

Original Research Article

The burden of diabetes in America: a data-driven analysis using power BI

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ABSTRACT

Background: High blood glucose levels in diabetes lead to devastating damage to the heart, blood vessels, eyes, kidneys, and nerves. It affects millions of Americans and costs the healthcare system billions of dollars. The disease's causes, risk factors, and effective prevention and treatment methods are still unknown despite its prevalence.

Methods: This descriptive study used US census and CDC data to describe diabetes in America. The US census and CDC provided this study's population and diabetes data. This study used two datasets. The first dataset contains 73054 2020 US population records. This dataset's second type was strings and decimals, including state, county, and 2020 affected population percentage. Diabetics are represented by 3154 data points. Power BI was used to visualize decision support data.

Results: According to our analysis, millions of Americans suffer from diabetes, which costs billions in healthcare costs annually. Diabetes is most prevalent in California, with 28.9 million people affected. Most cases are 45-64 years old, and the number has increased over the past decade. These findings suggest that America's growing diabetes epidemic requires more resources and facilities.

Conclusions: Finally, our study covers diabetes's prevalence, incidence, and trends in America. Our findings show that America's growing diabetes epidemic need more money, manpower, and infrastructure. We advise the government to monitor diabetes and plan for future healthcare needs.

Keywords: Diabetes, Health care, Metabolic disease, Prediabetes, Prevalence

INTRODUCTION

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves.^{1,2} Three (3) main types of diabetes have been noted which includes type 1, type 2 and gestational diabetes of which type 2 is the most

common.^{1,2} In the past 3 decades the prevalence of type 2 diabetes has risen dramatically in countries of all income levels.¹ Approximately 422 million people worldwide have diabetes, the majority living in low-and middle-income countries, and 1.5 million deaths are directly attributed to diabetes each year. Both the number of cases and the prevalence of diabetes have been steadily increasing over the past few decades.¹

Prediabetes is a serious health condition where blood sugar levels are higher than normal, but not high enough yet to be diagnosed as type 2 diabetes.²⁻⁴ Of those with prediabetes, more than 80% are not aware they have it.² Prediabetes can result to an increased risk of developing type 2 diabetes, heart disease, and stroke.² Doctors have mainly observed the changes of blood glucose in the past four (4) decades through fasting plasma glucose (FPG), glycated haemoglobin (HbA1c), 2-hour postprandial blood glucose (2hPG), to provide a basis for the diagnosis of diabetes.^{5,6} Symptoms of diabetes can be observed in individuals of different gender, race and age.

Globally, chronic care conditions burden society with high costs and diminished quality of life for affected individuals. American Diabetes Association (ADA) and Diabetes Research Institute (DRI) estimated that about 37.3 million Americans had diabetes, with an estimated prevalence of 11.3%.^{7,8} They also showed that nearly 1.9 million Americans had type 1 diabetes, including about 244,000 children and adolescents.^{5,6} Of the 37.3 million adults with diabetes, 28.7 million were diagnosed whereas about 8.5 million were undiagnosed; the number of new cases per year were 1.4 million; and the number of Americans with Prediabetes were 96 million (aged 18 years and above).^{5,6}

In 2018, about 17 million Emergency Department (ED) visits were reported with diabetes as any listed diagnosis among ≥ 18 years.⁵ Incidence rates of diagnosed diabetes were higher among adults aged 45-64 years and those aged ≥ 65 years as compared to those adults aged 18-44 years.⁵ Based on race/ethnicity, ADA noted that the rates of diagnosed diabetes among adult Americans in 2019 were 14.5% among American Indians/Alaskan natives, 12.1% among non-Hispanic blacks, 11.8% among Hispanics, 9.5% among Asian Americans and 7.4% among non-Hispanics whites.⁶

Diabetes was the 7th leading cause of death in the United States in 2017 and 2019, based on the 83,564 and 87,647 death certificates in which diabetes was listed as the underlying cause of death.^{5,6} It was also noted that diabetes was mentioned as a cause of death in a total of 270,702 and 282,801 certificates in 2017 and 2019 respectively.^{9,10}

