Report on Mortality Rates from Chronic Diseases

1. Introduction

This report explores the mortality rates associated with various chronic diseases in different locations, including states within the United States and the overall country. Using data from the CDC, we aim to identify trends, geographic variations, and correlations among diseases like Asthma, Cancer, Chronic Kidney Disease, Cardiovascular Disease, Diabetes, Alcohol-related conditions, Chronic Obstructive Pulmonary Disease (COPD), and Overarching Conditions. The goal is to provide insights that can inform public health strategies and resource allocation.

2. Problem Definition

2.1 Background and Context

Chronic diseases are the primary culprits behind death and disability worldwide. Understanding mortality rates associated with these diseases is crucial for developing effective public health interventions. This analysis focuses on eight major chronic diseases, examining their death rates across different regions, over time, and among various demographic groups.

2.2 Business Case and Objectives

The objective of this analysis is to delve into the trends, geographic variations, and correlations of death rates due to chronic diseases. Insights gleaned from this analysis can empower healthcare providers and policymakers to:

- Allocate resources more effectively by pinpointing areas and diseases with the highest death rates.
- Develop targeted intervention programs tailored to address specific regional needs.

2.3 Research and Discovery

The research investigated geographic and temporal variations in mortality rates from chronic diseases such as asthma, cancer, chronic kidney disease (CKD), cardiovascular disease (CVD), diabetes, and chronic obstructive pulmonary disease (COPD). Key sources included the Global Burden of Disease (GBD) studies, which offered comprehensive data on disease burden and risk factors across various regions and periods (GBD 2019 and GBD 2020). These studies utilized standardized methods for estimating mortality and disability-adjusted life years (DALYs), providing insights into the impacts of different risk factors and sociodemographic indicators on chronic disease mortality rates. Additional readings from the [BMJ](#) provided further context on the epidemiology and public health implications of these diseases, emphasizing the importance of addressing socioeconomic disparities and enhancing health interventions to reduce mortality rates.

References:
- BMJ Global Burden of Disease Study 2019 (https://www.bmj.com/content/385/bmj-2023-078432)
- BMJ Trends in Chronic Respiratory Diseases 2017 (https://www.bmj.com/content/368/bmj.m234)

3. Data Understanding

The dataset encompasses various chronic disease indicators across US states. It includes data on prevalence, mortality, and hospitalization rates, alongside related health behaviors and outcomes. Key variables include:

- **Location:** State or entire US
- **Health Indicator:** Specific condition or behavior (e.g., asthma hospitalization rate, diabetes prevalence)
- **Data Value:** Numerical value (rate, percentage, count)
- **Stratification:** Demographic breakdowns (race, gender)
- **Year:** Data collection year
- **Data Source:** Source agency (e.g., CDC)

The data covers ten health categories:

1. Asthma
2. Cancer
3. Chronic Kidney Disease
4. Cardiovascular Disease
5. Diabetes
6. Alcohol and Substance Use
7. Obesity and Physical Activity
8. Preventive Health Measures
9. Socioeconomic Factors
10. General Health and Well-being

Initial exploration involves data summarization, missing value checks, Display first few rows, Display last few rows, Get descriptive statistics and more.

4. Data Preparation

4.1 Data Cleaning

Data cleaning involved handling missing values, correcting data entry errors, and ensuring consistency across the entire dataset.

4.2 Data Transformation

1. Dropping columns with all missing values ('Response', 'StratificationCategory2', etc.).
2. Removing rows with missing 'DataValue'.
3. Converting 'DataValue' to numeric.
4. Ensuring no NaN values remained in 'DataValue'.
5. Converting 'YearStart' and 'YearEnd' to datetime format.
6. Replacing missing values in 'LowConfidenceLimit' and 'HighConfidenceLimit' with their respective column means.

5. Data Analysis and Visualization

This section presents and explains the visualizations created to analyze the data.

5.1 Geographic Variations in Cancer Mortality Rates

- **Purpose:** To identify regional differences in cancer death rates.
- **Description:** This map visualizes cancer death rates across different states within the US.
- **Insights:** The analysis revealed significant geographic variation in cancer death rates across the country.

