

Coronary Heart Disease Mortality Trends in U.S. Adults Aged 35+

1. Introduction and background

The motivation for selecting Coronary Heart Disease (CHD) as a topic arises from its high prevalence and significant impact on modern society. CHD remains a leading cause of death in the United States, particularly among adults aged 35 and older. Despite advances in healthcare and lifestyle changes that have influenced CHD incidence and mortality in recent years, deeply rooted risk factors persist. Inspired by sources such as Jung & Yang (2021)ⁱ, we recognize that understanding the causes of CHD and the distribution of high-risk populations is critical for driving effective public health interventions and creating targeted prevention strategies.

This study aims to analyze CHD mortality trends to reveal how health disparities and environmental factors influence CHD mortality. **Key questions include:** How severe is the mortality rate of CHD? Which regions or populations exhibit higher CHD incidence? How do social factors (e.g., age, education, income) and lifestyle/environmental factors (e.g., hypertension, obesity, air quality) impact CHD rates? Through this project, we aim to benefit public health in several ways:

1. **Identify high-risk populations for targeted interventions:** Using data on regional and demographic differences, we will identify high-incidence areas and population types, promoting more focused screening and educational initiatives.
2. **Establish a data-driven prevention framework:** Our visualizations will illustrate CHD trends and risk distributions comprehensively, using line charts, bar charts, maps, and scatter plots to present disease trends and risk factors at both macro and micro levels, providing a well-rounded backdrop for analysis.

2. Datasets

1. **Coronary Heart Disease and Stroke Mortality Dataⁱⁱ**: This dataset, originating from the National Vital Statistics System, was developed to support heart disease and stroke prevention by identifying effective health interventions aimed at reducing cardiovascular disease mortality. Covering a 19-year span from 1999 to 2018, it includes stroke and coronary heart disease mortality rates for two age groups (35–64 and 65+) across 1,830 U.S. counties. With 288,512 cases, the dataset provides county-level geographic information, year, age group, mortality rate per 100,000 people, and confidence intervals. This allows for in-depth analysis and visualization at county, state, and national levels, tracking trends and comparing cardiovascular mortality across regions. However, its focus on U.S. counties and mortality rates alone limits broader health outcome analyses and global comparisons, which would require additional data.
2. **National Health and Nutrition Examination Survey (NHANES)ⁱⁱⁱ**: Published by the U.S. Department of Health and Human Services, NHANES is a national cardiovascular disease monitoring dataset containing indicators such as health behavior, lifestyle, and disease diagnoses. The data serves public health research by tracking cardiovascular disease trends across the U.S. With a large sample size, NHANES enables analysis of lifestyle impacts on CHD, though self-reported variables may affect accuracy.
3. **U.S. Population Data^{iv}**: Collected by the U.S. Census Bureau, provides annual population data from 2010 to 2019, covering each U.S. state. It supports policy-making and research by offering insights into population trends. By analyzing annual changes, we can better assess the potential impact of population shifts on healthcare resource distribution and cardiovascular disease prevalence. Its limitation lies in only covering 2010 to 2019, excluding post-2020 data.
4. **National Obesity by State Data^v**: Collected by Lake County GIS in Illinois and published on Data.gov (2015), this dataset provides obesity rates across U.S. states, supporting public health interventions through analysis of state-by-state obesity trends. The dataset includes obesity rates

for all 50 states as a snapshot of that year, helping us understand obesity as a CHD risk factor across regions. The main limitation is that it only includes data from 2015, offering no insight into long-term changes.

5. **PM2.5 Index by County Data**^{vi}: Published by the National Institute on Minority Health and Health Disparities through HDPulse, this dataset provides PM2.5 levels for U.S. counties in 2018, supporting research on environmental health disparities. Variables include county names, FIPS codes, and PM2.5 concentrations in micrograms per cubic meter. While useful for examining the relationship between air quality and coronary heart disease (CHD), a limitation is that it only covers a single year, making it inadequate for capturing long-term air quality trends.
6. **National Center for Health Statistics (NCHS) and National Health Interview Survey (NHIS)**^{vii}: This dataset includes information on various health topics, including coronary heart disease, and can be categorized by demographic characteristics such as age, race, and gender. Data are collected from interviews with a representative sample of the civilian, noninstitutionalized population and are calculated using the Clopper-Pearson method with weighted estimates and two-sided 95% confidence intervals.

3. Data Story

Table 1 and Chart 1 use data from the National Center for Health Statistics (NCHS), which covers all 52 U.S. states and was funded by the CDC to analyze leading causes of death in the U.S. This data helps the public understand mortality trends and major health concerns. The table includes variables for cause of death and total death counts, while the graph provides a comparative view of the top causes, showing heart disease as the leading cause.

