Exploring the extent of correlation between obesity and cardiovascular health in the United States of America and India

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Abstract

Obesity is only one of many risk factors for cardiovascular disease, however, it has received high levels of medical attention in recent years which has transferred over to the public eye. Excess abdominal fat can impact the structure and function of the heart. Obesity triggers the inflammatory processes to harm the cardiovascular system through structural and functional changes. These risk factors include hypertension, diabetes, and cholesterol abnormalities. The inflammation increases the plaque formation which can eventually lead to blood clots and cause heart-related complications. Obesity can also enlarge the heart due to untreated high blood pressure. This epidemic is mainly caused by lifestyle choices, eating habits, and exercise. Obesity poses a risk for several cardiac events which can be life-threatening. Instead of age, genetics, and gender, which are three of the most prominent, non-modifiable risk factors, the focus will be placed on modifiable risk factors including BMI values. This paper raises awareness among the general public on this important issue. My findings show there is a significant positive correlation between obesity and cardiovascular disease in both the United States and India. More specifically, both health issues are more frequent in urbanized communities and high mortality rates of cardiovascular disease in regions with high obesity rates. The majority of readers do not have an advanced education of the human body and do not understand how significantly the heart can be affected by a poor diet and weight gain. This essay aims to explain complex concepts about the biology of the heart and the factors affecting its health in simple terms which would be fascinating for laymen. The public will gain valuable knowledge and benefit from being informed on potential causative agents of obesity and cardiovascular disease from this paper.

Keywords: cardiology; obesity; urbanization

Introduction

The increasing prevalence of heart disease and obesity today produces great pressure on healthcare professionals and necessitates the need for control and prevention programs. Over 214 billion dollars are spent annually by the American healthcare system on heart disease. Even though obesity is solely one of many risk factors for cardiovascular disease, it has recently received high levels of medical attention. Obesity is intertwined with several health conditions including cardiovascular disease, diabetes, high blood pressure, and abnormal blood cholesterol. Excess abdominal fat can impact the structure and function of the heart. Obesity has been perceived as a risk factor for cardiovascular disease worldwide (Kim et al., 2015). One's BMI is calculated by dividing body mass by the square of their height and can indicate reasonably well to what extent a person is overweight. This measure also allows weight updates to be accounted for during weight loss training so progress can be tracked. On the contrary, muscle mass and bone density are not accounted for, so BMI is not as reliable in some cases. The increase in one's body mass index (BMI) is associated with an increase in cardiovascular disease. The highest rates of obesity and heart disease are influenced by ethnic, regional, and income disparities that have become a major public health concern (Healthy Body Weight, 2016).

This paper will examine the effects of development on the correlation between obesity and cardiovascular health comparing two countries with different development levels, the United States of America and India. There is a positive correlation between the percent of adults who are obese and the rate of cardiovascular disease in both India and the United States of America.

The primary reason the United States of America and India were chosen as the regions to be compared was because both countries have a significant prevalence of obesity. Forty-nine percent of Americans are obese while only fifteen percent of adults are obese in India (Obesity-

Update-2017, 2017). Both face an issue of obesity and malnutrition depending on the urbanization of the city or village they live in. These two countries also have contrasting average annual incomes with most of the population in the United States having an annual household income of 50 000 to 75 000 U.S. dollars while the average household in India would earn roughly 924 to 1386 U.S. dollars annually. This effect of income and development on obesity and cardiovascular health and how their positive correlation is elucidated by the development factor will be further explained ahead (Statista, 2021).

Here, an interdisciplinary approach is taken which gives the opportunity to use knowledge and information from both biology and geography. Using only scientific reasoning would restrict the majority of research being completed to be based on the reasons behind cardiovascular disease and obesity and not the differences around the world. Geography as a subject, on the other hand, would potentially limit the understanding of the reader about causes and consequences about obesity and cardiovascular health and focus solely on the distribution of the two health issues due to developmental factors.

To better understand the true magnitude of these issues, imagine that the 325 million people that currently reside in the United States of America were ten people in one room. Five of those ten people would be obese and three would eventually die because of heart disease (Heart Disease Facts, 2021). On the other hand, out of India's population of over 1.3 billion people, the number of obese adults in India would be over the population of the United States of America and the annual deaths due to heart disease would be roughly 3.5 million (India Population, 2019). This allows for a simpler view of the true prevalence of obesity and heart disease. These similar statistics exhibit the presence of a positive correlation between them.

