

# US Obesity Trends from 2015-2019

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## Author contributions

Theo contributed by studying the data documentation, tidying, analyzing visualizations, and writing most of the plan report.

Jessica contributed by tidying the data, creating visualizations, analyzing visualizations, and going over the plan report.

Hera contributed by tidying the data, creating visualizations, analyzing visualizations, and going over the plan report.

Amy contributed by tidying the data, creating visualizations, analyzing visualizations, and going over the plan report.

## Abstract

Soaring obesity rates in recent years present a very real problem for the US. But past studies have also shown that obesity is not indiscriminate; certain factors are more or less correlated with the condition. The goal of our analysis was to capture the overall trend of obesity in the US, and then to try and account for what might cause more specific (but still fairly broad) differences in terms of the trend. The results of our analysis suggest that obesity generally shows a rise with time, that education levels have a negative correlation with obesity, and that Southern and Eastern regions have the most and least obese individuals, respectively.

## Introduction

### Background

An overweight individual is defined as having a BMI between 25 and 29.9; a BMI of 30+ is classified as obese. It is well-documented that the latter, obesity, is a growing problem in the USA. Within the context of the current COVID-19 pandemic, it stands that getting outside can be difficult and many Americans' diets have taken a turn for the worse.

In fact, according the CDC, obesity rates in the USA have pushed past 40% of the population in recent years! The effects of obesity are widespread. Not only are those with the condition predisposed to other, abject health conditions - such as the recent COVID19 virus - but as a result, it also takes a toll, financially, on the nation's healthcare system. However, obesity isn't indiscriminate. Studies show that socioeconomic status and race affect obesity rates. For example, lower-income stratas are more likely to consume cheaper foods which contain more sugar and calories, and are prevented from getting outside as often due to demographic turmoil.

### Aims

The scope of this report is not so nuanced as to explore all of the above trends specifically; however, we aim to depict the general growth trend of obesity in the USA, and we'll also try to break down some major demographic trends. By means of visualization, our results will suggest that obesity is *at least* associated with education level and that there is a general uptrend in obesity in the last few years. Further analysis will also suggest that certain regions of the US appear to show higher rates of obesity.

## Materials and methods

### Datasets

The data that we will use depicts obesity rates in the United States, by state, for the years 2015-2019. We have combined the original dataset (from the BRFSS surveys; more on that below) with additional BRFSS datasets that contain education level, and then added in a regional indicator based on the state noted in the dataset.

Here's an example of some rows from our dataset:

Year	Location	Percent of adults Low	Sample Size	Education Level	Region
2015	AL	40.5	2,336	High school graduate	SOUTH
2015	AK	33.2	922	High school graduate	WEST
2015	AZ	31.3	1,639	High school graduate	WEST
2015	AR	37.7	1,669	High school graduate	SOUTH

And here are the variable descriptions:

Name	Variable description	Type	Units of measurement
Year	Year data was taken	Numeric	Calendar year
Location	State	Character	N/A
Percent of adults	Percent w/ obesity	Numeric	Percent
Sample Size	Respondents	Numeric	People

Name	Variable description	Type	Units of measurement
Education Level	Highest level of schooling	Character	N/A
Region	Which part of the US	Character	N/A

All of this data (minus the Education variable we added) was collected from the Behavioral Risk Factor Surveillance System (BRFSS) survey which we have utilized previously in PSTAT100. Some of the parameters surrounding the survey are as follows:

- One respondent (an adult) from each household is contacted via landline or cellphone to take the survey.
- The sample frame is dedicated cellular banks sorted on the basis of area code and exchange within a given state.
- Because only USA households (and adults) are contacted, the scope of inference is limited to adults in the USA.

