Tracking the Leading Causes of Death in the United States Over Time

Understanding the top causes of death in the U.S. is very important for improving public health strategies, identifying risk factors, and tracking progress over time. Using public data from the National Center for Health Statistics (NCHS), this report will present a series of visualizations exploring mortality trends across the country from 1999 to 2017.

The analysis focuses on five major causes of death:

- Heart Disease
- Cancer
- Stroke
- Chronic Lower Respiratory Disease (CLRD)
- Unintentional Injuries

Each chart in the following sections highlights a different aspect of the data, including national trends, state-level variation, and comparisons among causes. Together, these visualizations are aiming to tell a clear story about how Americans are dying, how that's changing, and what patterns stand out.

The dataset used for this report was obtained from data.gov and includes main variables such as **year**, **state**, **cause of death**, **number of deaths**, and **age-adjusted death rates**. Charts were created using a combination of **Python** and **R**.

To provide some background context for the analysis, Figure 0 presents the ten leading causes of death in the United States based on total deaths between 1999 and 2017. As we can see heart disease and cancer are the most common by far, each responsible for over 10 million deaths during the period. These two causes dominate the national mortality scale, standing far from the next group of causes — Stroke, Chronic Lower Respiratory Disease (CLRD), and Unintentional Injuries, which still represent millions of deaths each.

This chart sets the foundation for the rest of the report, highlighting the scale of these causes and showing the top 5 causes that were used in the report.

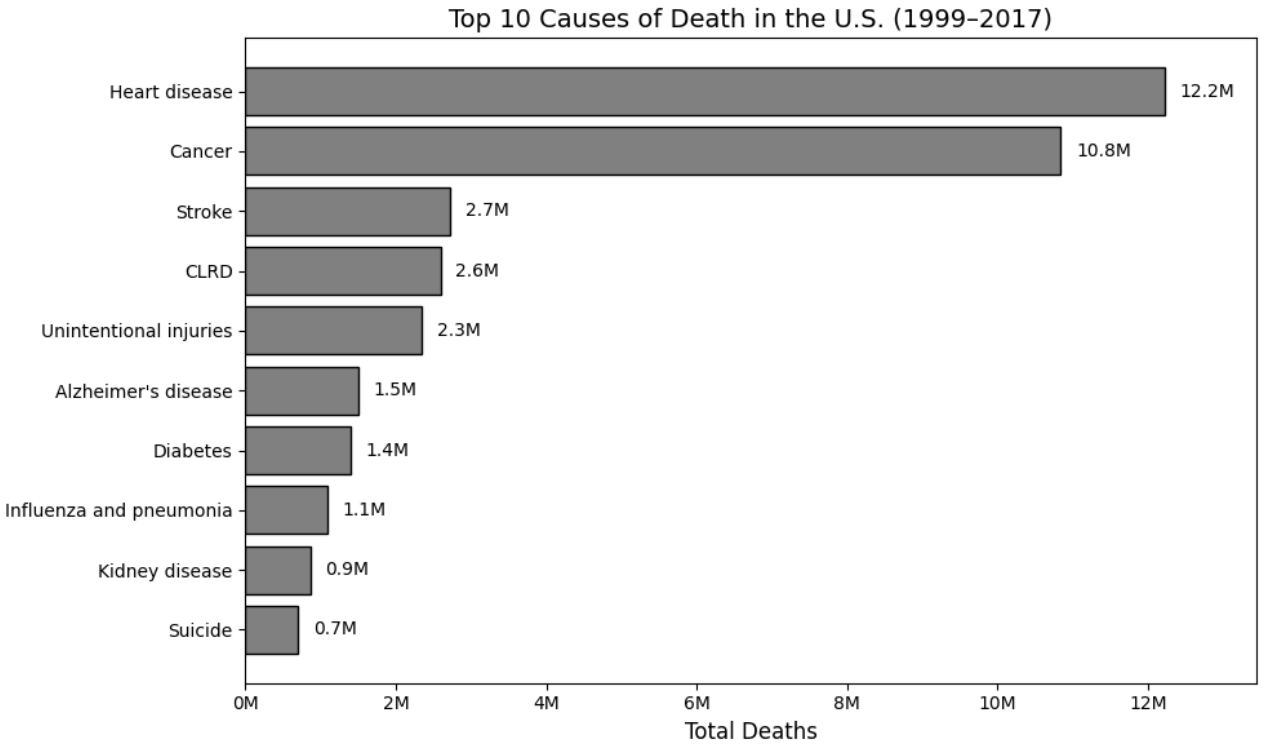

Figure 0. Total number of deaths from the 10 leading causes in the U.S. between 1999 and 2017. Heart disease and cancer account for the largest overall mortality by a wide margin.
(Generated using Python – Matplotlib)

To build on that foundation, **Figure 1** presents a heatmap showing how age-adjusted death rates for the five selected leading causes have changed over time in the United States. This visualization provides a quick view of national mortality trends from 1999 to 2017. The shades of red indicate the severity of death rates, with darker shades representing higher mortality levels.