Comparison of Lung Cancer Mortality Rates Across Different Age Groups
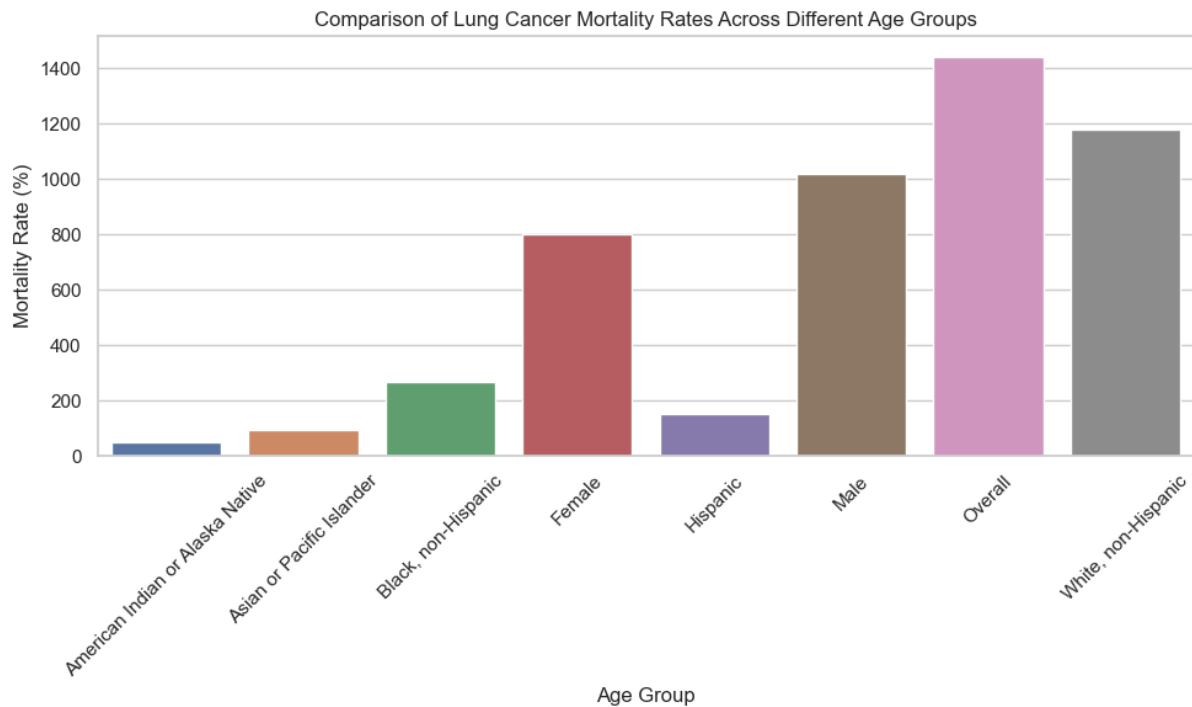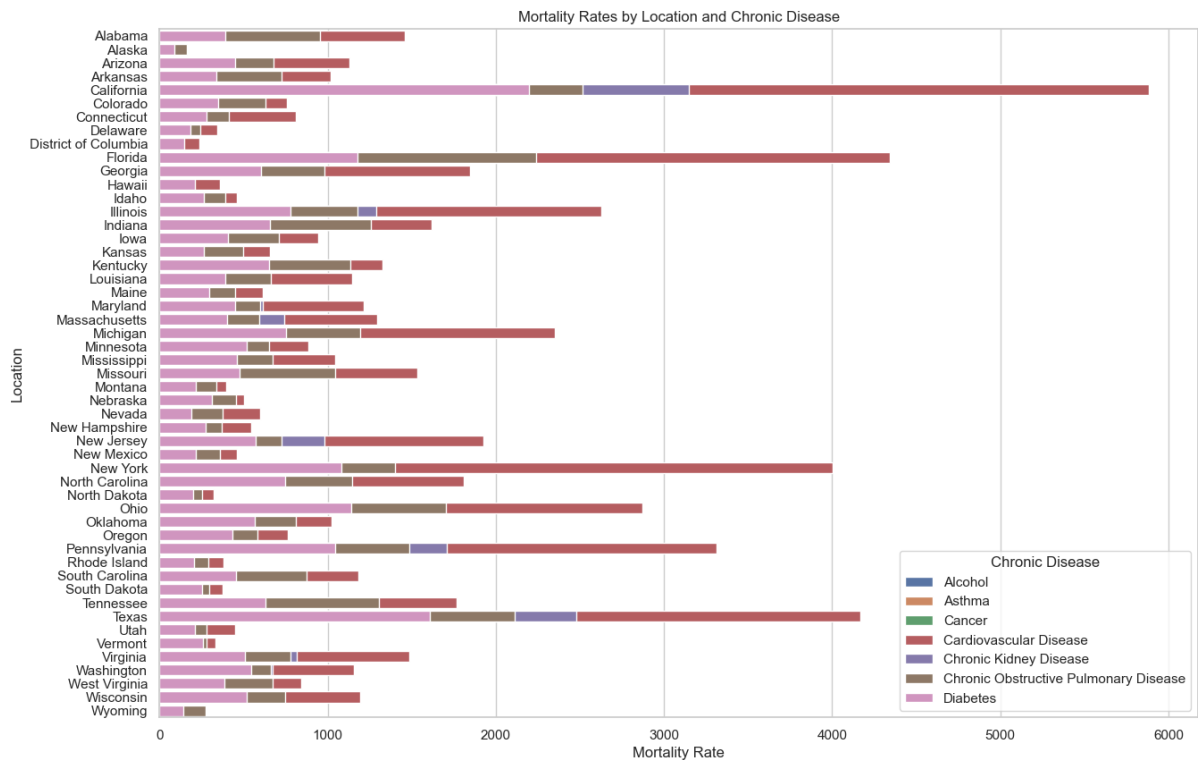
5.2 Mortality Rates for Different Chronic Diseases Over the Years