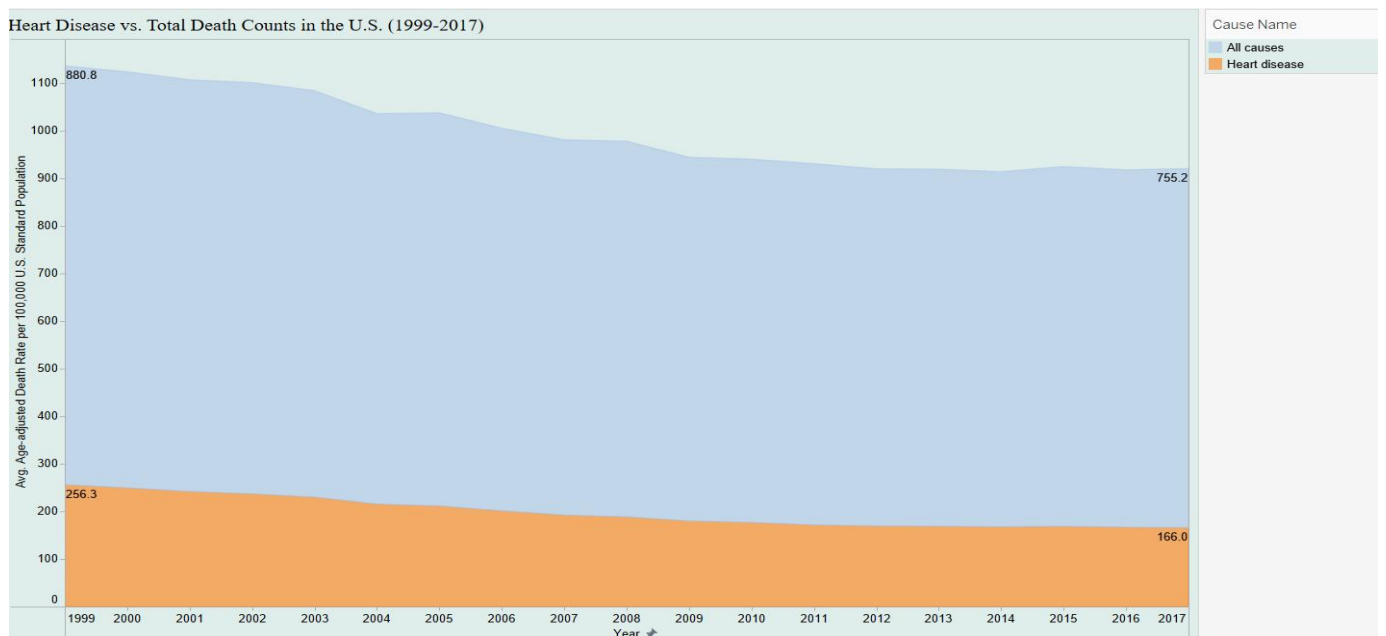
Top 10 Leading Death Causes From 1999 to 2017

Cause Name	F
Heart disease	24,445,280
Cancer	21,687,288
Stroke	5,453,046
CLRD	5,189,854
Unintentional injuries	4,695,640
Alzheimer's disease	2,989,632
Diabetes	2,799,886
Influenza and pneu..	2,189,282
Kidney disease	1,717,226
Suicide	1,394,032

Table 1

The line chart (Chart 1) illustrates total and heart disease-related deaths per 100,000 individuals from 1999 to 2017, with the blue area representing total mortality and the orange area showing deaths specifically due to heart disease. For example, in 1999, 881 deaths occurred per 100,000 people, 256 of which were from heart disease. Although both overall and heart disease-specific death rates have decreased over time, heart disease still accounts for over 30% of total deaths, underscoring its persistent impact. However, this dataset lacks demographic details like gender and race, which would allow for deeper insights into subgroup mortality trends.

Chart 1



The data for Charts 2 and 3 was collected by the CDC's Division for Heart Disease and Stroke Prevention. Chart 2 reveals that most CHD patients are aged 65 and older, Texas has the highest proportion of CHD cases, and areas with darker colors, indicating higher rates, are concentrated along the East Coast, Northwest Coast, and parts of the central U.S.

