https://schs.dph.ncdhhs.gov/schs/pdf/primer13_2.pdf.*

- Rates often use a multiplier, like a rate per 100,000 population. Scaling the data like this makes rare events easier to see and compare.
    - Without a multiplier most rates would be very small decimal numbers.
    - Using a multiplier helps to make the rate more meaningful and understandable.



The figure above gives an example of an injury rate calculation for two groups. Even though there may be more injuries in Group 1 (six injuries compared to four in Group 2), Group 2 has a higher rate when considering there is a smaller total number of people in that group (13.3 compared to 10.0 per 100,000).

Types of Rates

There are different types of rates.

Percentages

Percentages, or proportions, compare a part of something to its whole and are a type of rate per 100.

Percentages are rates, but not all rates are percentages.

$$\text{Percentage} = \frac{\text{The number of events for } \textbf{part of the group} \text{ during a time period}}{\text{The number of events for the } \textbf{whole group} \text{ during the same time period}} \times 100$$

Below are some examples of how IVPB uses percentages:

- Of the 4,442 overdose deaths in 2023, 3,417, or 77%, involved fentanyl.
- 967, or 62%, of the 1,562 suicides in 2022 involved a firearm.
- 21,695, or 78%, of the 27,880 hospitalizations for fall injuries in 2023 were among adults 65 and older.

IVPB uses percent change to understand how much something has increased or decreased over time.

Percent change takes the difference of a value (percentage, count, rate, etc.) at two points in time, divided by the starting value.

$$\text{Percent Change in the Injury Rate from 2020 to 2025} = \frac{(\text{2025 Injury Rate} - \text{2020 Injury Rate})}{\text{2020 Injury Rate}} \times 100$$

For example:

- There was a **228% increase** in medication and drug overdose deaths over the 10-year period of 2014-2023 (1,355 deaths in 2014 and 4,442 deaths in 2023).
- The number of emergency department (ED) visits for motor vehicle traffic injuries **decreased by 2%** from 124,932 ED visits in 2019 to 121,930 ED visits in 2023

Crude Rates[1]

IVPB uses crude or unadjusted rates to monitor injuries over time and compare the burden of injuries across groups.

Crude injury rates are the number of injuries that occurred divided by the population at risk of injury for a given time frame, like the rate shown in the figure on page 1. These are rates that have not incorporated any considerations for differences between populations.

- A crude rate is a rate that has not been adjusted.
    - Crude rates do not take into account the difference in the risk of an injury between groups within the total population (see Age-Adjusted Rates below).
- IVPB calculates crude rates among specific groups, such as rates by age group, sex, and race-ethnicity.
    - These group-specific rates can be compared to show differences within groups.
        - For example, fall injury rates among children are much lower than fall injury rates among older adults.
    - Group-specific rates help focus public health prevention on those experiencing the greatest burden, or highest rate, of injury.
        - Reducing injuries among groups with the highest rates of injury will reduce the overall injury rate and help reduce disparities.
        - For example, if a quarter of the 1,780 fall deaths in older adults (ages 65+) had been prevented in 2023, the overall fall death rate would be reduced from 18.5 to 14.4 per 100,000.
- IVPB typically uses a multiplier of 100,000 when calculating crude rates of injuries.
- Below are some examples of how IVPB uses crude rates:
- The overdose rate in NC in 2023 was 41.0 per 100,000, an increase from the overdose rate in 2014 (13.6 per 100,000).
- The firearm death rate in NC was higher for Non-Hispanic (NH) American Indian/Alaskan Native (26.3 per 100,000) and NH Black (25.4 per 100,000) residents than the state rate of 15.2 per 100,000 in 2022.
- Overdose death rates were lowest in Tyrrell County (0.0 per 100,000) and highest in Swain County (122.2 per 100,000) in 2023.