You can see here for more information on the BRFSS survey:

<https://www.cdc.gov/brfss/index.html>

And all of the data we used is publicly available on the CDC's website as seen here:

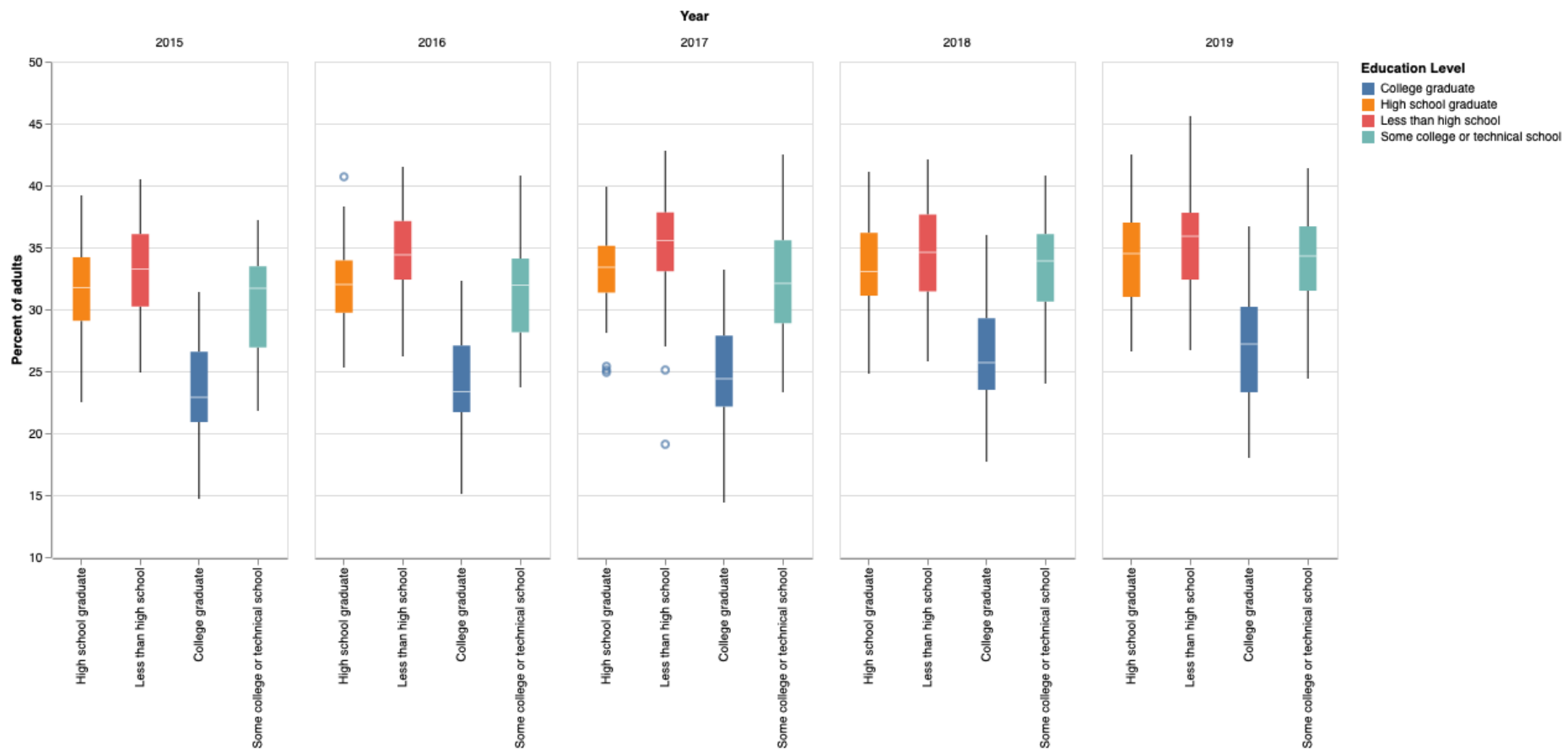
Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps [online]. [accessed May 19, 2021]. URL: <https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html>.

## Methods

The nature of our data was fairly straightforward, so we were able to eschew complex analysis. Like so, our approach largely consisted of visualizations. First, we plotted boxplots of education vs. percentage of adults with obesity and then faceted by years to show annual trends. After seeing a general, preliminary trend to that, we decided to try and depict growth over time more clearly with a line plot. Finally, we then chose to create a heatmap of major regions in the US relative to their levels of obesity. From this, we were able to get a more nuanced (albeit, again, still fairly large picture) feel for obesity trends in the USA for the years 2015-2019 (inclusive).