The connection between obesity and heart disease is varied. For instance, obesity increases the development of risk factors for heart disease by triggering the inflammatory processes to harm the cardiovascular system through structural and functional changes. These risk factors include hypertension, diabetes, and cholesterol abnormalities. The inflammation increases the plaque formation which can eventually lead to blood clots and cause heart-related complications. Obesity can also enlarge the heart due to untreated high blood pressure.

Cardiovascular health is a major issue globally and there are numerous types of cardiovascular health problems that humans have endured. Heart disease could also be referred to as a condition where there are narrow blood vessels which could potentially lead to a heart attack. A heart attack can occur when a certain section of the heart cannot receive blood because of ruptured plaque or a clot in an artery blocking the movement of blood cells.

Factors affecting cardiovascular health

Throughout the United States of America, someone has a heart attack every 40 seconds. There are many factors that can affect one's risk for cardiovascular health issues, namely age, genetics, and gender are three of the most prominent, non-modifiable risk factors (Sudden Cardiac Arrest (SCA), 2020). Other than the 3 factors listed which are uncontrollable, there are many others that are modifiable such as smoking, a poor diet, and physical inactivity. Disparities in wealth and development between countries can play a major role in the prevalence of obesity and cardiovascular disease. By gaining knowledge about the consequences of maintaining lifestyles including controllable risk factors, the public can willingly make choices to prevent further harm to their cardiovascular health.

Factors affecting obesity and its physiology

Obesity impacts more than half a billion people around the world. Obesity is a major health concern in most urbanized countries. Someone is classified as obese when they are 20 percent or more than their ideal body weight or have a body mass index (BMI) of 30 or more (Shields et al., 2012). Thirty million adults in India were obese in 2014 and the number has been on the rise. The United States of America and India are two major countries in terms of population, economy, and power and face issues of obesity in several cities. The United States of America is ranked first in terms of obesity prevalence with India being third in the world (World Rankings: Obesity Rates by Country, 2017).

This epidemic is mainly caused by lifestyle, changes involving eating habits, and exercise. Obesity poses a risk for several cardiac events which can be life-threatening. There has been a surge in levels of obesity in both countries specifically after 1990. Coincidentally, there has been a 6.3 percent increase in the urbanization of the United State which led to more fast-food restaurants along with the higher availability of buses and taxis (Ritchie, 2018).

Another factor directly correlated to the quality of one's diet is stress. Seven out of ten adults in the United States claim that they experience stress daily (Physical Activity Reduces Stress | Anxiety and Depression Association of America, ADAA, 2018). Many people with low annual incomes also tend to worry about paying taxes, bills, rent, groceries, and many other costs. One way of dealing with stress is overeating and is especially common in the United States. This addictive way of dealing with chronic stress is known as comfort eating. However, stress can also act as a reason to add exercise in their daily or weekly schedule since it is scientifically proven that exercise produces endorphins in the mind that also reduce stress levels. Furthermore, research has shown exercising roughly 30 minutes per day, most days a week can help prevent heart disease. (Heart Disease Symptoms and Causes, 2021).

The most common physiological correlation with obesity is the level of cholesterol in one's body. It is proven there is a significant increase in LDL (low-density lipoprotein), or bad cholesterol, due to factors such as a poor diet, saturated fats, trans-unsaturated fatty acids, and physical inactivity. An abnormally high cholesterol level can also be due to an inherited condition. A high level of low-density lipoprotein increases someone's risk of heart attacks and cardiovascular disease. An obvious and salient solution to decrease one's cholesterol would be to eat fewer fats and have an increased physical activity; however, for someone who is obese, their body has adapted to the high levels of low-density lipoprotein and even with an improved diet, the liver of that person will continue to produce the same level of cholesterol. The most proven solution is to lose weight along with following a diet consisting of low fat, more protein, along with fruits and vegetables (Health Guides, 2021).