The figure reveals a major decline in Heart Disease and Cancer rates over the years, two historically dominant causes. Meanwhile, Unintentional Injuries seems to be the only one that shows a consistent upward trajectory. Stroke and CLRD also show a gradual decline, though at a slower and a more stable pace than Heart Disease and Cancer.

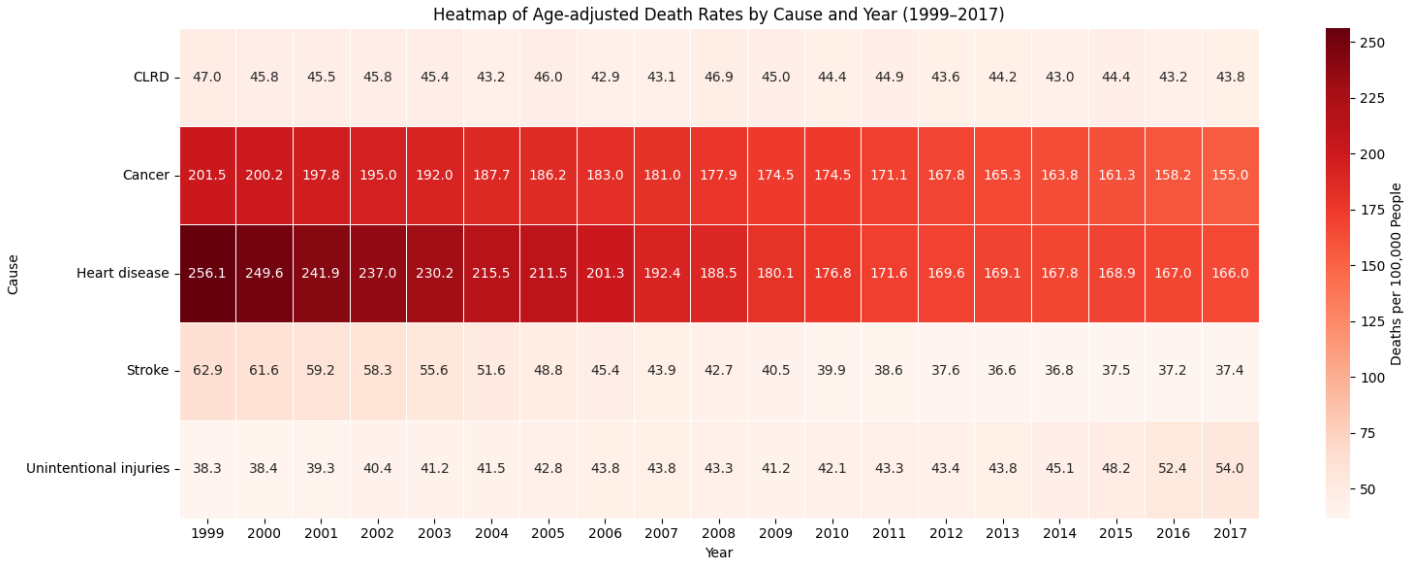

Figure 1. Heatmap showing national average age-adjusted death rates per 100,000 for Heart Disease, Cancer, Stroke, CLRD, and Unintentional Injuries from 1999 to 2017. Darker shades of red indicate higher mortality levels. This visualization highlights the decline of several leading causes over time, with Heart Disease and Cancer decreasing significantly, while Unintentional Injuries rise steadily in recent years.
(Generated using Python – Seaborn)

Now, let's look at how these trends appear geographically. To highlight the national progress in addressing heart disease, **Figures 2a and 2b** show the **age-adjusted death rates** from heart disease by state in **1999** and **2017**. These maps use a **consistent color scale** to allow for accurate visual comparison over time.

In **Figure 2a (1999)**, nearly the entire country experienced high mortality rates, particularly in the **Southeast and parts of the Midwest**. **Mississippi** had the highest rate at **347.4 deaths per 100,000**, and several neighbor states also surpassed 300. This period could reflect a peak in the cardiovascular disease crisis, a crisis driven by factors such as smoking, poor diet, limited access to preventive types of healthcare, and high rates of hypertension and obesity.