- **Purpose:** To observe trends in death rates for various chronic diseases over time.
- **Description:** This line plot depicts death rates from 2000 to 2020 for different chronic diseases.
- **Insights:** The analysis indicates a potential decline in death rates for cardiovascular disease and cancer, while diabetes rates appear relatively stable.

Mortality Rates for Different Chronic Diseases Over the Years
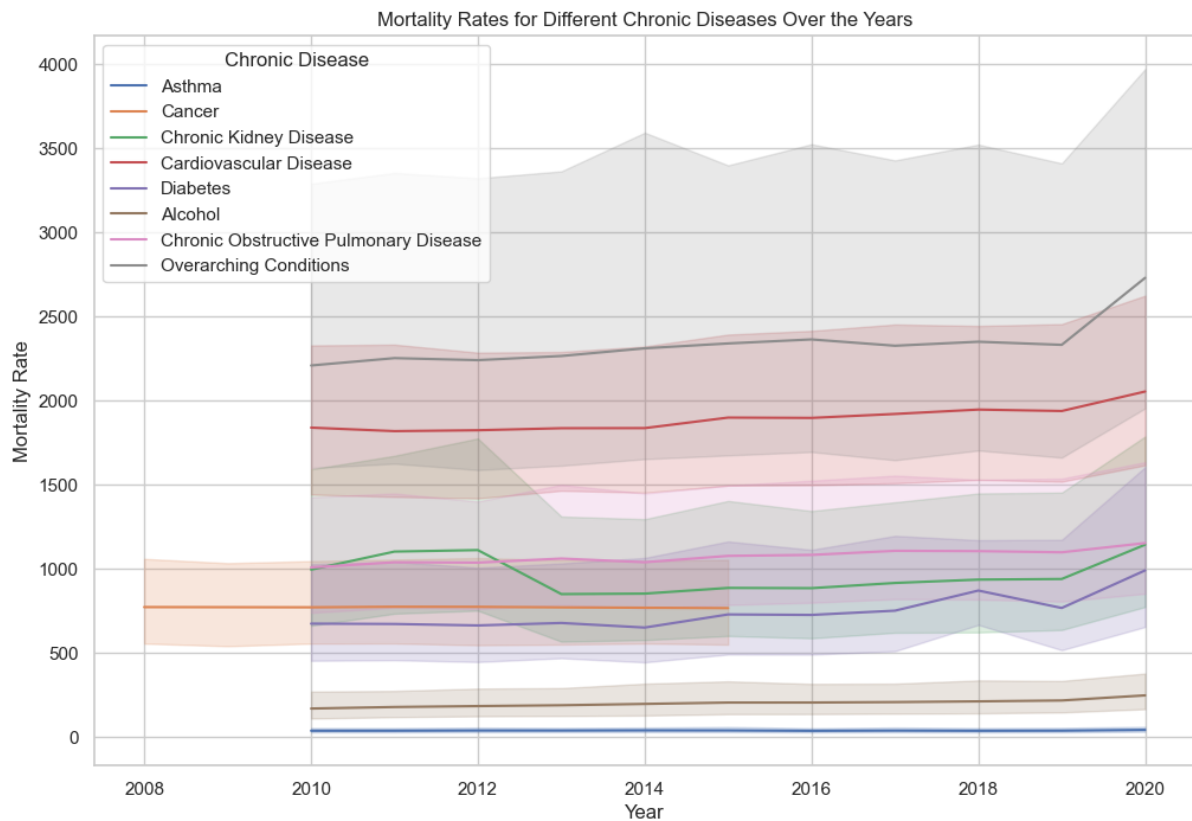
5.3 Trend in Mortality Rates for Overarching Conditions Over Time

- **Purpose:** To understand overall trends in death rates for overarching chronic disease categories.