Chart 2

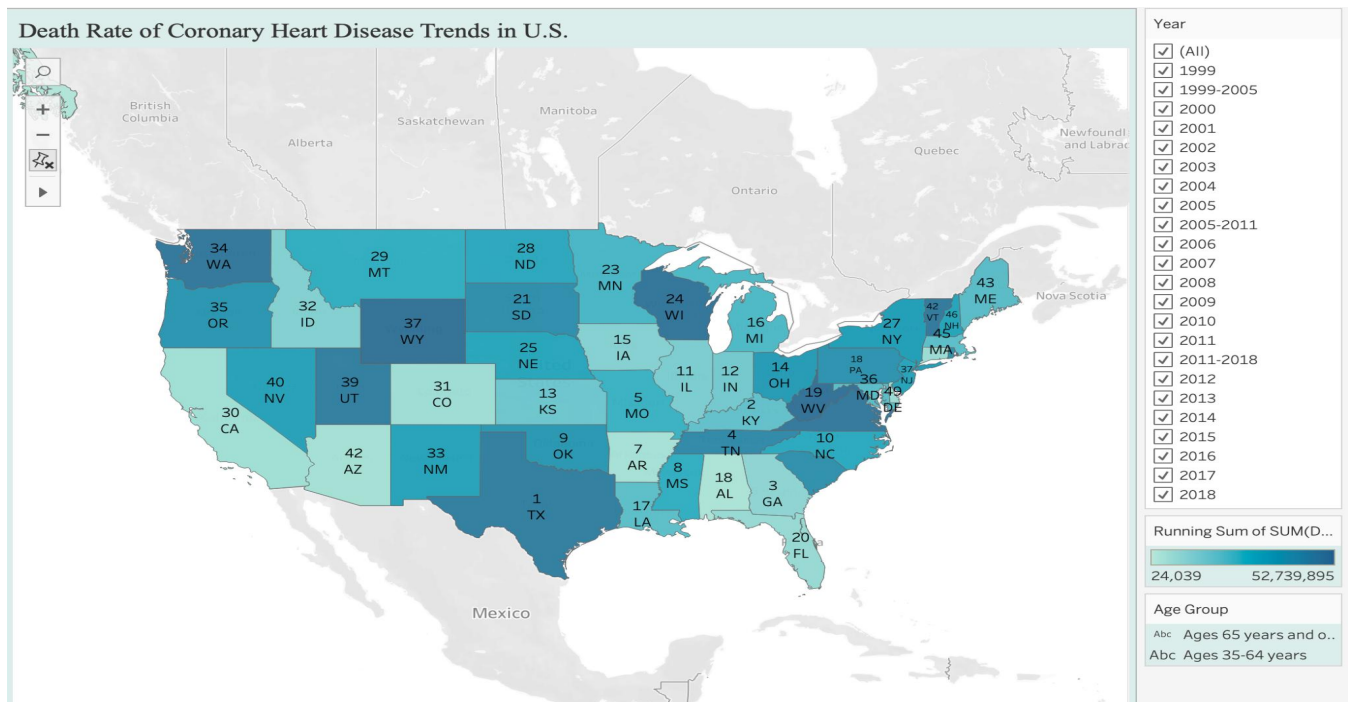
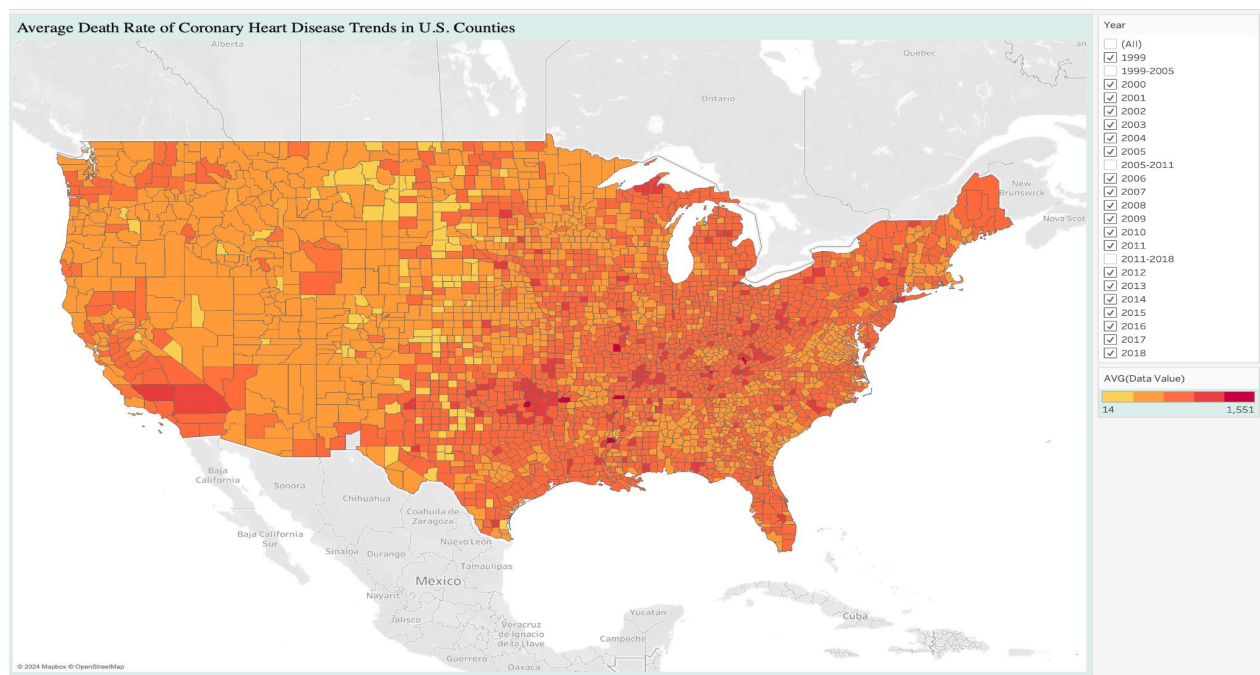


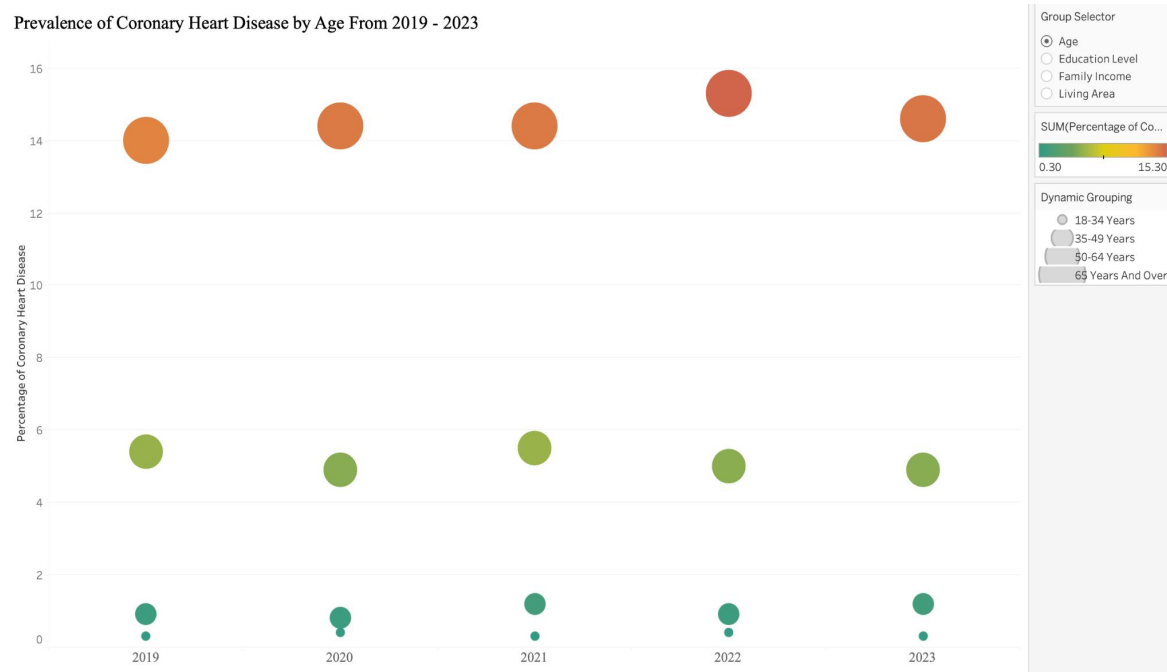
Chart 3 shows the average mortality rate by county, with higher rates near Washington. A limitation of these maps is that they do not reveal causative factors, indicating a need for further research into contributing elements.