By **2017 (Figure 2b)**, the national picture had drastic improvement. The **highest rate** was now recorded in **Oklahoma**, at **237.2 deaths per 100,000**. This was over **100 points lower than the 1999 peak**. While the South still shows some elevated mortality, the **overall reduction in rates** across the map is clear, showing major progress in **cardiovascular awareness, treatment advancements, and preventive healthcare programs**.

These two maps underscore both the success of long-term public health efforts and the continued need to address **regional disparities**, particularly in the Southern states.

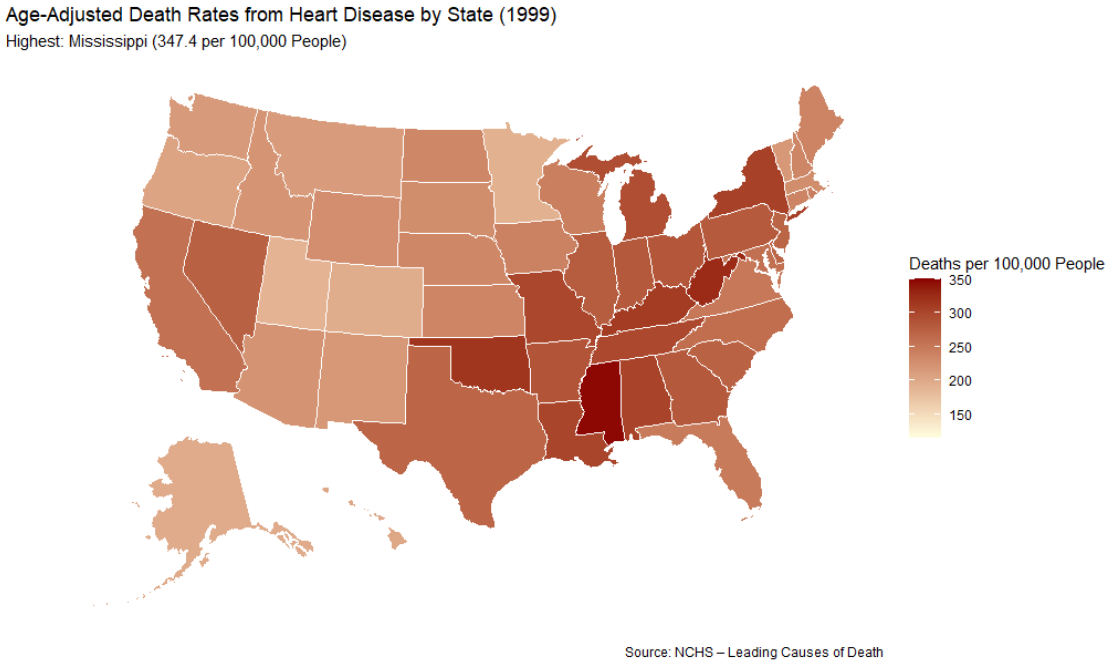

Figure 2a. *Age-adjusted death rates from Heart Disease by state in 1999. Highest rate: Mississippi (347.4 per 100,000 People).*