Methods and approach

In my data analysis, pre-existing data was processed in order for specific graphic representations to be made. From there, the states with the highest, lowest, and close to average obesity percentages were noted and the numerical data was converted into a series of colours representing low to high values. These colours were added to each state on a blank map of either India or the United States of America. Figures 2 and 3 were represented similarly except they were both the United States from different years in order to display a shift in prevalence. Data from "The State of Obesity" was used in the same way as Figure 1 (New Adult Obesity Maps, 2021).

In Figure 4, many sources had to be used to process statistics to achieve data about cardiovascular disease mortality percentage compared to total deaths per year, percentage obesity compared to the total population, and the states and regions with the highest obesity levels. The

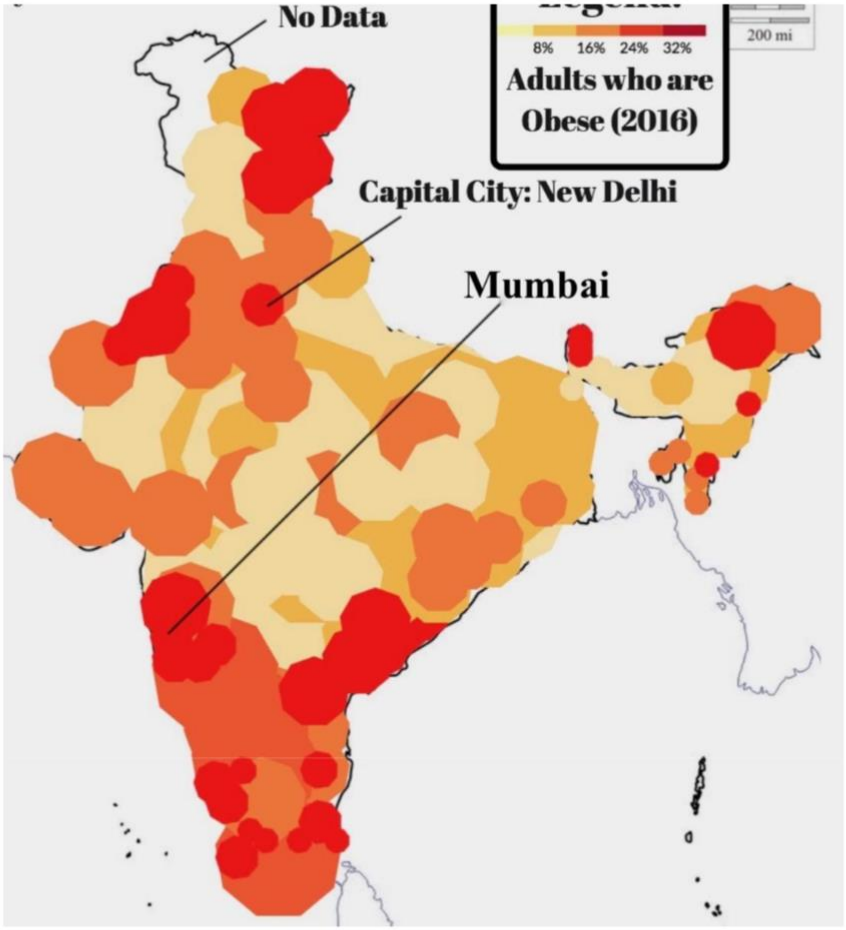
most salient sources are from “Centers for Disease Control and Prevention” used to gather data on heart disease death rates, “Down to Earth” (Pandey, 2016) was used for obesity prominence in India which was later processed with the total population to calculate percentages of obesity levels in certain regions. In Figure 5, data since 2000 on the number of deaths due to cardiovascular disease compared to the total population of the United States (Lee et al., 2021).

Figures 1, 2, and 3 display trends in the spread of obesity levels in India and the United States of America along with displaying the shift in obesity prevalence in the United States of America from 1990 to 2016. Creating these Figures helped answer the research question since a similar pattern or rate of increase in cardiovascular health issues could show correlation. Figure 4 provides the reader with specific numerical data which is crucial to understanding the extent to which obesity and cardiovascular health are correlated.