Chart 3



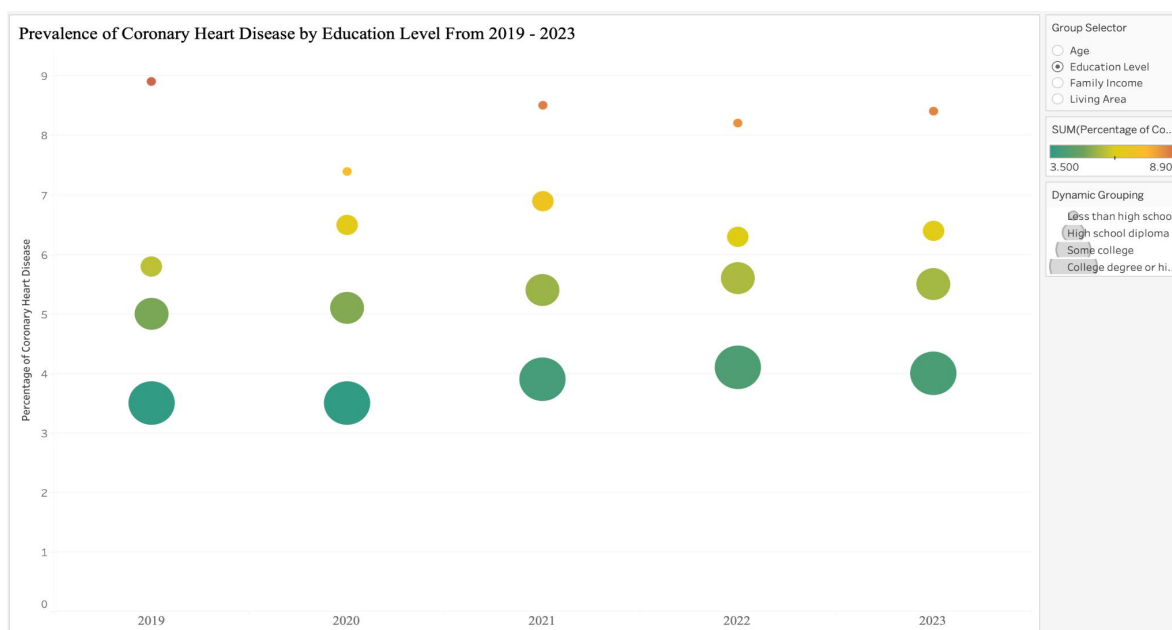
The bubble charts (Charts 4–7) provide insights into coronary heart disease (CHD) prevalence across U.S. demographics from 2019 to 2023, focusing on age, education, income, and living area. A key finding is the impact of age on CHD rates, with adults 65 and older showing the highest prevalence at around 15%, compared to much lower rates in younger adults (18-34), emphasizing the need for targeted interventions for older populations.

Chart 4



Education level also plays a significant role: individuals without a high school diploma have the highest CHD rates, while college graduates show considerably lower rates, suggesting that higher education may correlate with improved heart health through greater health awareness and resource access.

Chart 5



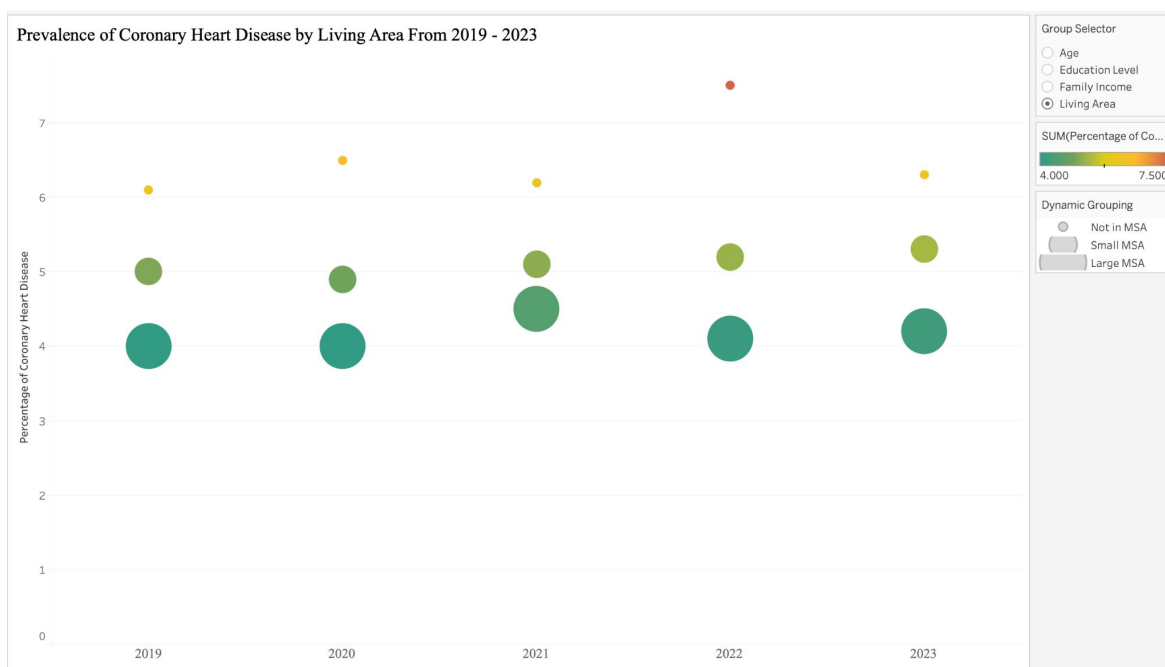
Economic status further influences CHD prevalence, with households below the Federal Poverty Level (FPL) facing higher rates, likely due to limited access to quality healthcare and healthier lifestyle options.