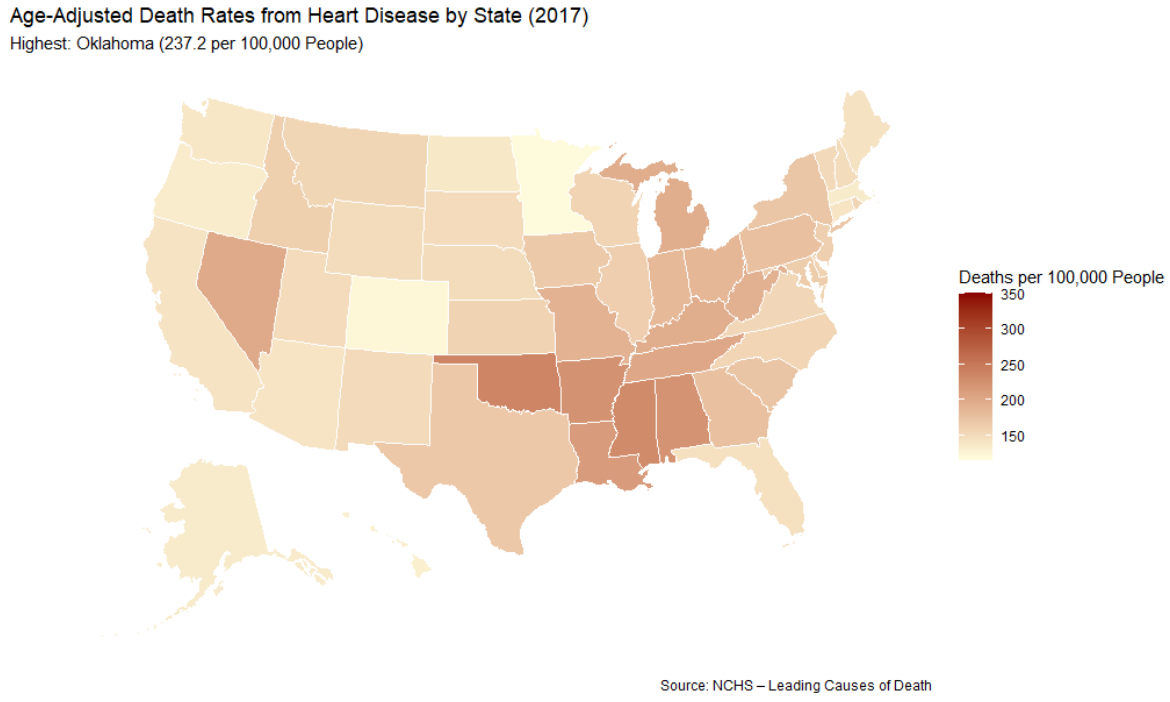

Figure 2b. *Age-adjusted death rates from Heart Disease by state in 2017. Highest rate: Oklahoma (237.2 per 100,000 People).*
Maps use a consistent color scale (150–350 deaths per 100,000) to enable a direct visual comparison.
(Generated using R – usmap + ggplot2)

Now to compare the distribution of major causes of death across the states with the highest population, **Figure 3** presents a stacked bar chart showing the average age-adjusted death rate for five leading causes across the 10 largest U.S. states by population. Each bar represents the total mortality rate in that state taking the average across about 20 years, with segments indicating contributions from Heart Disease, CLRD, Cancer, Stroke, and Unintentional Injuries.

This visualization shows that Heart Disease consistently dominates the overall death rate across all states, closely followed by Cancer and then after by varying levels of CLRD and Stroke. Something to consider is that **Ohio and Michigan** demonstrate the highest total age-adjusted death rates among the ten states, while **California, even though being the most populated U.S. state, shows the lowest overall rate**. This may reflect differences in healthcare access, preventative healthcare, lifestyle factors, or public health investments.

The height of the bars and number labels inside make it easy to compare not only the total number but also how each cause contributes differently by state. For example, **Georgia shows a higher-than-average impact from Stroke**, while **North Carolina has an especially elevated burden from Unintentional Injuries**.

The internal numerical labels provide exact age-adjusted rates for each cause, and the totals at the top of each bar offer a quick snapshot of the combined mortality burden. This chart complements the earlier choropleth maps by offering a focused cause-by-cause breakdown for the nation's most populated states.