With respect to cost, it was estimated that the total cost of diagnosed diabetes in the United States in 2017 and 2022 were 327 billion and 412.9 billion dollars respectively.^{5,6} Total estimated direct cost of diagnosed diabetes increased from 188 billion in 2012 to 237 billion in 2017 and 306.6 billion in 2022; and total indirect costs increased from 73 billion in 2012 to 90 billion in 2017 and 106.3 billion in 2022.^{5,6} When these costs were compared to the general population, it was found that the average medical expenditure among people with diagnosed diabetes were 2.6 times higher than what expenditures would be in absence of diabetes.^{5,11,12}

This study therefore planned to elucidate and draw attention to the increasing trend in the prevalence and incidence of diabetes among the American population.

METHODS

To provide a comprehensive overview of diabetes in America, this descriptive cross-sectional study done from October to November 2023 utilized data from the US Census data and CDC, which consist of the population of the United States and diabetes data and statistics. Two datasets were used for this study. The first dataset consists of 73054 records indicating the number of people in the United States in 2020. The dataset also contains decimals and integers, which include the number of individuals in the country and percentage, tract ID, unemployment, building.

The second type of data in this dataset was strings and decimals, which include state, county, and percentage of affected individuals in 2020. The data consists of 3154 data points indicating the number of individuals with diabetes. Therefore, the sample size use for this study was 73054 which was the total population of adults living in the United States as at the last country's census and 3154 of the population diagnosed with diabetes as of 2020 which was the year of the last census in America. The original dataset formats are in CSV and the unified dataset's format were also in CSV. The inclusion criteria include adults from age 18 and above who live in America and access healthcare while the exclusion criteria are adults who don't live in America and adults who don't access healthcare in the United State. The data for decision support was done using Power BI platform for data visualization.

Descriptive research design was used to provide an overview of diabetes in America. We used the datasets from the US Census and CDC to analyze the prevalence of diabetes in the United States. We also compared the prevalence of diabetes in different age groups and geographic regions. Power BI platform for data visualization was employed for visualizing the data set for this study. The methods used for this study include data collection, data cleaning, data analysis, and data visualization. The prevalence of diabetes in the United States was visualized from the analysis. The data was cleaned to remove any errors or inconsistencies. We then analyzed the data to identify patterns and trends in the prevalence of diabetes. Finally, we used data visualization techniques to present the results of our analysis.

RESULTS

Figure 1 shows the pictorial distribution of the population of the United States as of 2020.

Figure 2 below depicts that there was almost equal distribution of diabetes among the male and female

population with prevalence of 50.86% and 49.14% respectively.

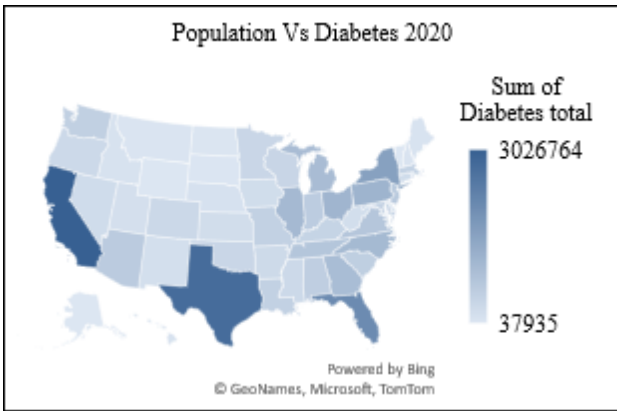


Figure 1: Population of United States of America as of 2020.

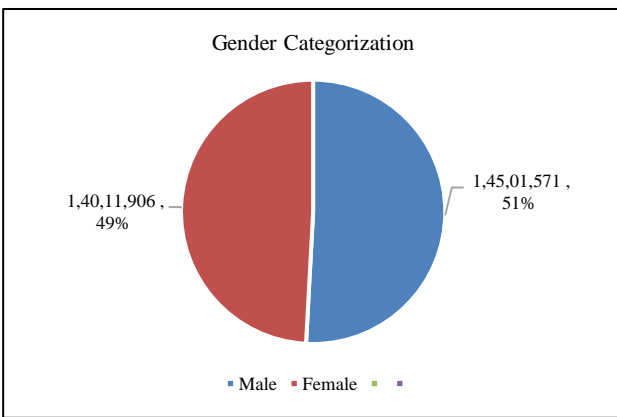


Figure 2: Distribution of diabetes by gender among the American population.