Chart 6



Additionally, residence location affects CHD risk; residents in large Metropolitan Statistical Areas (MSAs) generally have lower CHD rates than those in smaller MSAs or rural areas, potentially due to better healthcare access in urban environments.

Chart 7



A limitation is that while these charts highlight associations, they do not establish causal relationships, leaving the specific impact of each factor on CHD unclear and warranting further research.

Charts 8–10 and Table 2 use data from the CDC's report titled "Rates and Trends in Coronary Heart Disease and Stroke Mortality in U.S. Counties, 1999-2018." This study focuses on the relationship between hypertension (blood pressure: BP) and CHD prevalence, displaying four main variables: Year, Average Value (average CHD rate), and two BP levels (130/90 and 140/90), including data on medication usage in both groups.

Chart 8 is an interactive graph tracking the trend of each data point, while Chart 9 compares CHD prevalence rates for BP 130/90 and BP 140/90 from 1998 to 2018, showing that CHD rates are consistently higher for BP 140/90.

Chart 8

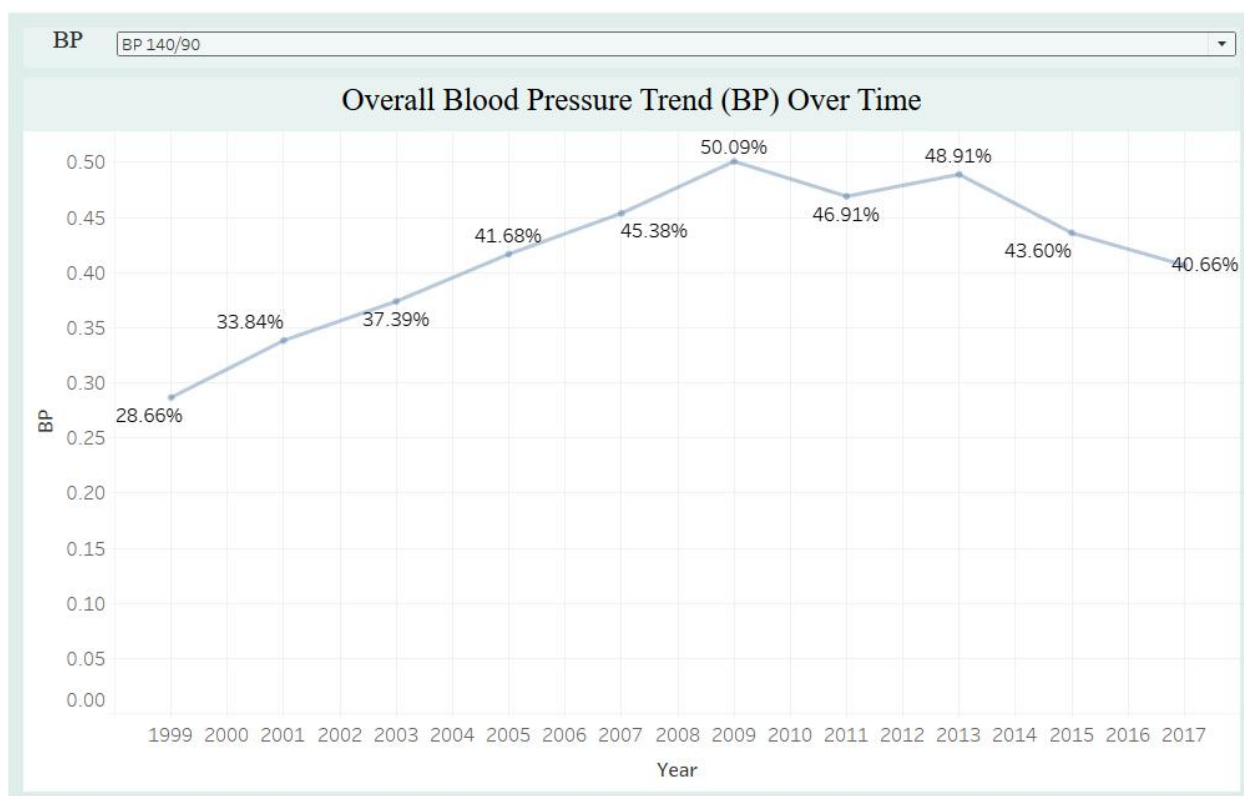


Chart 9

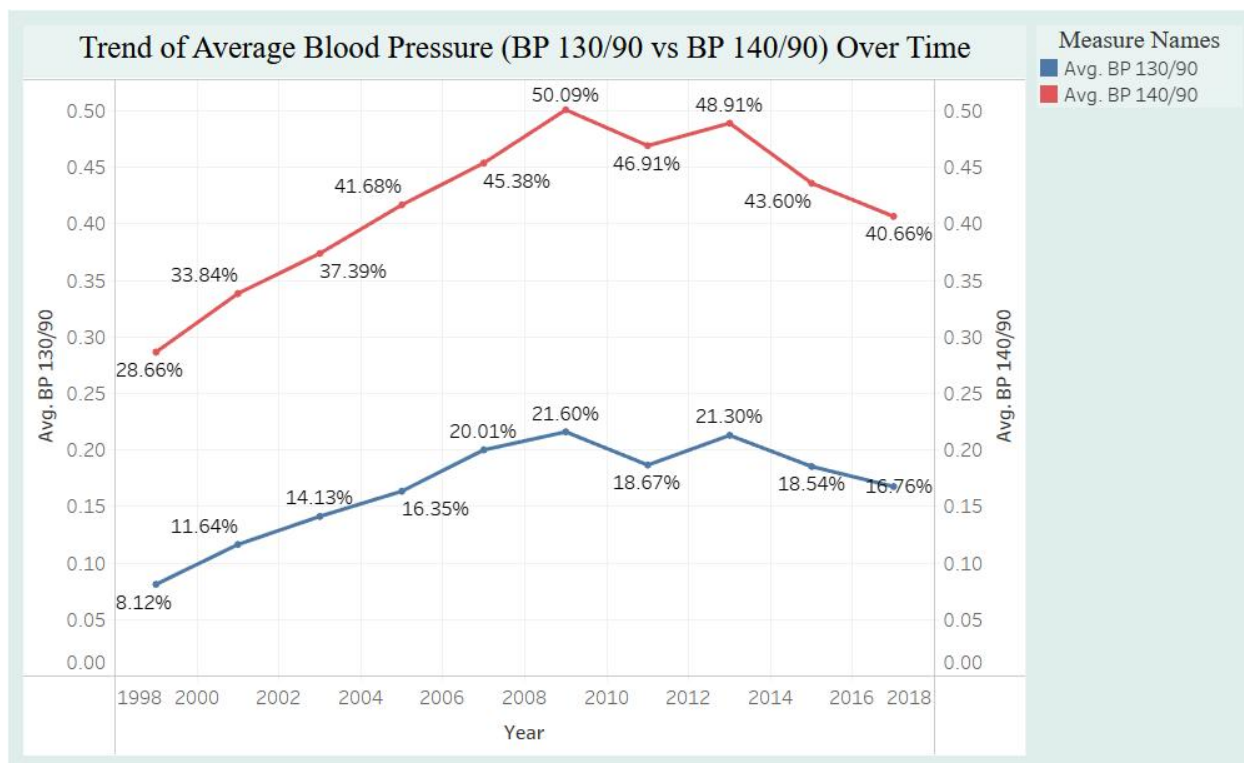
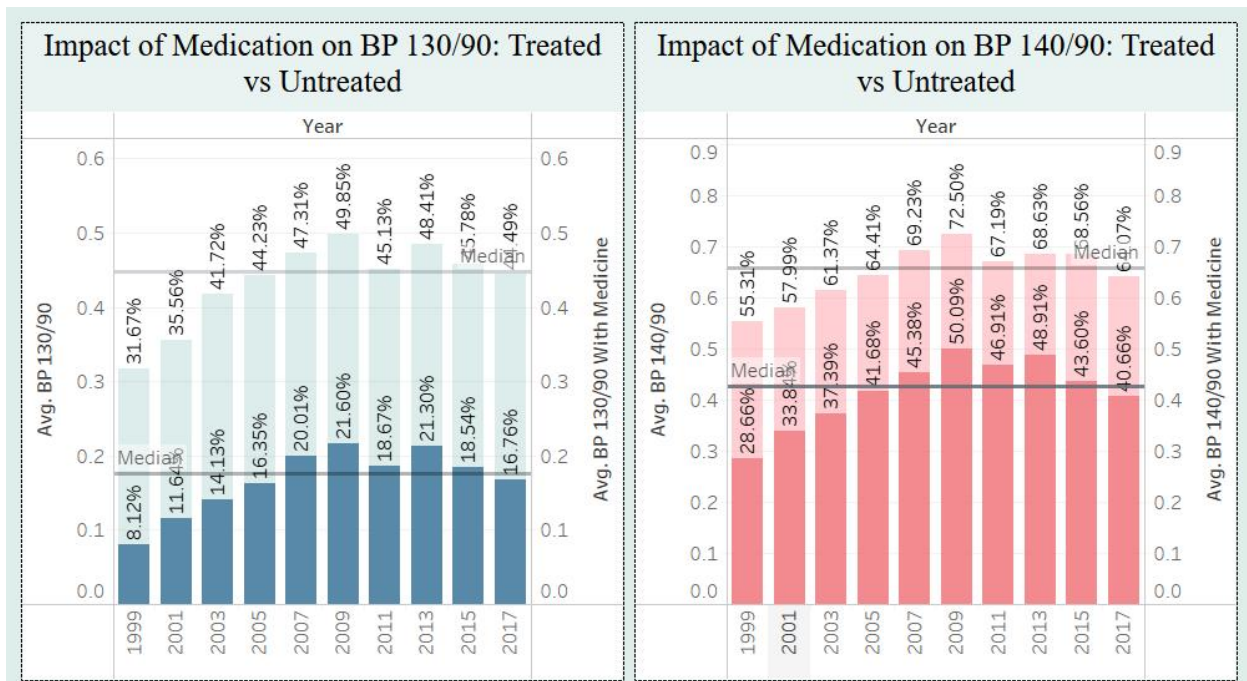


Chart 10 includes two comparison charts: the blue chart on the left shows the average annual CHD prevalence rate for BP 130/90, distinguishing between medicated and non-medicated groups, while the red chart on the right does the same for BP 140/90. An interesting pattern emerges in which CHD prevalence is notably higher among individuals on medication compared to those at the same BP level without medication, particularly within the BP 130/90 group.

Chart 10



This likely reflects the fact that individuals requiring medication often have more severe health conditions. This trend is further supported by median comparisons in Table 2.

Table 2

**Median Blood Pressure Comparison
(BP 130/90 and BP 140/90, With and
Without Medication)**

Median BP 130/90	16.80%
Median BP 130/90 With Medicine	43.05%
Median BP 140/90	42.50%
Median BP 140/90 With Medicine	65.60%

A limitation of this analysis is that while Chart 9 highlights differences in CHD rates between medicated and non-medicated groups, it lacks detailed information on the patients' overall health status or medical history, limiting insights into whether more severe underlying conditions contribute to higher CHD prevalence among medicated individuals.