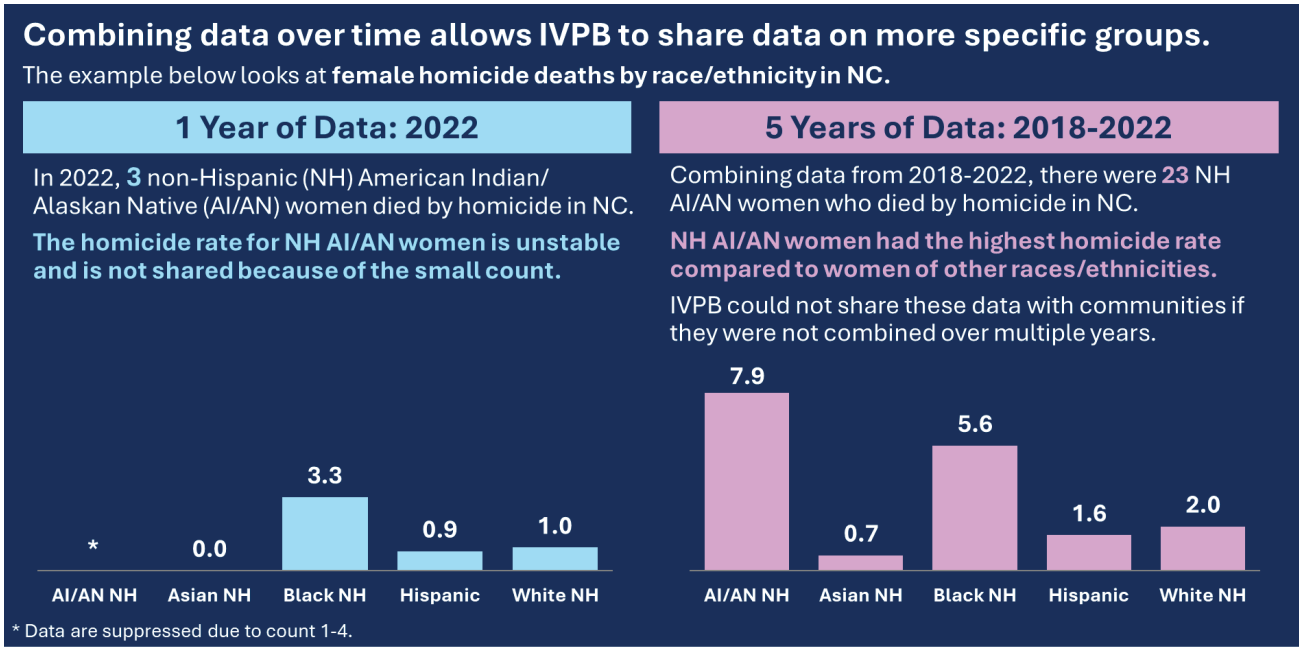
Multi-Year Rates

Multi-year rates average data over several years to provide more stable and reliable estimates, especially when there are small numbers of injury events.

Multi-year rates are calculated using the same formula shown in the Injury Rates section above.

- Rates based on small numbers can change drastically with small shifts in the number of injury events from year to year.
    - IVPB does not usually calculate rates of injury when the number of injuries is greater than zero and fewer than five (1-4).

    - Rates calculated when the number of observed events is between five and nine should be interpreted with caution.
- Combining data over multiple years allows rates to be calculated and compared for certain injuries, groups, or places where there are not enough injury events to calculate a single year rate.
- For more information visit, Data Suppression and Working With Small Numbers.



Rolling Rates[1]

Rolling rates allow us to monitor trends over time when there is a small number of injury events for certain injuries, groups, or places.