Results

Figure 1

The percentage of obesity in different states of India



When a city is urbanized, there are many modern amenities and fast-food restaurants which is evident from various well-known franchise locations. There is a correlation between obesity levels and the development of a city. In smaller developing cities and villages, many of the residents would likely have a low-income and therefore, would be forced to have a restricted and limited diet mainly consisting of self-grown plant-based foods especially due to the lack of nearby grocery stores and restaurants. According

to the map I created, the prevalence of obesity varies across India. There is generally an increased obesity percentage near the coasts of the country. The south of India also has an increased number of adults who are obese such as areas close to the megacity, Mumbai which is the largest city in India. The total population of Mumbai alone was 18.41 million people in 2011 and since then it has risen to over 22 million in 2018 (World Population by Country, 2016). In a developed city like Mumbai where there are many job opportunities for residents, the likelihood that one would choose fast food over cooking at home is high predominantly due to lack of time since purchasing and preparing fresh vegetables, proteins, and carbohydrates is time consuming. The urbanization of New Delhi is comparable to Mumbai and displays a high prevalence of obesity in adults. A strength of this map is that it visually displays the country-wide spread of obesity. A limitation is that the exact numerical data is not present for many specific areas.

Figure 2: The percentage of obesity in different states of the United States of America in 1990

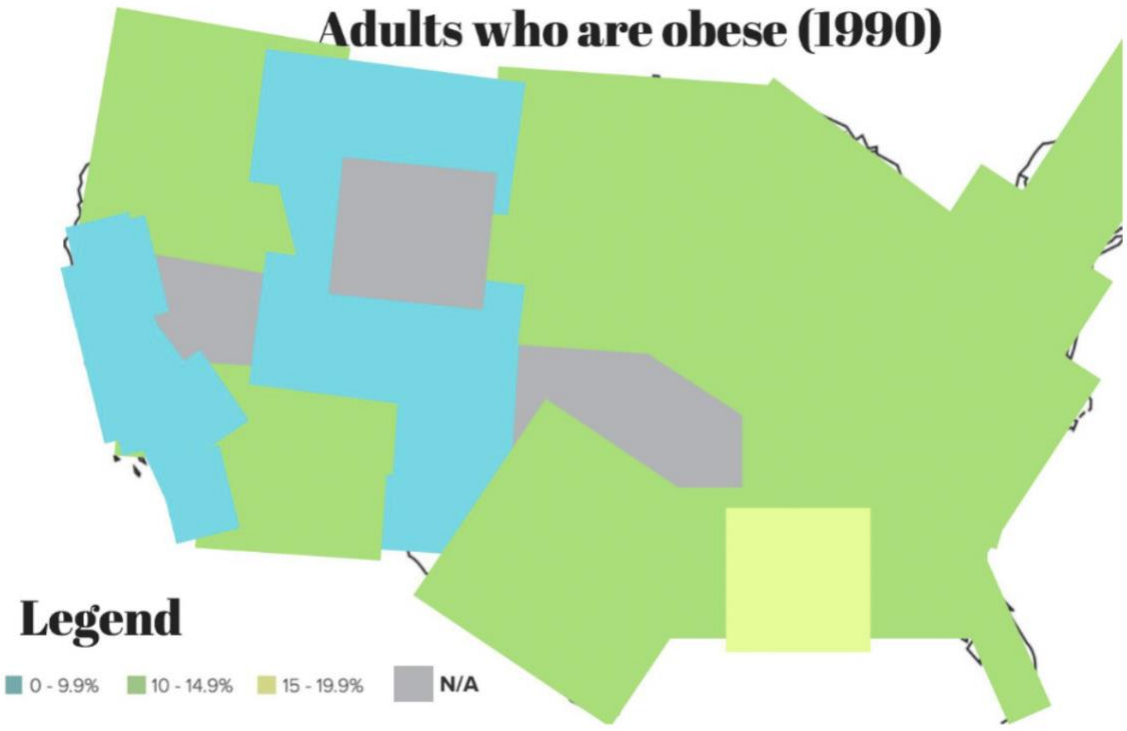
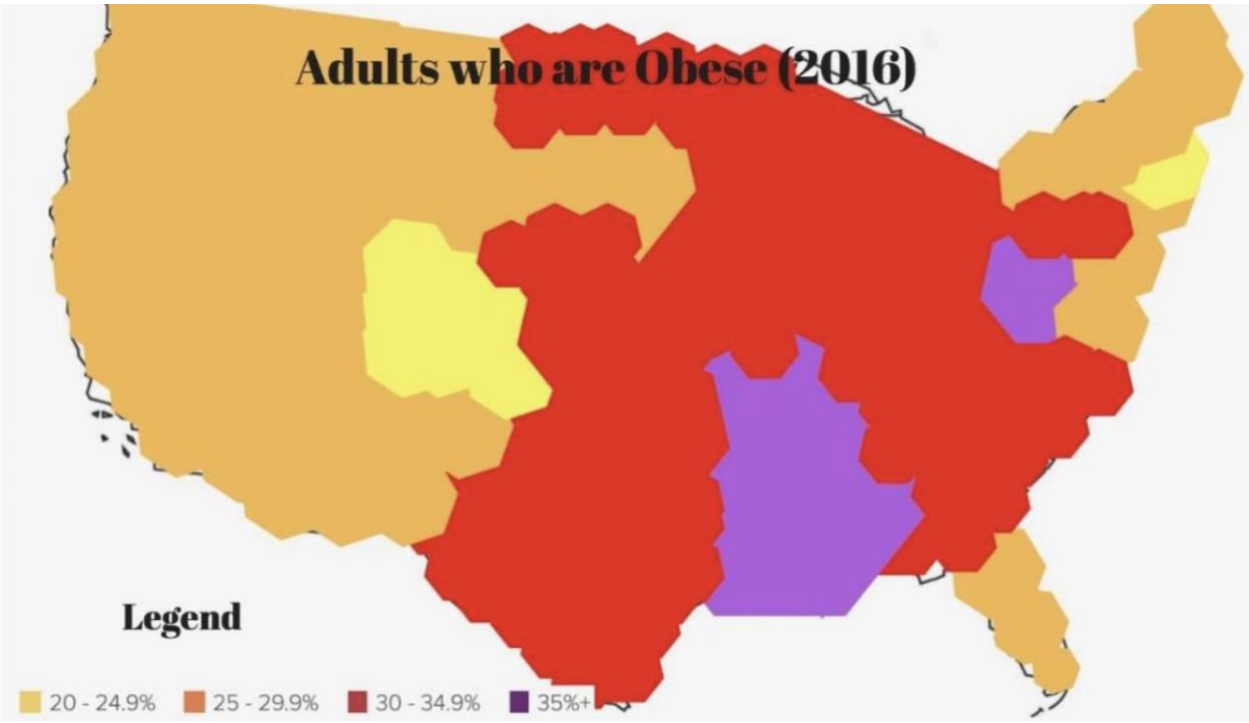