Chart 11 and 12 aim to find how obesity and air pollution may affect the mortality rate of CHD. Obesity rate and PM2.5 both have a positive relationship with CHD mortality rate, which means obesity is a major risk factor for coronary heart disease and long-term exposure to polluted air also may increase the risk of coronary heart disease. Chart 11 illustrates the relationship between state-level obesity rates from the 2015 "National Obesity by State Data" and CHD mortality rates from the CDC's "Coronary Heart Disease and Stroke Mortality Data." The chart uses obesity rate on the vertical axis and CHD mortality rate per 100,000 people on the horizontal axis. While the obesity data provides a snapshot from 2015, the CHD mortality data spans nearly two decades, offering insights into how obesity may contribute to CHD. A limitation, however, is that the single-year obesity data may not capture long-term trends, which could impact interpretation of the correlation between obesity and CHD mortality at the state level.

Chart 11

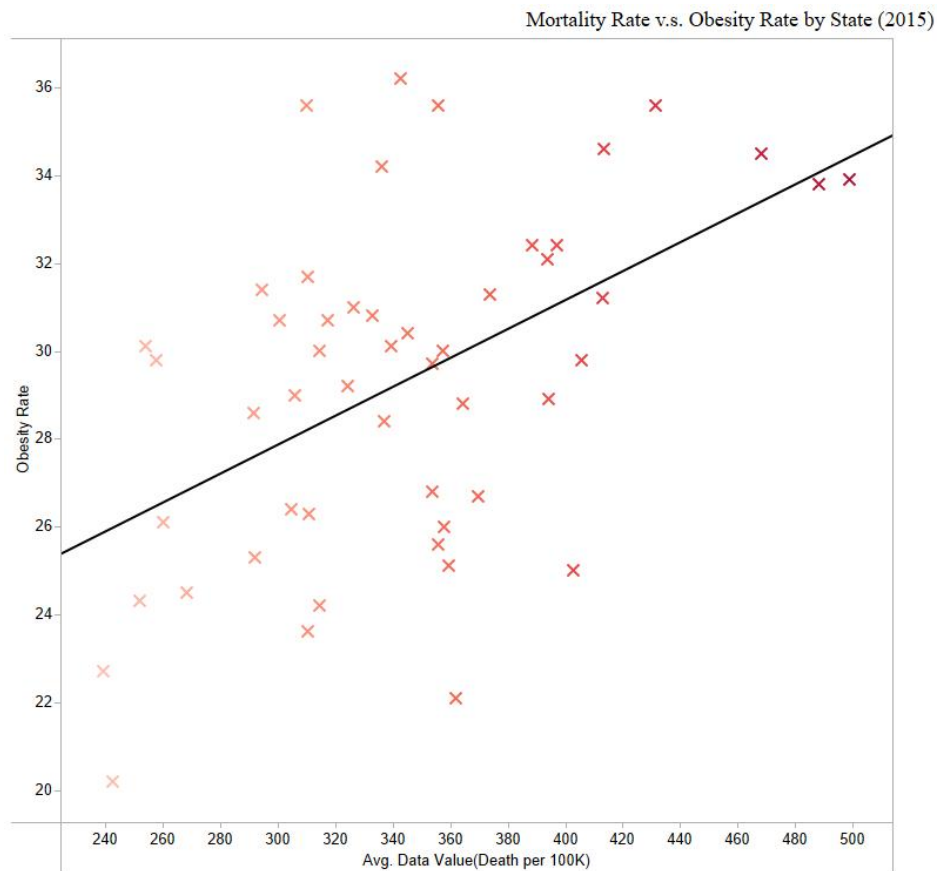
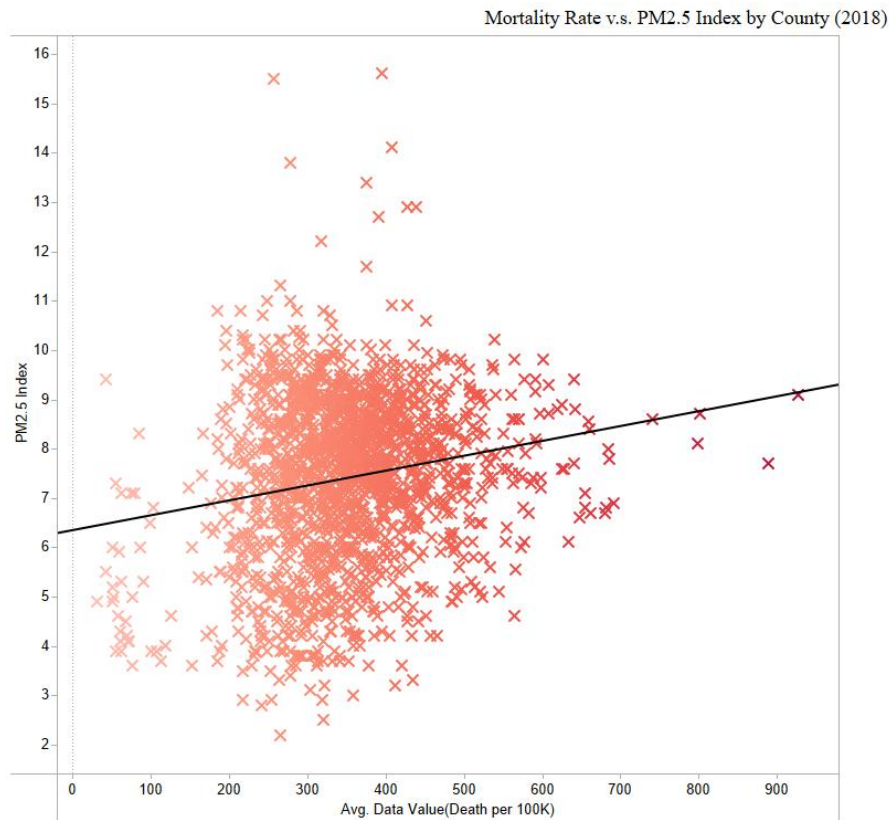