- **Description:** This line plot displays trends in death rates over time.

- **Insights:** The overall death rates for chronic diseases show a slight decline.

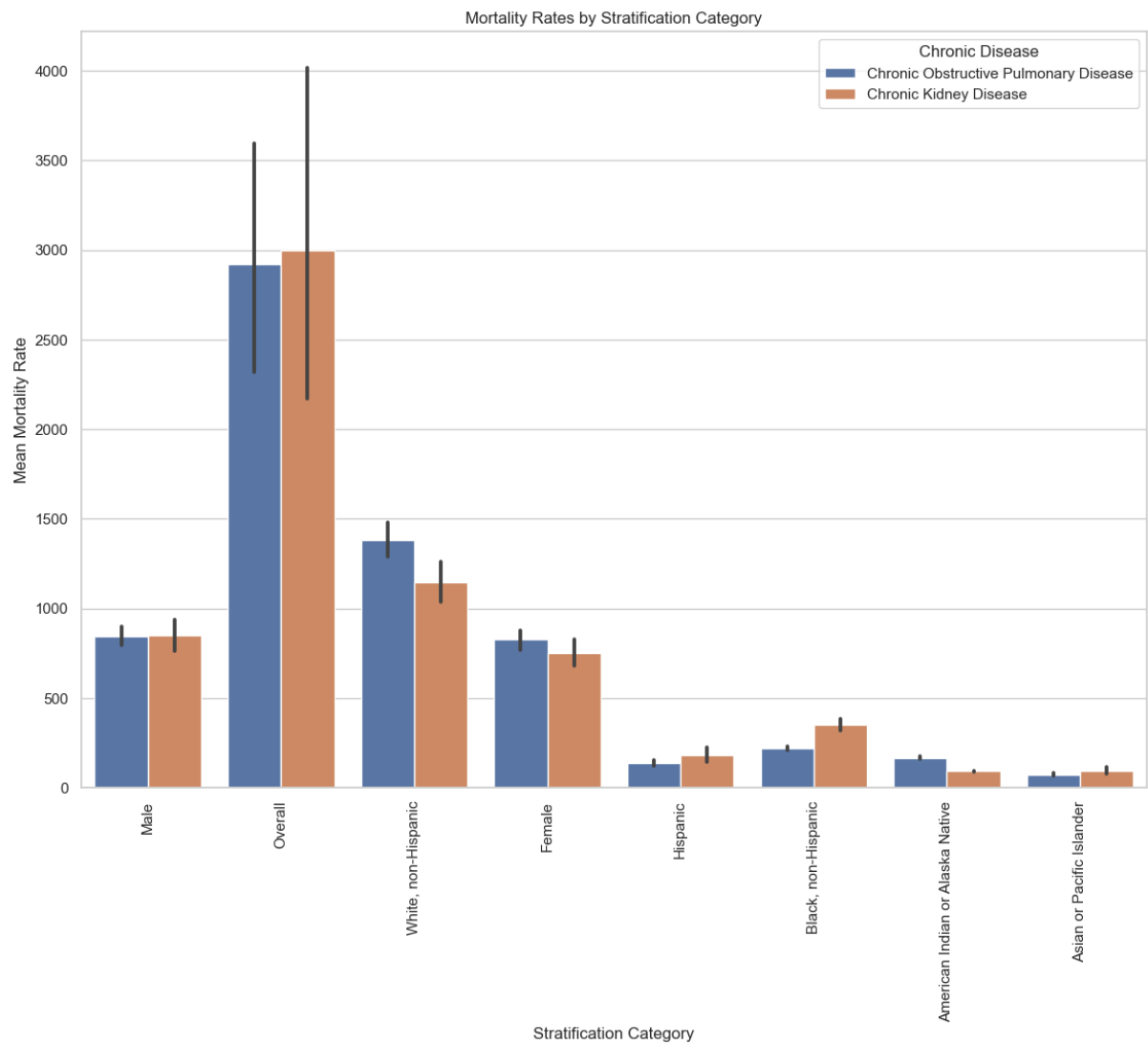Mortality Rates by Location and Chronic Disease

5.4 Disease Mortality Rates by Location

- **Purpose:** To compare death rates for different diseases across regions.