## Results

**Figure 1. Obesity in relation to Education Level:**



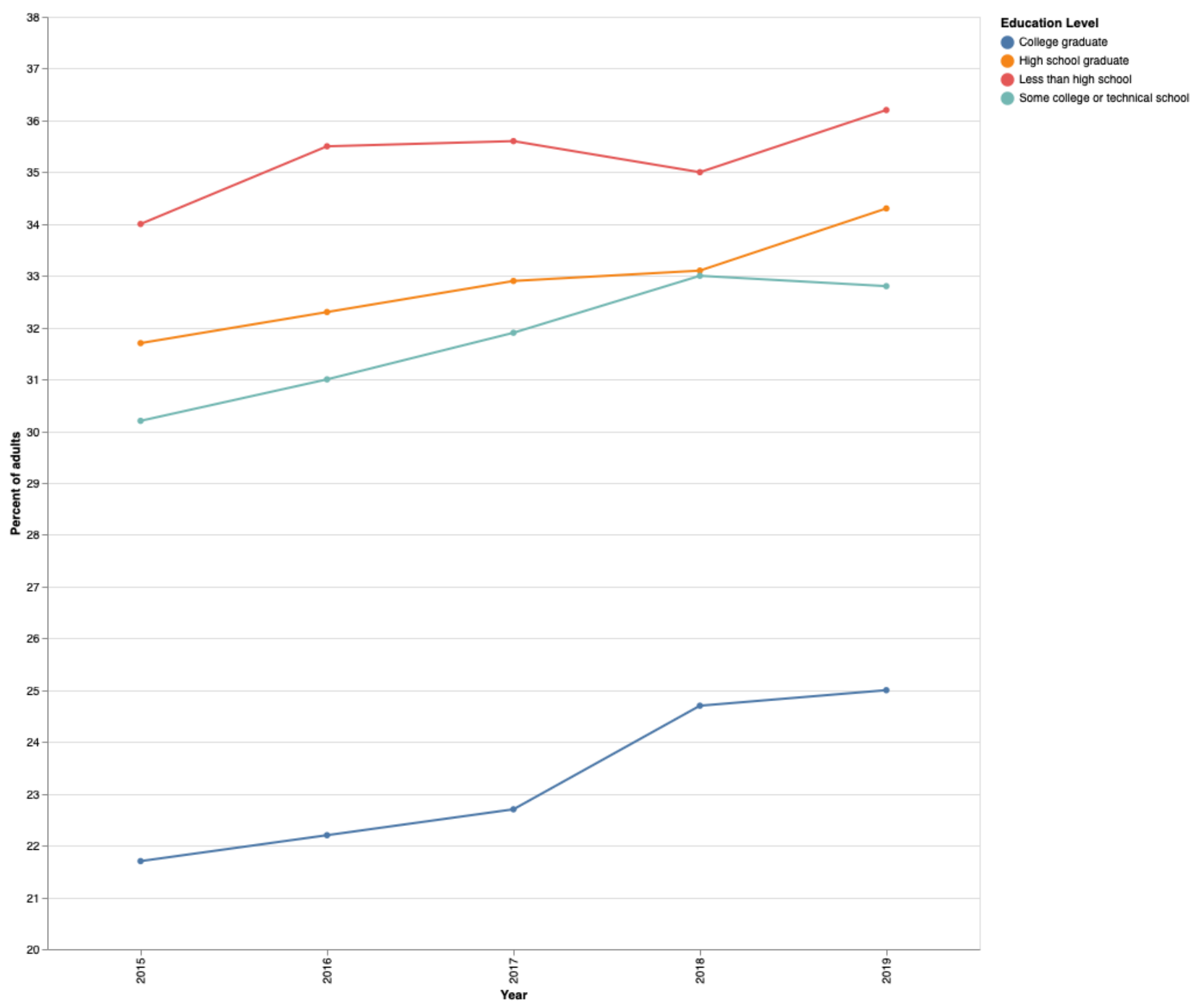
In Figure 1, the boxplots show the percentages of adults who are obese in relation to their education level over the years 2015-2019 (inclusive). The education levels range from less than high school, high school graduate, some college or technical school, and college graduate.

According to our plot, the data indicates that college graduates, on average, are less likely to be obese, followed (in order) by adults with 'some college or technical school', high school graduates, and adults with 'less than high school' degree. This order shows on average an increased likelihood of obesity as education level decreases.