Chart 12 illustrates the relationship between county-level PM2.5 data, provided by the National Institute on Minority Health and Health Disparities, and CHD mortality data from the CDC. The chart uses the PM2.5 index in micrograms per cubic meter on the vertical axis and the average CHD mortality rate per 100,000 people on the horizontal axis. The PM2.5 data reflects air quality in U.S. counties specifically for 2018, while CHD mortality rates represent the same year. This scatter plot aims to examine if higher PM2.5 levels correlate with increased CHD mortality. A limitation is that the air quality data is restricted to a single year, whereas CHD mortality spans a broader period, potentially affecting the interpretation of long-term impacts. Nonetheless, this chart offers insight into a potential link between air quality and public health outcomes.

Chart 12



4. Summary and Conclusions

This study examines coronary heart disease (CHD) mortality trends among U.S. adults aged 35 and older, highlighting key factors such as age, socioeconomic status, hypertension, obesity, and air pollution. Major findings indicate that CHD is particularly prevalent among older adults, lower-income groups, and those with less education, with elevated blood pressure (140/90) consistently linked to higher CHD rates. Additionally, obesity and higher PM2.5 levels are associated with increased CHD mortality, suggesting lifestyle and environmental factors play substantial roles in heart health.

The main limitations include single-year data for air quality and obesity, differing time spans across datasets, lack of health status and medical history in the medication comparison and the limitations of maps in identifying causative factors.

5. Contributions

Our team of four dedicated a total of 60 hours to this project, divided across three core phases. We spent 20 hours exploring the datasets, with each member investing time in analyzing all kinds of different themes. And decided deep dig CHD-related theme in several group meetings. Identifying background, variables, trends, and meeting weekly to share findings. Approximately 20 hours went into designing and refining our visual displays, where we experimented with different chart types and adjusted layouts for clarity and consistency. Finally, we spent around 20 hours crafting the narrative, aligning it with our visuals to create a cohesive, data-driven story and final project.

Team Member	Assigned Task	Chart Title	APA References to Find
Yahuan Peng	Background and motivation: Write the background section of the project, discussing mortality trends of cardiovascular disease among adults aged 35 and older in the U.S. and the research motivation.	1. Top 10 Leading Death Causes From 1999 to 2017. 2. Line Chart: Trend of Heart Disease from 1999 to 2017.	Find literature on overall cardiovascular disease trends and their death rate.
Yao Liu	Objective and significance: Clarify project objectives, analyzing how to improve public health.	5~8. Percentage of CHD Morbidity by Age, Education Level, Family income and Area.	Find literature on cardiovascular disease incidence across social issues.
Huangkun Chen	Dataset description: Provide a detailed description of the dataset and its source of variables.	3. Cardiovascular Disease Mortality Rates by State Map. 4. County Average Death Population Map.	Find literature on geographic location and the distribution of cardiovascular disease.
Yingtong Wang	Visualization design and divide team tasks: Describe how the six charts help achieve the project goals. Summary and Revise final project.	9~11. Trend line; Annual Coronary Heart Disease Rates by Blood Pressure Levels (130/90 vs 140/90); Comparison of medication group VS. normal group; median value table.	Find literature on the relationship between blood pressure and cardiovascular disease.
Xiaoting Lu	Result analysis and discussion: Analyze the results of the charts and discuss their implications for the research objectives.	12. Obesity VS. CHD 13. AQL VS. CHD	Find literature on the impact of living environment on health and obesity problem.

6.Reference

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- ⁱ Jung, H. G., & Yang, Y. K. (2021). Factors influencing health behavior practice in patients with coronary artery diseases. *Health and Quality of Life Outcomes*, 19(3). <https://doi.org/10.1186/s12955-020-01635-2>
- ⁱⁱ Centers for Disease Control and Prevention. (n.d.). Rates and trends in coronary heart disease and stroke mortality in U.S. counties, 1999-2018. <https://data.cdc.gov/Heart-Disease-Stroke-Prevention/Rates-and-Trends-in-Coronary-Heart-Disease-and-Str/9cr5-2tt7/about>
- ⁱⁱⁱ U.S. Department of Health and Human Services. (n.d.). National Health and Nutrition Examination Survey (NHANES): National cardiovascular disease surveillance. Data.gov. <https://catalog.data.gov/dataset/national-health-and-nutrition-examination-survey-nhanes-national-cardiovascular-disease-su>
- ^{iv} U.S. Census Bureau. (2019). Population for the United States, April 1, 2010 to July 1, 2019. <https://www.census.gov/data/datasets/time-series/demo/popest/2010s-state-total.html>
- ^v Lake County Illinois GIS. (2015). National obesity by state. Data.gov. <https://catalog.data.gov/dataset/national-obesity-by-state-d765a>

^{vi} HDPulse: An Ecosystem of Minority Health and Health Disparities Resources. National Institute on Minority Health and Health Disparities. From Data Portal | HDPulse (NIMHD)

^{vii} National Center for Health Statistics. (2024). Percentage of angina for adults aged 18 and over, United States, 2019–2023: National Health Interview Survey. Retrieved September 22, 2024, from

https://wwwn.cdc.gov/NHISDataQueryTool/SHS_adult/index.html

National Center for Health Statistics. (2022, April 21). Leading causes of death: United States. Data.gov.

<https://catalog.data.gov/dataset/nchs-leading-causes-of-death-united-states>