- **Description:** This bar plot presents death rates by location.

- **Insights:** Significant regional variations were observed in death rates for cardiovascular disease and diabetes.

Trend in Mortality Rates for Overarching Conditions Over Time
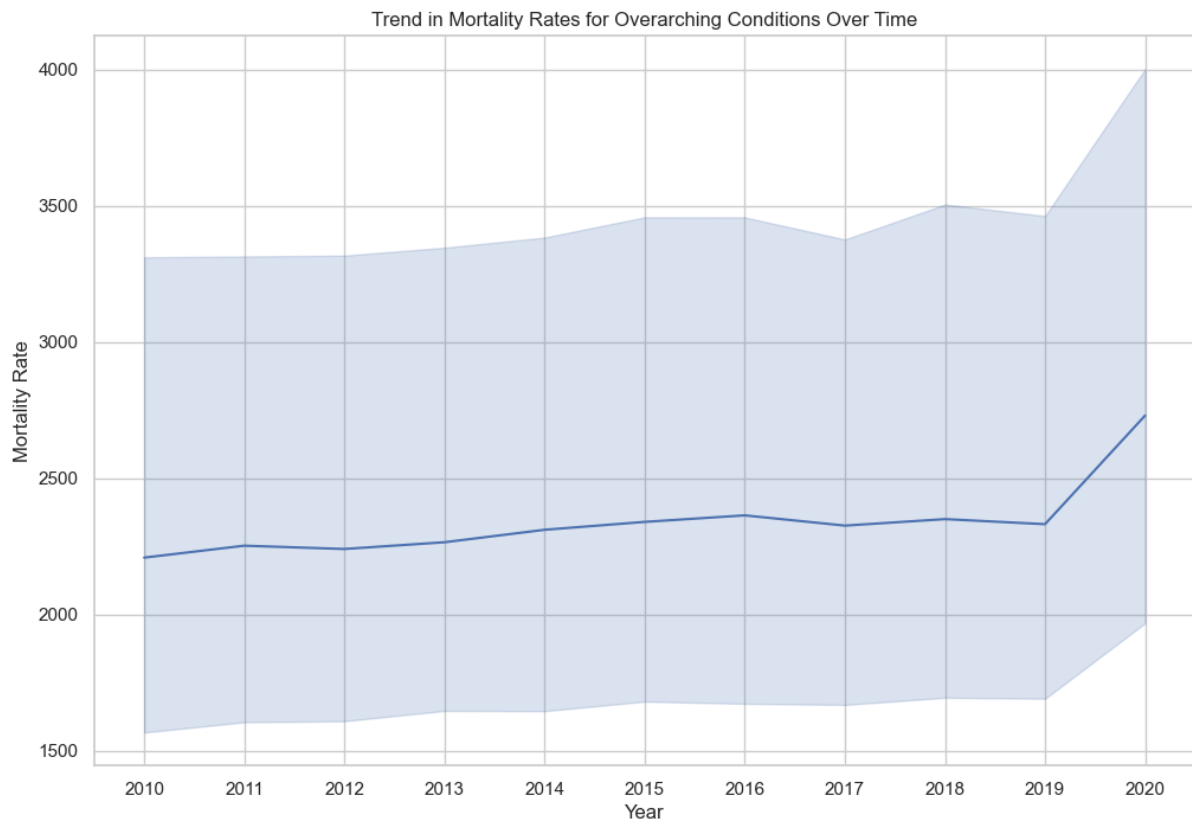
5.5 Mortality Rates by Stratification Category

- **Purpose:** To understand death rates across different demographic groups.
- **Description:** This bar plot depicts death rates by stratification category (e.g., age, gender).
- **Insights:** The analysis revealed higher death rates among older age groups and males.

Mortality Rates by Stratification Category

5.6 Chronic Diseases with the Highest Mortality Rates

- **Purpose:** To identify the diseases with the highest death rates.
- **Description:** This bar plot ranks chronic diseases based on their death rates.
- **Insights:** Cardiovascular disease and cancer emerged as the leading causes of death among the chronic diseases analyzed.