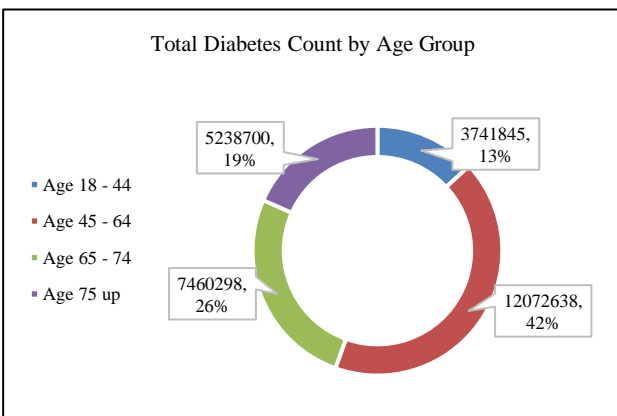


Figure 3: Distribution of diabetes by age among American population.

Figure 3 above showed that diabetes was more prevalent among those aged 45-64 years, followed by those within the age range of 65-74 years with prevalence of 42.34% and 26.16% respectively.

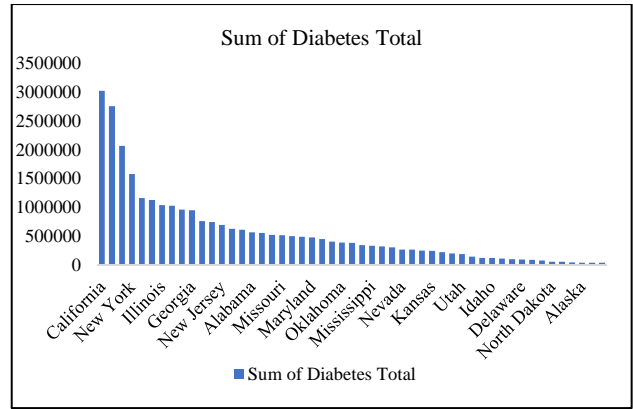


Figure 4: Diabetes Distribution according to States in the United States of America

Figure 4 above showed that California had the highest population of people with diabetes, followed by Texas and Florida. However, Wyoming and Vermont had the least number of people with diabetes.

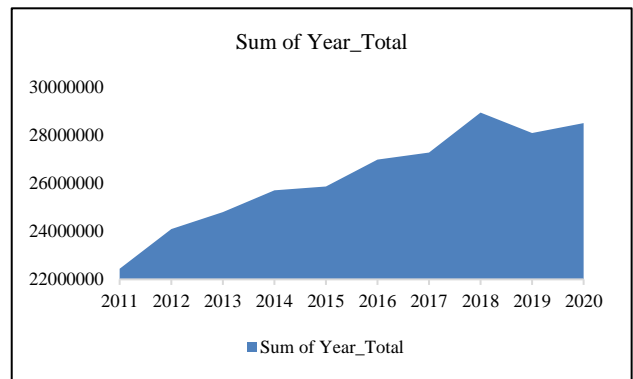


Figure 5: Trends in diabetes prevalence among American population.

Figure 5 above showed an increasing trend in the prevalence of diabetes among the American population for the past ten (10) years.

DISCUSSION

Our analysis reveals that diabetes is a significant public health concern in America, affecting millions of people and costing billions of dollars in healthcare expenses each year. We found that California is the geographic hotspot for diabetes, with 28.9 million people suffering from the disease. The predominate age group is 45-64, and there has been an increase in the number of cases for the past ten years. These findings suggest that there is a need for increased resources and facilities to address the growing diabetes epidemic in America.