Figure 3

The percentage of obesity in different states of the United States of America in 2016



Both maps compare the percentage of adults who are obese in different states. There is data from 2016 and 1990 and it is evident that there have been significant changes in numerical data since 1990. Less data was also available during 1990 for American adults who are obese which was the reason for different shapes of colour in Figure 2 compared to Figure 3. In-depth data on obesity from the 1990s was not available for India.

Looking ahead to the map of the percentage adults who are obese with more development occurring around the country with increased hours of work and an increase in the number of fast-food chains and convenience of unhealthy and processed food, the obesity rates have also increased. It is evident that there is a correlation between the popularity of fast food and the rise in obesity levels. As the cost of potentially missing work to cook multiple times increases along with the quality and portion sizes of fast food, most of the population in mainly developed

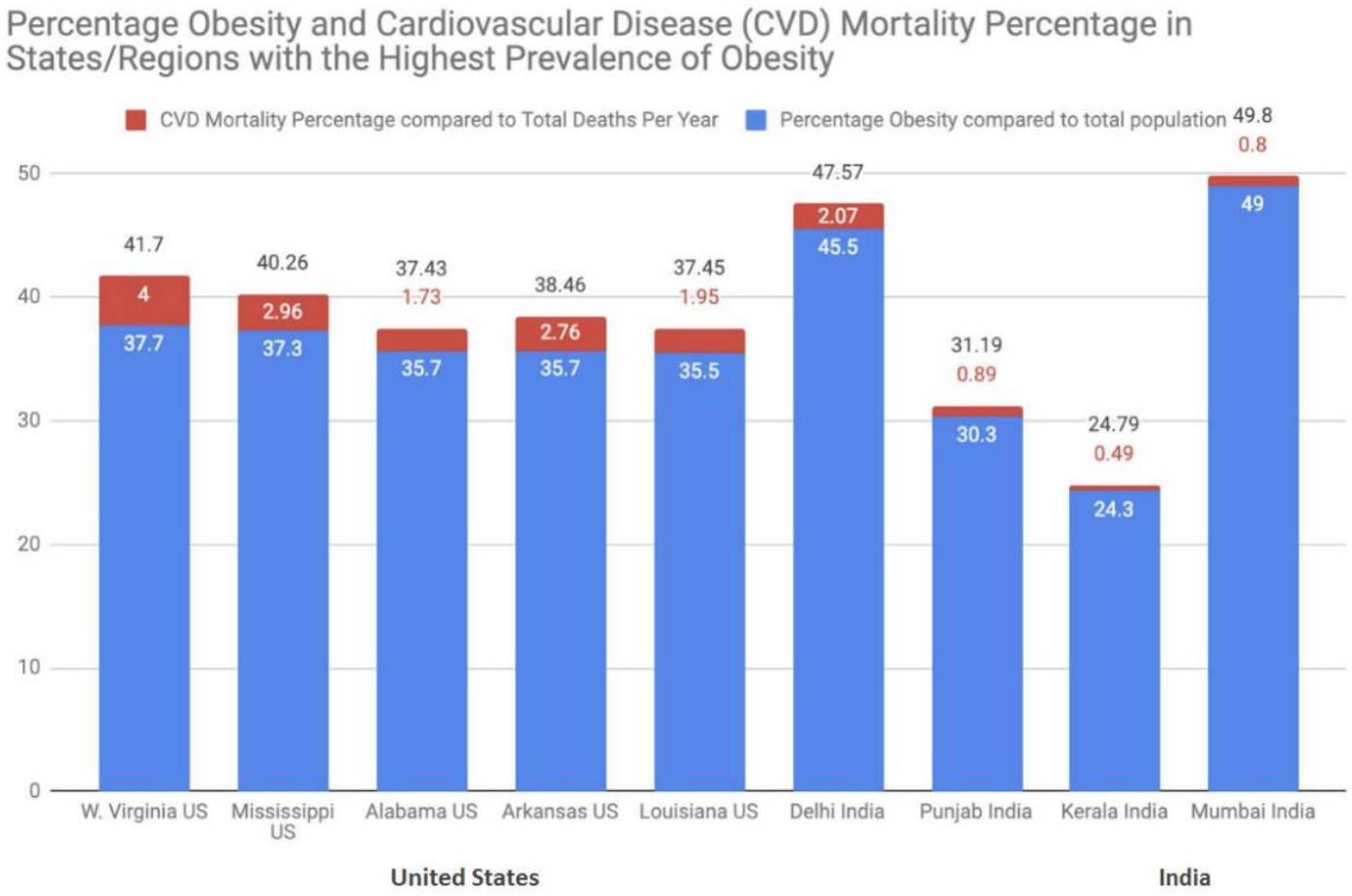
regions tend to lean toward fast food. What is not usually considered as important is the harm to health and increased health risks, especially to the heart.

In 1990, the majority of adults in the United States of America were not obese with only 10-14.9% of people being obese at the time. States such as Nevada, California, and Montana had the lowest rates from as low as 0% to 9.9%. Mississippi was the state with the highest levels of obesity in 1990 with approximately 15 to 19.9% of adults being obese.

Moving forward, in 2006, Mississippi was the first U.S. state to have more than 30% of adults obese. Soon after, many other states such as Alabama and Tennessee, which neighbour Mississippi also reached 30% obesity of all adults. Even in 2018, Mississippi has the second highest adult obesity percentage out of the entire United States of America and was 37.3%. A potential reason for this extremely high obesity rate specifically in Mississippi is the development and urbanization along with the average income of a resident. Relative to the rate of development, increases in economic status occur very gradually. Mississippi is the poorest state in America and 21% of people live in poverty while fast food chains are prominent. Due to low incomes, people prefer to spend less and purchase foods with a larger portion size along with higher caloric values so they will feel full for longer. In 2016, it is evident that the entire country of the United States of America has experienced a significant increase and that most of the states have an obesity percentage of over 25%.