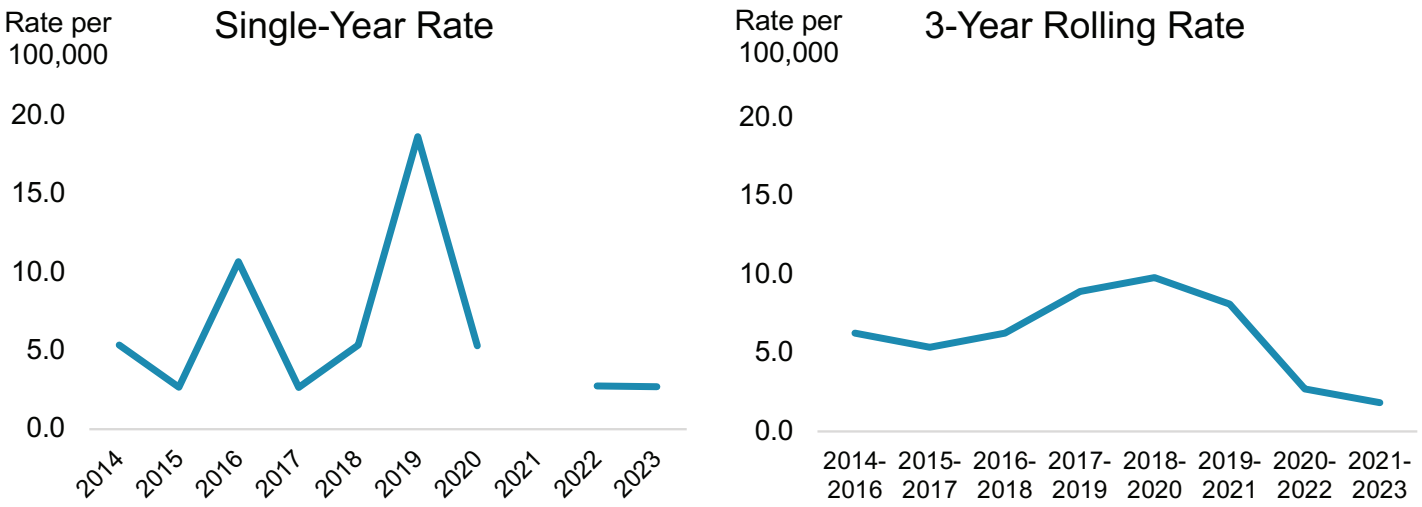
- Rolling rates are multi-year rates that are calculated over time.
    - Multi-year rates are calculated for the same number of years over time for multiple consecutive years.
    - Rolling rates typically use three to five years of data.

3-Year Rolling Rate	Data Years Included
2025 3-Year Rolling Rate	2023-2025
2024 3-Year Rolling Rate	2022-2024
2023 3-Year Rolling Rate	2021-2023

- Rolling rates are used to smooth out large changes that might happen in a single year from shifts in small numbers when monitoring injury trends over time.
    - Rolling rates can make data steadier over time. They can make it easier to understand and help visualize patterns.

Comparison of Single-Year and 3-Year Rolling Rates

Alexander County Homicide Rates, NC Violent Death Reporting System, 2014-2023



Age-Adjusted Rates[1-3]

Age adjusting is common in public health because it lets us know that the difference in rates between two groups is not caused by differences in the ages of people within those groups.

- **Age-adjusted** rates are rates that have been revised to account for the differences in age distribution between groups.
    - Age-adjusted rates are not the actual or true population rates. They are relative rates used specifically for making comparisons.
- Age adjusting is often used to account for the higher rates of disease and death that occur naturally among older populations as they age.
    - Counties with a larger population of older adults will have higher fall injury rates than counties with a larger population of younger adults just because older adults have a higher risk of falling.
    - Age-adjusting helps us make more meaningful comparisons of fall injury rates between counties with different underlying age distributions.

IVPB usually uses **age-specific** rates instead of age-adjusted rates for injury surveillance.

- For most injuries, older people do not have higher injury or death rates.
- Age-adjusting can make it more difficult to identify the ages most impacted by injuries and tailor prevention activities to them.
    - An age-adjusted rate is one rate that accounts for age differences but doesn't show how specific age groups differ in injury rates.
- Age-specific rates are limited to the injuries and population of a specific age group (i.e., 10 – 17-year-olds)
    - Age-specific rates are a series of rates, one for each age group. Age-specific rates account for age differences and also show how specific age groups differ in injury rates.

[3] *Centers for Disease Control and Prevention. (2025, June 25). Age adjustment. National Center for Health Statistics. https://www.cdc.gov/nchs/hus/sources-definitions/age-adjustment.htm*

- For example:
    - Although the highest count of ED visits for self-inflicted injury in NC was among those ages 25-44, the rate was highest for those ages 10-18 in 2024.
    - Females ages 10-18 had a rate of self-inflicted injury-related ED visits that was more than 3 times higher than that for males ages 10-18 (453.5 and 136.4 per 100,000, respectively) in 2024.