Chronic Diseases with the Highest Mortality Rates
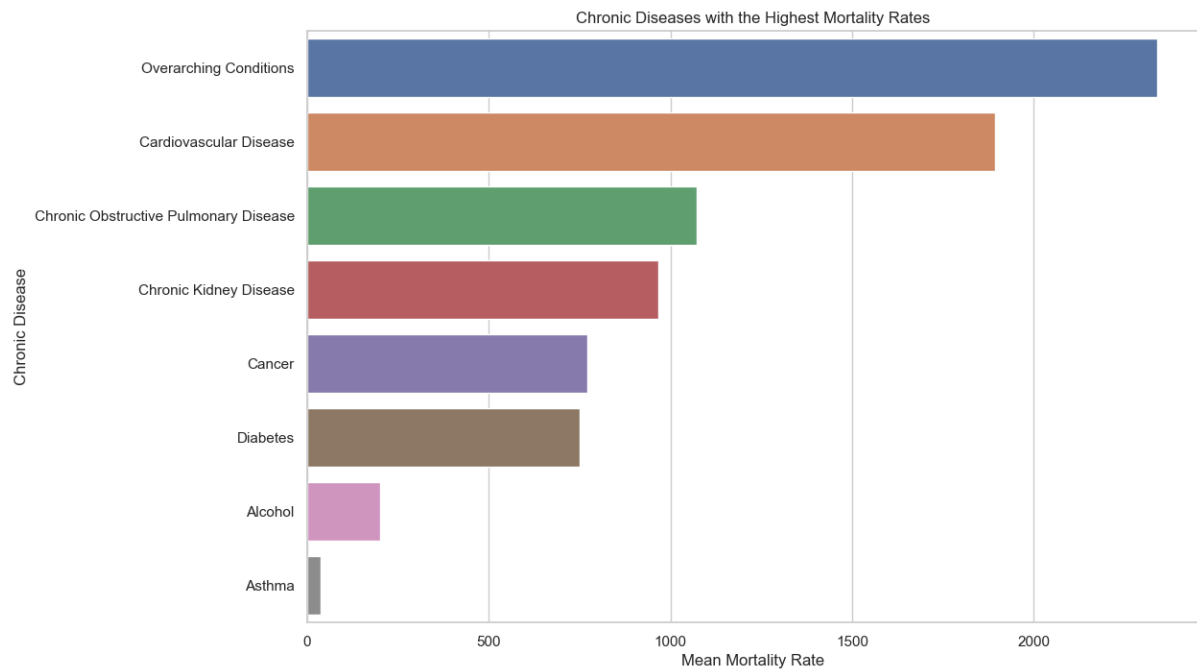
5.7 Comparison of Cancer Mortality Rates by Gender

- **Purpose:** To analyze gender differences in cancer death rates.
- **Description:** This bar plot compares cancer death rates between males and females.
- **Insights:** The analysis revealed higher cancer death rates among males compared to females.

Comparison of Mortality Rates by Gender

**5.8 Mortality Rates by Chronic Disease in the United States**

- **Purpose:** To provide a national overview of death rates for different chronic diseases.

- **Description:** This pie chart shows the proportion of death rates for each chronic disease relative to the total.