Figure 4

Percentage of obesity in different states of the United States of America and India versus the cardiovascular mortality rate as a percentage of the total deaths in each state in 2016



According to the figure, West Virginia has the highest percentage (4) of deaths due to cardiovascular disease along with the highest percentage (37.7) of obesity within America closely followed by Mississippi, Arkansas, Alabama, and Louisiana. In West Virginia specifically, the mortality percentage of 4 is only closely followed 3.9 due to cancer. This bar graph specifically displays the number of people who lose their life due to cardiovascular disease per year and the percentage of people who are obese in the top 5 states with the highest obesity levels in both the United States and India.

In terms of percentage obesity in India, Mumbai is highest, while the highest using cardiovascular disease mortality is Delhi. A significant anomaly within the data which was noticed was Goa, which had a relatively low percent obesity; however, the highest CVD mortality which is 5.3 percent. A potential reason is the population of the city is relatively low being at 1.9 million compared to Delhi at 19 million and Mumbai at 18.4 million. Since the population is low with a rapidly increasing percentage of obesity per year, which is currently 23 percent of obese adults in Goa compared to 13 percent in India, several types of cardiovascular diseases which are linked to obesity will lead to an increased mortality rate among Goans. After observing this graph, it is possible that there is a correlation between a high obesity percentage within a city and the mortality rate due to cardiovascular disease.

Figure 5

Percentage of obesity in the United States versus the cardiovascular mortality rate as a percentage of the total deaths annually

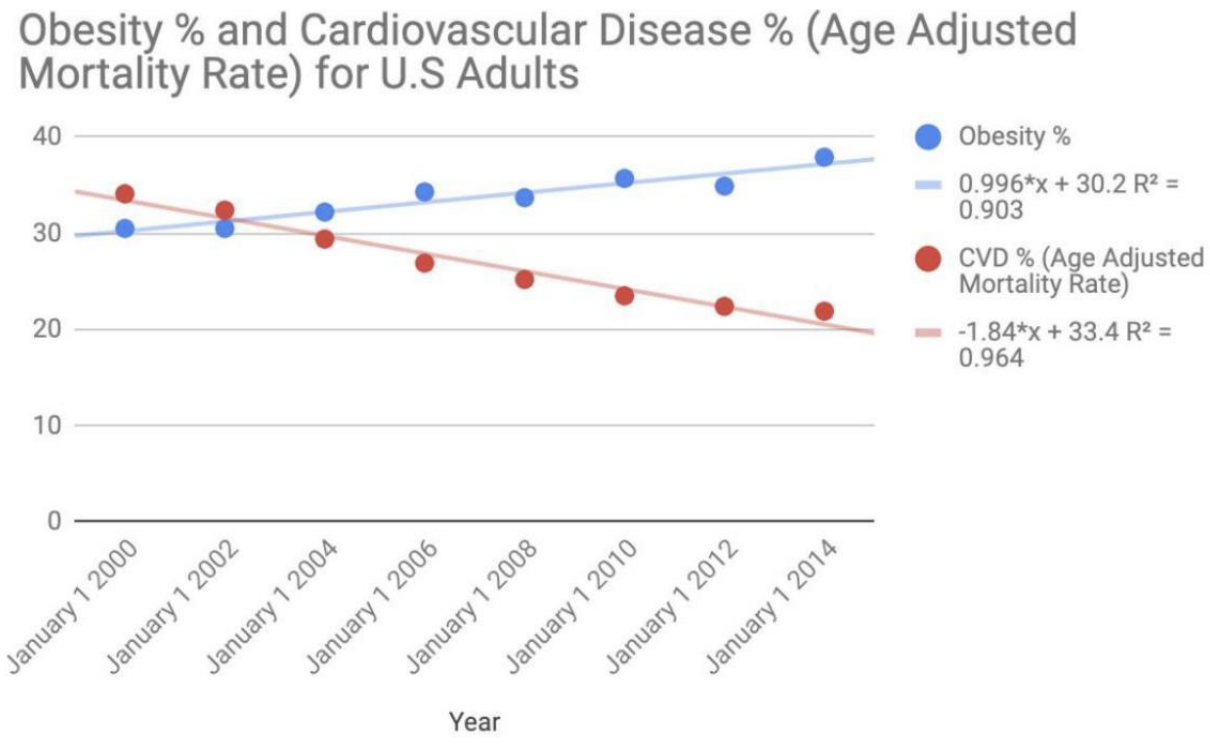


Figure 5 displays the correlation between the rise or fall in the percentage of adults in the United States of America which are obese and have a cardiovascular disease-related death. According to this graph, it is noticeable that the mortality rate of cardiovascular disease has been decreasing since 1999 until 2015 with levelling out occurring from 2011 to 2015. On the other hand, the percentage of adults who are obese has been steadily increasing slightly from 1999 to 2015. One reason for this contrast in trends over time for obesity and the cardiovascular disease mortality rate is that there are currently many medications readily available for anyone who has been diagnosed with a problem related to the heart or for the prevention of disease.