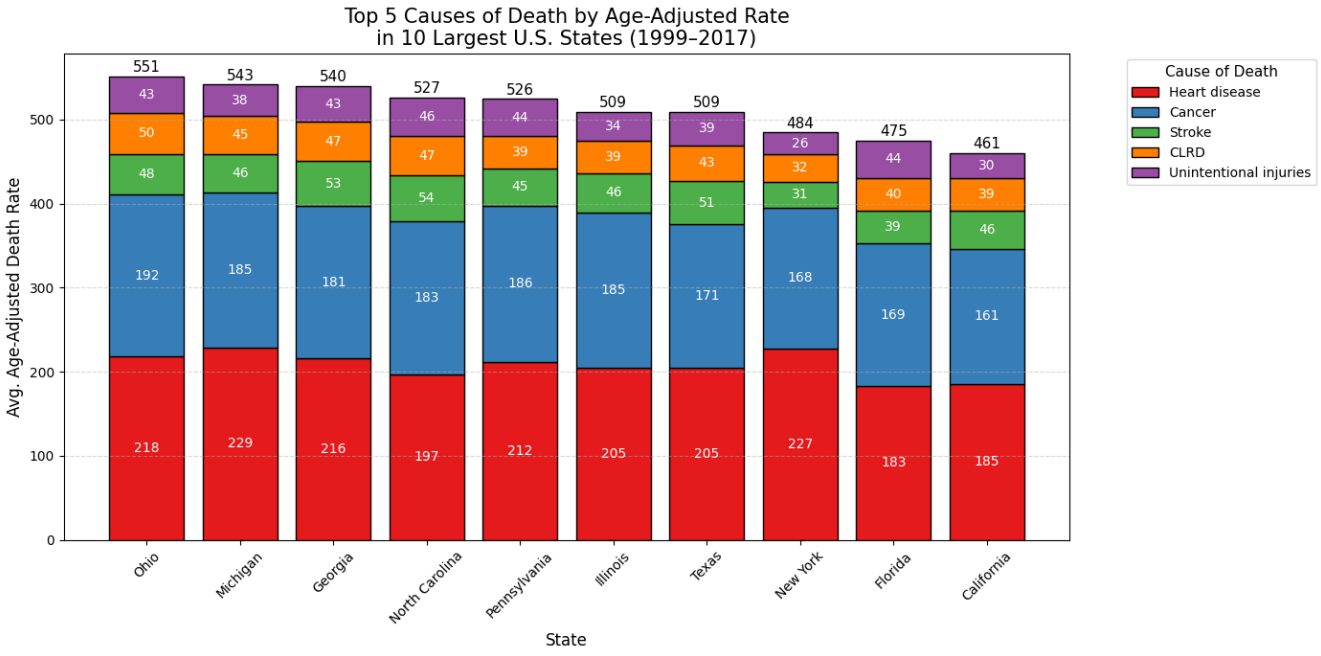

Figure 3. Average age-adjusted death rates (per 100,000) from Heart Disease, CLRD, Cancer, Stroke, and Unintentional Injuries in the 10 most populated U.S. states (1999–2017). Totals are labeled at the top of each bar; individual segment values are displayed within each cause.
(Generated using Python – Matplotlib)

Following the state-level comparison, **Figures 4a** and **4b** provide a broader national perspective by testing overall mortality trends across all causes of death. These two charts show an important difference between **death rates** and **total number of deaths**, and why the two may move in opposite directions.

Figure 4a shows a steady decline in the **age-adjusted death rate** from 1999 to 2017. The good thing about this rate is that it considers for population size and age structure, allowing for more meaningful year-to-year comparisons. The drop from **877 to 731 deaths per 100,000 people** shows progress in reducing mortality risk across the U.S. population, likely driven by advances in medical treatment, public health initiatives, and lifestyle improvements such as reduced smoking rates.

However, **Figure 4b** demonstrates that the **total number of deaths** increased over the same time period, increasing from **2.39 million in 1999 to over 2.8 million in 2017**. The contradiction between these two can be explained by two things:

1. **Population growth** – The U.S. population expanded drastically between 1999 and 2017.
2. **Population aging** – A larger share of Americans are now in older age brackets where death is more likely.

As a result, even though the average American was less likely to die in any given year, the *absolute* number of deaths rose because there were simply more people and especially more older adults in the population.

Together, these figures highlight the importance of using age-adjusted rates when evaluating public health progress, while also acknowledging the growing mortality due to demographic change.