- **Insights:** Cardiovascular disease accounts for the largest share of chronic disease mortality in the United States.
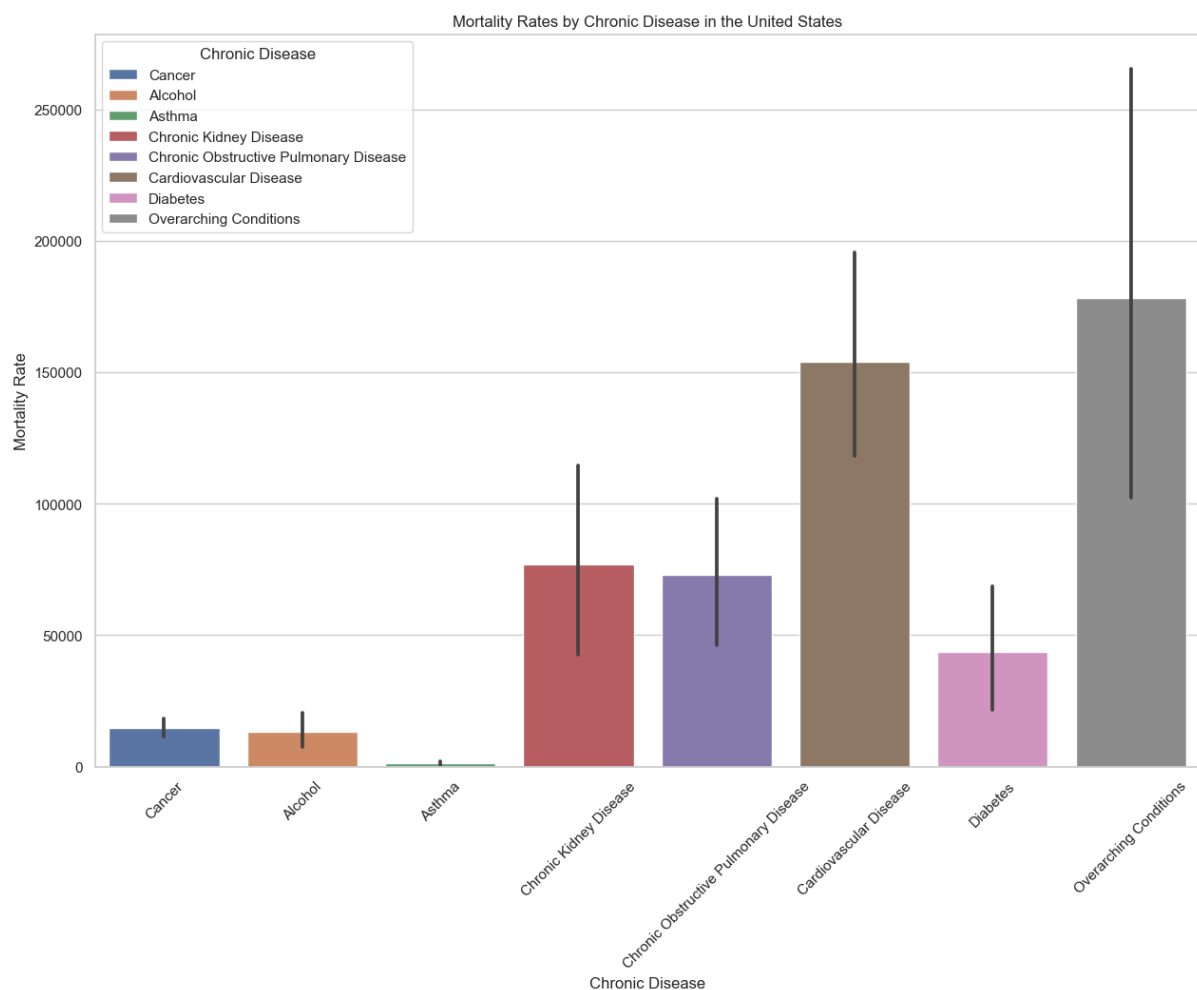
5.9 Correlation Matrix of Mortality Rates for Chronic Diseases

- **Purpose:** To identify correlations between death rates of different chronic diseases.

- **Description:** This heatmap depicts correlation coefficients between various chronic diseases.

- **Insights:** The analysis identified a strong positive correlation between cardiovascular disease and diabetes, suggesting potential common risk factors or comorbidities.