The availability of highly effective medications to treat cardiovascular disease is a product of development. Developments in the same region but different industries can show large variations in health-related outcomes. Increases in total obesity percentages can be due to increases in fast food availability while decreasing cardiovascular disease mortality rates can be associated with developments in health-care facilities and to education-systems where people can gain awareness of health issues and steps for prevention. This could be a potential cause for the decreasing percentage of deaths due to heart disease.

On the other hand, many people who are obese lose weight by making changes to their diet or exercise regime; however, many also tend to regain weight after a few months (Cooper, 2015). By continuously following a harmful routine every day, eventually, one's body may gain weight and there is a strong possibility they could face serious health problems. These problems include high blood pressure, due to the extra weight the muscles must support and the persistently faster rate of pumping that the heart has to complete. An obese person may also have a higher risk of having a cardiovascular disease especially if one has abdominal obesity since excess fat on the body tends to increase the low-density lipoprotein (LDL) in the body which

causes plaque to build up in the arteries of the heart (Shields et al., 2012). Over years, if diet and exercise do not undergo changes, plaque inside the coronary arteries will build and can potentially cause blockages which can lead to a heart attack.

As previously mentioned, there are many factors in a person's life that can potentially lead to weight gain which include urbanization, lifestyle choices, stress, and annual income. Both countries, in this case, have an issue of both sides for these factors. Certain parts of the countries are heavily urbanized with many amenities and services readily available such as New York and New Delhi. This could cause either an increase or a decrease in obesity levels depending on a myriad of choices by the citizens.

Conclusion

Through my findings, it is evident that highly urbanized communities show significantly increased rates of both obesity and cardiovascular disease and the overall rates have increased from 1990 to 2016. In terms of mortality rates, obesity mortality has an upward projection and vice-versa for cardiovascular disease. However, deaths due to cardiovascular disease still make up the majority of deaths in both the United States and India and the highest mortality rates due to cardiovascular disease occurs in regions with high obesity rates.

Cardiovascular disease and its risk factors should be prevented and controlled at an individual, community, and government level by education, promotion, motivation, and awareness. The government along with other companies and city services can also take certain actions in order to raise awareness among the general public on this potentially lethal issue. This could involve Heart Associations advertising on social media and in public places about awareness of several risk factors the residents of that area could have in the near future with their current daily routines. This could prove to be very beneficial in

the United States especially since there has been a sudden rise in adult obesity from 1990 to 2016 according to Figures 2 and 3.

Another step the government can take to allow people to better understand what is in their food is controlling the number of harmful ingredients such as trans fats. Increasing the size of nutritional value labels and moving the number of calories to the front of the food label can also help consumers to focus more on nutrition when choosing packaged items in grocery stores. The calories can also be stated on more menus in restaurants beside the name of the meal.

Many people who do not have an advanced education of the human body might not understand how significantly the heart can be affected by a poor diet and weight gain. This relates to creating more documentaries which explain complex concepts about the biology of the heart and the factors affecting its health in simple and interesting techniques which would be fascinating for laymen. Having professionals who are knowledgeable about the heart give presentations in schools would also be beneficial since students at a relatively young age tend to remember concepts faster and learn to apply them early. Adults can also benefit from specific changes in their community and if they are not willing to alter their lifestyle, motivation is essential for a change to be made. There should be enough community fitness complexes.

In conclusion, the question of “What are the effects of development on the correlation between obesity and cardiovascular health comparing two countries with varying development levels, the United States of America and India?” can be explored using multiple perspectives and in the future, there are multiple routes researchers can take

to identify more specific factors affecting obesity and cardiovascular health and to what extent are they negatively or positively correlated.

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