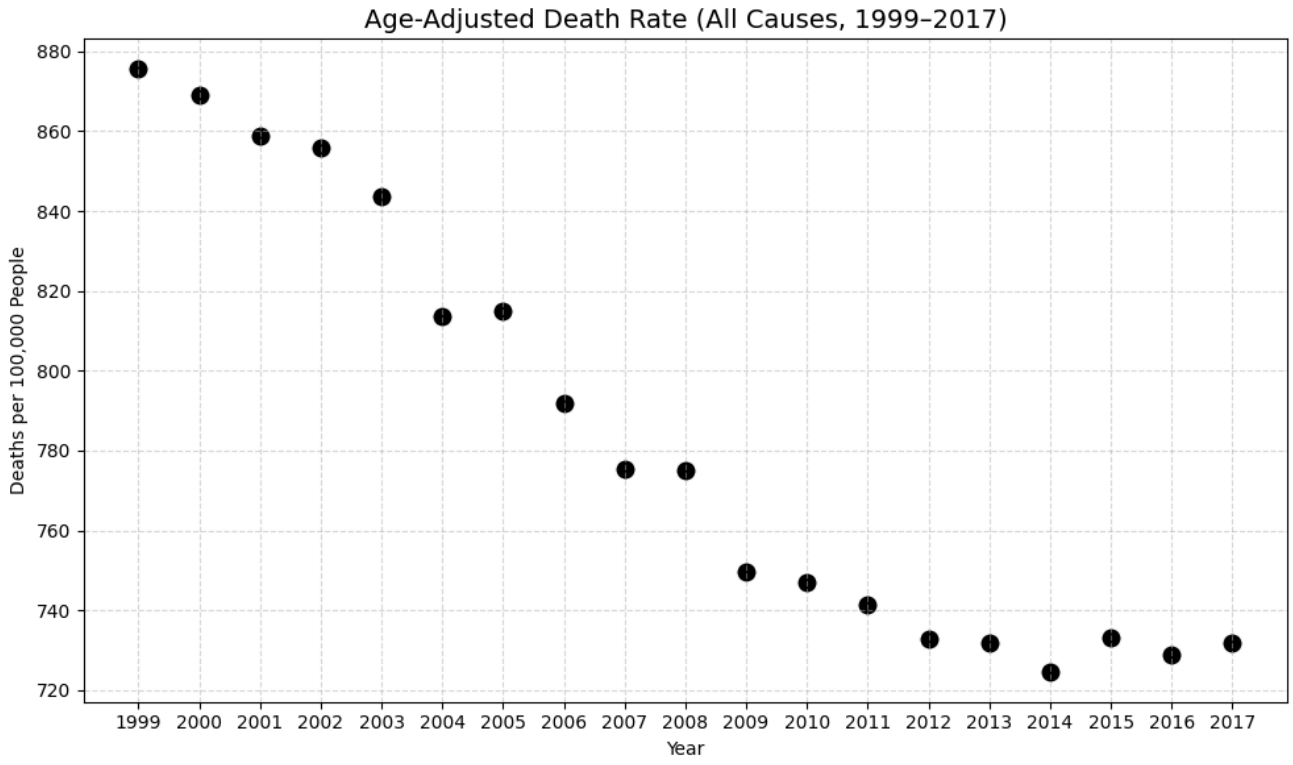

Figure 4a. *National trend in age-adjusted death rates from all causes (1999–2017). The chart shows a steady decline from 877 to 731 deaths per 100,000 people, showing overall improvements in U.S. public health and medical care over time.*
(Generated using Python – Matplotlib)