IVPB shares age-adjusted rates with the Centers for Disease Control and Prevention (CDC) to compare injury rates nationally and between states.

IVPB uses the direct method to calculate age-adjusted rates. This approach produces an estimate of what the rate would be if the groups within a population had the same age distribution, or the same number of people in each age group.

- Data are broken out into age groups (like <1, 1-4, 4-9, etc.).
- Age-specific death rates are calculated for each age group.
- Those age-specific rates are then applied to the age distribution for a "standard" or "control" population to calculate expected age-specific rates.
- The expected rates for each age group are added up and then divided by the total standard population to get an "expected" overall rate for that group.
- This helps to make the rate more meaningful when comparing data about one place to another.

For more information on age-adjusted rates, visit CDC's age adjustment website.

The figure gives an example of the difference between a crude rate and age-adjusted rate across two causes of injury death, unintentional falls and homicides, and how age-adjustment takes into account the different age distribution among populations impacted by different causes of death.

Age Adjusted Rates, Falls and Homicides in NC in 2022

The rate of **unintentional fall deaths decreases after age-adjustment** because most fall deaths happen among older adults, who represent a smaller proportion of the overall population. The **homicide rate increases after age-adjustment** because most homicides were among young to middle-aged adults, who represent the largest part of the population in NC.

Crude Rate

Unintentional Fall Deaths
17.2 Per 100,000 population

Homicides
8.9 Per 100,000 population

Age Distribution

Age	State Population	Number of Fall Deaths	Number of Homicides
<1 yr	121,554	0	4
1-4 yrs	474,936	2	13
5-9 yrs	623,783	0	17
10-14 yrs	660,316	1	18
15-19 yrs	705,170	0	96
20-24 yrs	747,739	1	182
25-34 yrs	1,437,479	15	325
35-44 yrs	1,351,351	19	262
45-54 yrs	1,346,958	41	236
55-64 yrs	1,367,808	144	254
65-74 yrs	1,106,578	242	185
75-84 yrs	568,271	567	132
85+ yrs	187,030	814	72
Total	**10,698,973**	**1,846**	**1,796**

Age-Adjusted Rate

Unintentional Fall Deaths
14.4 Per 100,000 population

Homicides
9.1 Per 100,000 population

Years of Potential Life Lost (YPLL)[4-6]

YPLL is an estimate of how long a person would have lived if they didn't die early.

YPLL can be used to help show which types of injuries and other health problems cause people to die too soon.

Using YPLL helps to:

- Understand deaths that could have been prevented
- Identify causes of death that impact younger people

How is YPLL calculated?

YPLL is the difference in years between the age when someone dies and the age they were expected to live to (estimated life expectancy).

- That number is then totaled for all people who died within a specific group or for a specific cause of death.
- Life expectancy is set to a standard age. This cut point can vary depending on the analysis.
- If someone died at the standard age or were older than the standard age when they died, they wouldn't be included in the total YPLL.

$$YPLL = \sum (\text{Standard Age} - \text{Age at Death})$$

For example:

Three people died from overdose in a city in NC in 2025. They were 18, 45, and 24 years old. If the standard age was set to 75, the YPLL from overdose in that city would be:

$$YPLL = \sum (\text{Standard Age} - \text{Age at Death})$$

$$YPLL = (75 - 18) + (75 - 45) + (75 - 24)$$

$$YPLL = 138 \text{ years}$$

YPLL can be used as a count or a rate.

While knowing the total YPLL can be useful, it is also helpful to use YPLL with the total number of deaths for the group or cause of interest for more context when making comparisons.

- Causes of death with a higher YPLL and a lower number of deaths show that more young people are dying of that cause.