In the boxplot, there are a few noticeable outlier points in 2016 and 2017. In 2016, West Virginia's obesity percentage for high school graduates was significantly higher than other states. For 2017, states such as Utah, Montana, and Colorado (whom have big sample sizes) had significantly lower obesity percentage rates for their high school graduates. Unfortunately, it's difficult to ascertain why these states might be outliers without more in-depth analysis (searching yielded us inconclusive results).

But we can still conclude that individuals with high education levels, on average, appear to be less likely to be obese.

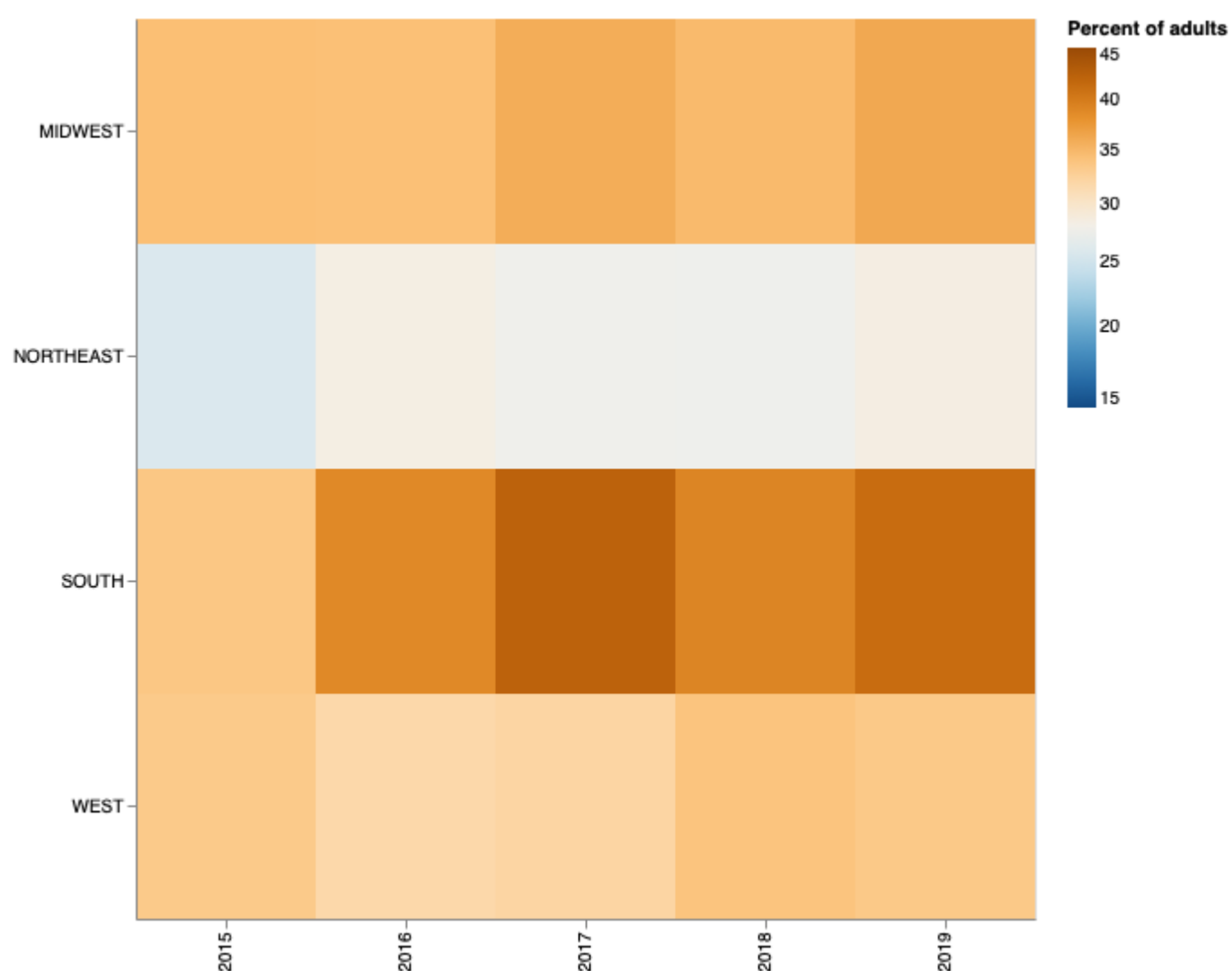
**Figure 2. Obesity over the years 2015-2019:**



In this plot, percentage of adults with obesity are plotted against the years 2015-2019 (inclusive) with education levels: less than high school, high school graduate, some college or technical school, and college graduate differentiated by color.