Diabetes is a big health problem in the United States, according to our results, with 28.9 million people suffering from the condition. In the United States, California is the geographic hotspot for diabetes. Diabetes affects roughly 4 million people between the

ages of 18 and 44, 12.1 million people between the ages of 45 and 64, 7.5 million people between the ages of 65 and 74, and 5.3 million people between the ages of 75 and up. This was in not tandem with the work done by Whicher et al in their work diabetes in the UK were only 7% of the UK population are diabetics.⁹

Diabetes is a substantial health problem in several countries, including Australia, Canada, New Zealand, the United Kingdom (UK), and the United States (US), according to a study published in the BMC Health Services Research.⁷ The study evaluated diabetes management in five OECD nations (Australia, Canada, New Zealand, the United States, and the United Kingdom) using data from general and indigenous populations where available.⁷

When compared to Australia and New Zealand, the study revealed that the United States and the United Kingdom fared well across the four process indicators.⁷ Annual HbA1c and cholesterol testing, for example, were provided to 70-80 percent of patients in the US and UK, but only 50-60 percent of patients in Australia and New Zealand.⁷ In terms of proximal outcomes, patients in Australia and New Zealand had better HbA1c management than patients in the US and UK.⁷ The study suggested that policymakers and health-care professionals from different nations can learn from one another to enhance data collecting and diabetes care delivery at the population level.⁷

Diabetes is a global health condition that affects millions of individuals globally, our study showed an increasing trend in the prevalence of diabetes among the American population for the past ten (10) years and this is in tandem with the report published by the World Health Organization (WHO).⁸ According to the data, the number of diabetics has increased from 108 million in 1980 to 422 million in 2014. Therefore, showing that there is an increased trend and prevalence of diabetes in America. Diabetes is also a leading cause of blindness, kidney failure, heart attacks, stroke, and lower limb amputation, according to research.¹³ According to our study California had the highest population of people with diabetes, followed by Texas and Florida. However, Wyoming and Vermont had the least number of people with diabetes this issue was addressed by the work published by the WHO suggesting that governments should make efforts to eliminate diabetes risk factors such as poor diets, physical inactivity, and tobacco use.^{8,13} The research also suggests that countries reform health-care systems to guarantee that diabetics receive the care they require.⁸

However, our data indicate that diabetes is a substantial health problem in the United States, with California serving as the disease's regional hotspot. Diabetes is most common in people aged 45 to 64, and the number of cases has increased over the last ten years. According to our analysis, California is in desperate need of resources such as funding, staffing, and facilities. For a feasible

solution, the predominant age group of 45-64 should be researched. It is also critical for the government to recognize the diabetes trend and plan for future healthcare demands. Furthermore, the government should consider enacting a policy of free medical treatment for people over the age of 65 to reduce the modality rate.

Our findings agree with those of the BMC Health Services Research and the World Health Organization.⁸ Diabetes is a global health issue that affects millions of individuals globally, according to the findings. The findings urge that governments take steps to eliminate diabetes risk factors and strengthen health systems to ensure that persons with diabetes receive the treatment they require. The studies also imply that policymakers and health-care providers from different nations might learn from one another to enhance data collection and diabetes care delivery at the population level.

Some caveats regarding this study should be mentioned. It is possible that the data utilized in this study is not entirely accurate, as it was derived from the US census and the CDC. Furthermore, the study disregards the prevalence of diabetes in other countries and solely considers diabetes in the US.

The last census in the united state was in 2020 and therefore we could not compare the latest diabetes prevalence of year 2023 with the latest population because it wasn't available

CONCLUSION

In conclusion, diabetes is a major public health concern in the US, with the Golden State experiencing disproportionately high rates of the disease. Diabetes primarily affects people between the ages of 45 and 64, and the prevalence of this disease has been on the rise over the last decade.

Recommendations

The state should increase its spending, personnel, and infrastructure to fight the disease. A potential solution could be found by studying the predominate age group 45-64. The government should also pay attention to the rising diabetes rate and make plans for future healthcare demands. Also, to lower the modality rate, the government should think about making medical carefree for everyone over the age of 65. The reliability of the data and the study's exclusive concentration on American diabetes are two of its major caveats. To find effective ways to fight the disease and to compare the prevalence of diabetes in other nations, additional research is required.

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