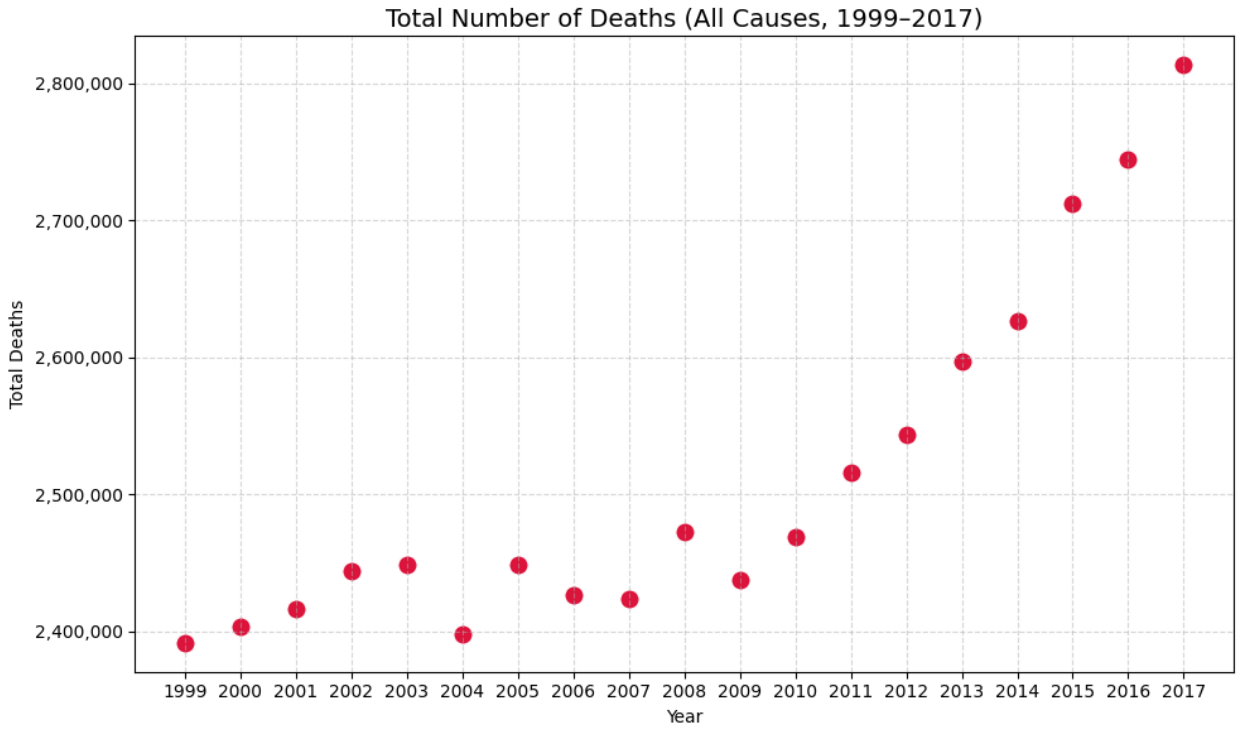

Figure 4b. *Total number of deaths from all causes in the U.S. (1999–2017). Total deaths rose from approximately 2.39 million to over 2.8 million, primarily due to population growth and aging.*
(Generated using Python – Matplotlib)

To conclude the analysis, **Figures 5a** and **5b** provide a final comparison that demonstrates the evolving impact of each leading cause of death from two different angles: **total deaths** and **age-adjusted death rates**. While the total number of deaths reflects the absolute burden on the healthcare system, age-adjusted rates provide a deeper insight into individual risk by taking into account demographic changes (different populations across states).

Figure 5a shows that **Unintentional Injuries** experienced a dramatic 73.7% increase in total deaths, way over other causes. **CLRD** and **Cancer** also showed a bit of a rise, while **heart disease** and **Stroke** declined. However, when adjusting for age (**Figure 5b**), the improvements show even better news: Stroke, Heart Disease, CLRD and Cancer all show reductions in death rate, signaling real public health progress. On the other hand, the age-adjusted death rate for Unintentional Injuries still increased by over 40%, highlighting a growing crisis that cuts across age groups.

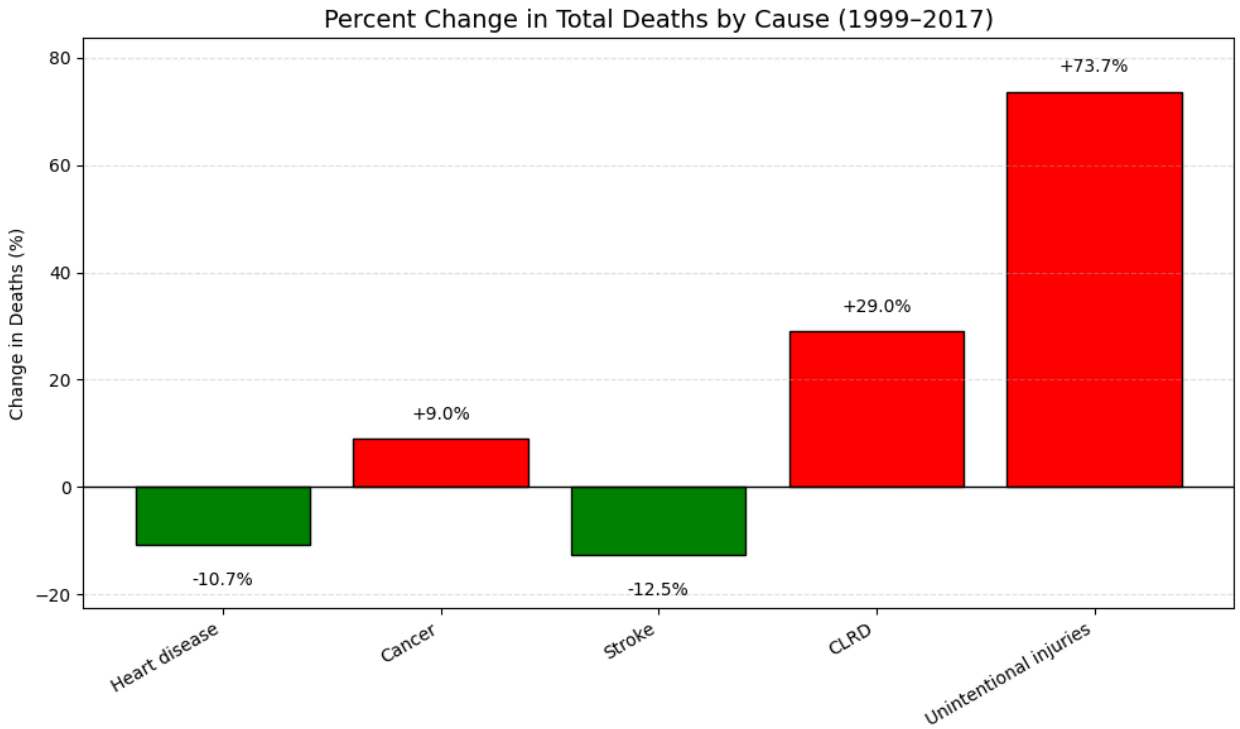

Figure 5a. Percent change in **total deaths** by cause from 1999 to 2017. While Heart Disease and Stroke saw declines, Unintentional Injuries surged by nearly 74%, marking the largest increase among the top five causes.