In all instances, except 2017-2018 for "less than high school" and 2018-2019 for "some college or technical school," the line plot indicates that there is a positive trend with respect to obesity and time for 2015-2019 (inclusive).

**Figure 3. Heatmap showing obesity rates by region:**



In this heatmap, the states in the Northeast region of the United States (ie. Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island,

Vermont, New Jersey, New York, Pennsylvania), have a significantly **lower** percentage of obesity among adults compared to the other regions in the US. By contrast, the South region of the US is shown to have significantly **higher** obesity rates.

Why might this be the case? An article from the CDC (cited below), based on data from the 2016 BRFSS survey, suggests a dichotomy between urban and rural demographics with respect to obesity. On average, urban areas are less obese and vice versa. A quotation from Wikipedia, then, states that "of the nation's four census regions, the Northeast has the second-largest percentage of residents living in an urban setting, with 85 percent, and is home to the nation's largest metropolitan area" which would account for the differences we observe.

In addition, states in the Southern region display a higher percentage of obesity among adults compared to other regions in the US. This could be accounted for partly by education. According to a study by WalletHub in 2021(cited below), states from the Southern region like West Virginia, Mississippi, Louisiana, Arkansas, Kentucky, Alabama, Texas, and Tennessee occupy 8 out of 10 states with the lowest education attainment. These 8 states account for half the states in the Southern region, which influences the region's high percent of obese adults relative to other regions in the US.

(<https://www.cdc.gov/media/releases/2018/s0614-obesity-rates.html>) (<https://wallethub.com/edu/e/most-educated-states/31075>)

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## Discussion

Overall, our findings suggest that education level has an inverse relationship with obesity. That is to say, as education levels rises, obesity levels drop and vice versa. Furthermore, obesity levels generally show an upward trend from 2015 to 2019 (inclusive). Common caveats to this interpretation include the cliché that "correlation is not causation" and the scope of our data.

To the point of the former, while there are other factors that might have influence, we can still attempt to explain what might have led to our results. First, educated individuals are more likely to be aware of the benefits of proper nutrition. For example, colleges (such as UCSB) offer elective courses on proper nutrition. However, it is important to note that education in itself does not solely contribute to lower likelihoods of obesity, and we have to consider the resources that education allows one to have, including healthier food and safer areas to exercise (as outlined in this report's background earlier). In addition, the better employment opportunities and thus better salaries that come with education enable more educated individuals to have access to better healthcare, acquire more education on nutrition, and pay for gym memberships to prevent and/or combat obesity.

To the point of scope, our information is gathered from a dataset limited to a certain set of years and only the United States; we do not know whether our assessment is directly applicable to other parts of the world. There is an opportunity for future exploration here. In addition, the dataset sample collection involved contacting one respondent (an adult) from each household via landline or cellphone to take the survey. Due to utilizing phone surveys, the results are self-reported and may have some inaccuracies. Furthermore, the sampling method may lead to undercoverage of people who do not have registered phone numbers for their household and for instance may be using prepaid phone numbers. A recent Pew Research Center study (cited below) found that prepaid phone users were more likely than other cellphone users to be non-white, lower income, less educated and live in urban areas, and the share of cellphone numbers that are flagged as prepaid is relatively large (around 12.4% to 15.4%). As a result, the dataset may have undercoverage of the US adult population.

As another point of interest, we saw that there are definitely regional differences between obesity rates. To what extent does the culture influence the obesity rates in these regions? What ethnic groups predominantly occupy these regions, and do their ethnicity correlate with the their likelihood of obesity? We could also explore how ethnicity in general correlates with obesity in the scale of the entire country.

(<https://www.pewresearch.org/methods/2015/11/18/advances-in-telephone-survey-sampling/>)