Average YPLL is a rate that considers both the YPLL and the total number of deaths.

$$\text{Average YPLL} = \frac{YPLL}{\text{Total Deaths}}$$

[4] *Centers for Disease Control and Prevention. (n.d.). WISQARS glossary. National Center for Injury Prevention and Control.* https://wisqars.cdc.gov/glossary/

[5] *Florida Department of Health. (n.d.). Years of potential life lost (YPLL): Description and calculation method. FLHealthCHARTS.* https://www.flhealthcharts.gov/Charts/documents/YPLLDescription.pdf

[6] *North Carolina State Center for Health Statistics. (2002). SCHS-130. North Carolina Department of Health and Human Services.* https://schs.dph.ncdhhs.gov/schs/pdf/schs130.pdf

Average YPLL can help compare the impact of early death across causes of death.

- A higher average YPLL for one group indicates that group dies earlier than others for that cause of death.

YPLL can also be expressed as a rate within a population, like a crude rate.

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

Expressing YPLL as a rate is useful when comparing YPLL across populations or groups and over time.

- A higher rate of YPLL for one group indicates that group dies earlier than others for that cause of death.

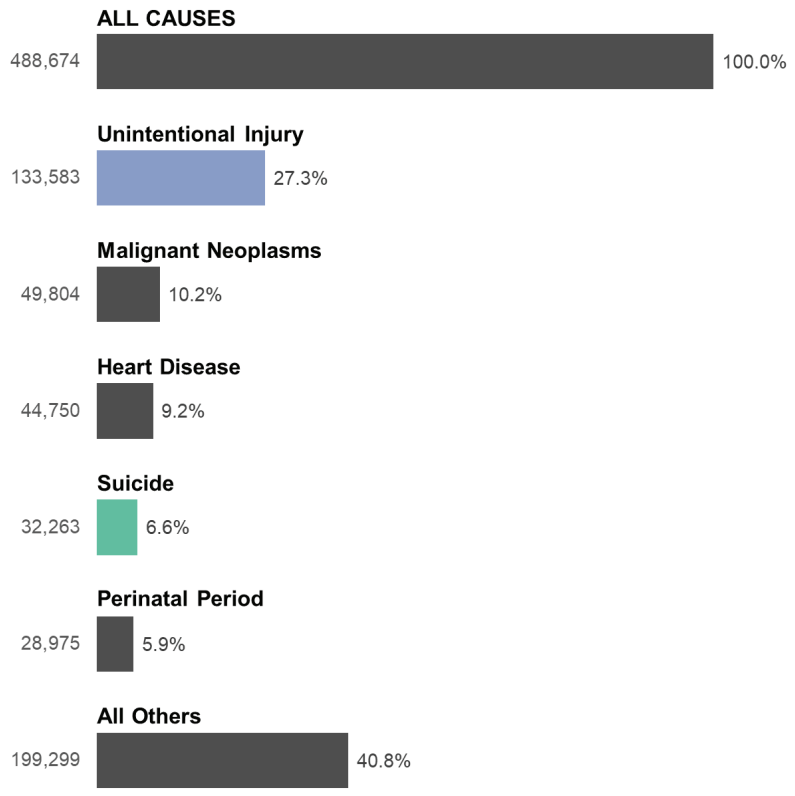
Percent of YPLL by Cause of Death

Comparing percent of YPLL for a cause of death out of the total YPLL for all causes of death can help show which causes of death contribute most to the YPLL.

- YPLL data are available on the Centers for Disease Control and Prevention (CDC) WISQARS Leading Causes of Death Visualization Tool for NC and for other jurisdictions.

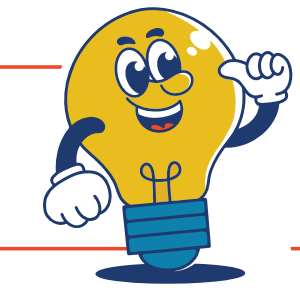
Years of Potential Life Lost Before Age 65 for the Top Five Leading Causes of Death in NC in 2023.

The figure shows the percentage of YPLL before the age of 65 for the five leading causes of death compared to the YPLL for all causes of death in North Carolina in 2023. This output was obtained from the CDC WISQARS Leading Causes of Death Tool on 6/25/2025.



For more information on YPLL, visit:

- CDC WISQARS Frequently Asked Questions
- FLHealthCHARTS YPPL factsheet



FOR MORE RESOURCES:
Visit our Injury Data Users Toolkit