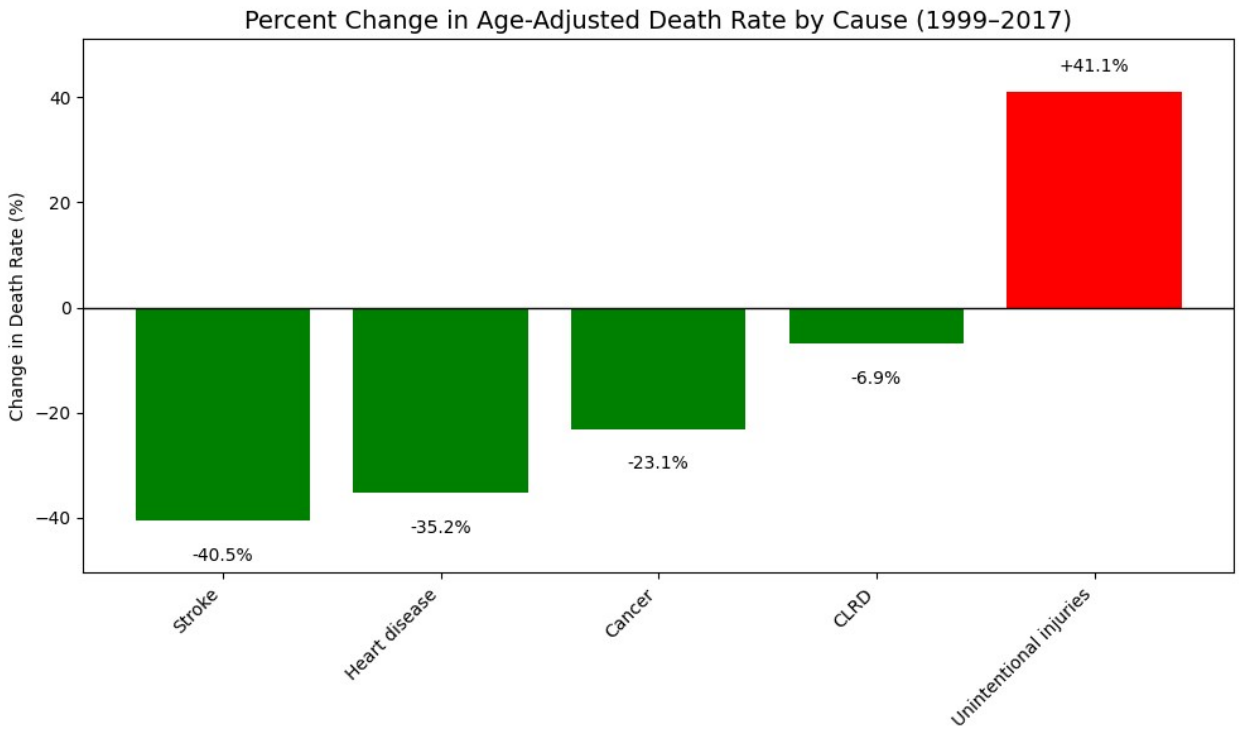

Figure 5b. Percent change in **age-adjusted death rate** by cause from 1999 to 2017. Stroke, Heart Disease, CLRD and Cancer experienced substantial decreases in individual mortality risk, while Unintentional Injuries increased by over 40%, reflecting an alarming upward trend despite age adjustment.
(Generated using Python – Matplotlib)

This report has traced nearly two decades of mortality trends in the United States, showing both national and state-level views into the five leading causes of death. From the impact of Heart Disease and Cancer to the quietly rising threat of Unintentional Injuries, the analysis has shown how public health challenges evolve over time. The final comparison in **Figures 5a** and **5b** brings the story to a full circle: while overall death rates have declined for several major causes, particularly Stroke and Heart Disease, the total number of deaths has not always followed, especially in a growing and aging population. The rise in deaths and risk from Unintentional Injuries stands out as a warning signal, suggesting that some of these threats are increasing despite medical progress in other areas. As the nation continues to age and populations shift, continued monitoring, targeted interventions, and public health awareness will be best in responding to these emerging causes of death.