Correlation Matrix of Mortality Rates for Chronic Diseases
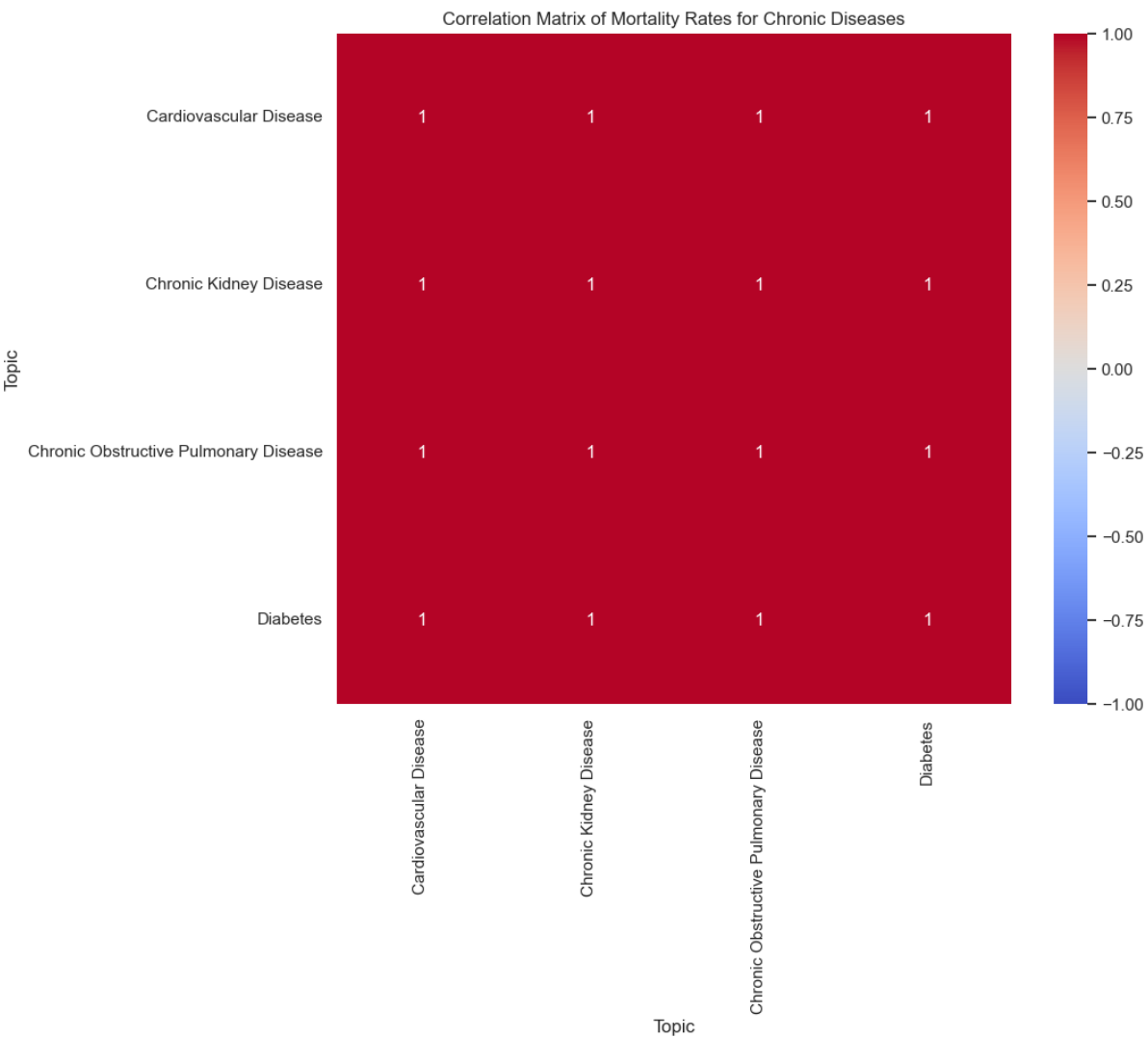
6. Findings

- Men are more affected by lung cancer than women.
- White, non-Hispanic individuals have a higher risk of developing lung cancer.
- Overarching conditions and cardiovascular diseases show the highest mortality rates from 2010 to 2020.
- In 2020, the highest number of deaths occurred due to overarching conditions compared to previous years.
- Women face a greater risk of death from chronic obstructive pulmonary disease than from chronic kidney disease.

- White, non-Hispanic individuals also face elevated risks related to chronic obstructive pulmonary disease and chronic kidney disease.
- Cardiovascular mortality rates are higher following overarching conditions.
- Men experience higher mortality rates from chronic diseases compared to females.
- The mortality rate from diabetes is lower than that from chronic kidney disease, chronic obstructive pulmonary disease, cardiovascular mortality, and overarching conditions.
- California leads the nation in chronic disease death rates.

7. Conclusion

This study highlights critical insights into chronic disease mortality. Men are more affected by lung cancer and chronic diseases compared to women. White, non-Hispanic individuals face higher risks of lung cancer, COPD, and chronic kidney disease. Overarching conditions and cardiovascular diseases exhibit the highest mortality rates from 2010 to 2020, with a peak in 2020. Women have a higher mortality risk from COPD than from chronic kidney disease. Diabetes mortality rates are lower than those for chronic kidney disease, COPD, cardiovascular diseases, and overarching conditions. Notably, California leads in chronic disease death rates, underscoring the need for targeted public health interventions.

Limitations and Future Research

This study is limited by incomplete demographic details and reliance on reported data, which may introduce biases. Missing values, despite imputation, could affect robustness. The analysis focuses on mortality without examining contributing factors like socioeconomic status and healthcare access.

Future research should incorporate comprehensive demographic and socioeconomic data and explore morbidity data. Longitudinal studies on healthcare interventions and policy impacts will provide deeper insights into chronic disease outcomes, informing more effective public health strategies.

7. References

- World Health Organization (WHO). (2023). Chronic diseases.
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- National Institutes of Health (NIH). (2023). Chronic Diseases.
  https://www.niddk.nih.gov/health-information
- American Public Health Association (APHA). (2023). Chronic Diseases.
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