

# The Association Between Socioeconomic Status and BMI of Teens in Washington State

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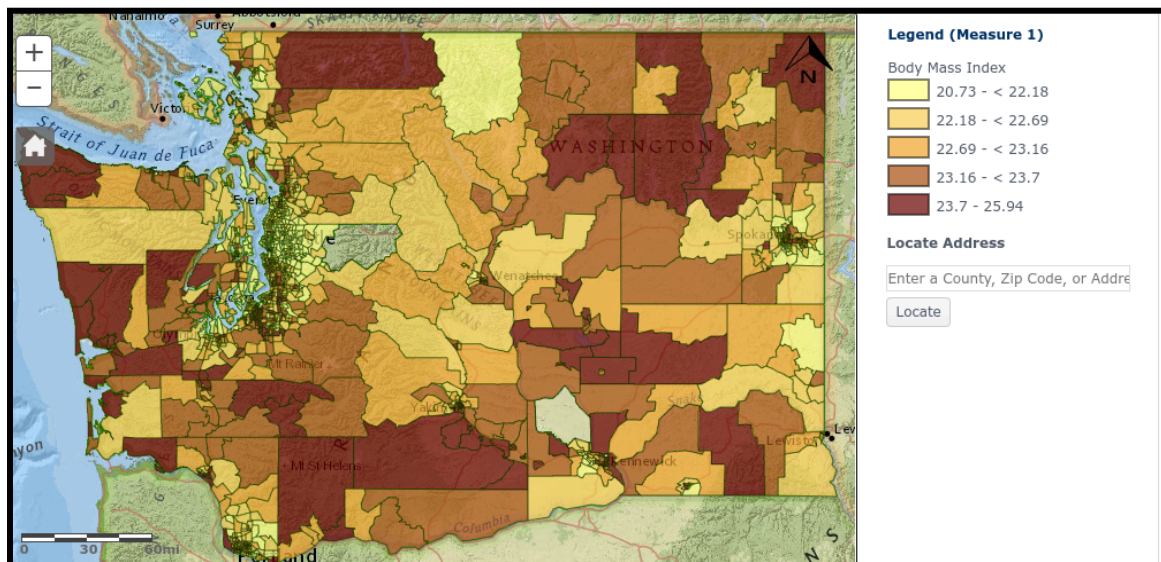
**Hypothesis: Poorer socioeconomic status across counties may be correlated to abnormal BMI in teens in Washington State.**

## Introduction

Body Mass Index (BMI) is one of the most easily available measures of health that we have. BMI in teens is an easy and inexpensive way to screen for potential future health problems, often sex and age-specific, referred to as BMI-for-age.<sup>[1]</sup> BMI is measured using a simple formula, dividing an individual's weight in Kilograms by the square of their height in Meters ( $\text{weight (kg)} / [\text{height (m)}]^2$ ). The resulting BMI can indicate levels of body fat and can screen for weight categories that may lead to health complications.<sup>[2]</sup> After BMI is calculated, it is expressed as a percentile relative to US children who participated in national surveys from 1963-1965 and 1988-1994.<sup>[1]</sup> Using data from the Washington Tracking Network (WTN), we are interested in looking at the BMI of adolescents in Washington and comparing them to the rates of teens living in poverty by county. By doing this we can see if there is a clear correlation between the two, and more efforts to protect the health of teens are required, or if there is no connection between BMI and socioeconomic standing.

## Data

**Figure 1: WTN data showing average BMI of people under 18 years old for each census tract.** <sup>[3]</sup>



**Figure 2: WTN data showing percentage of people under 18 years old living below poverty level for each census tract.** <sup>[3]</sup>

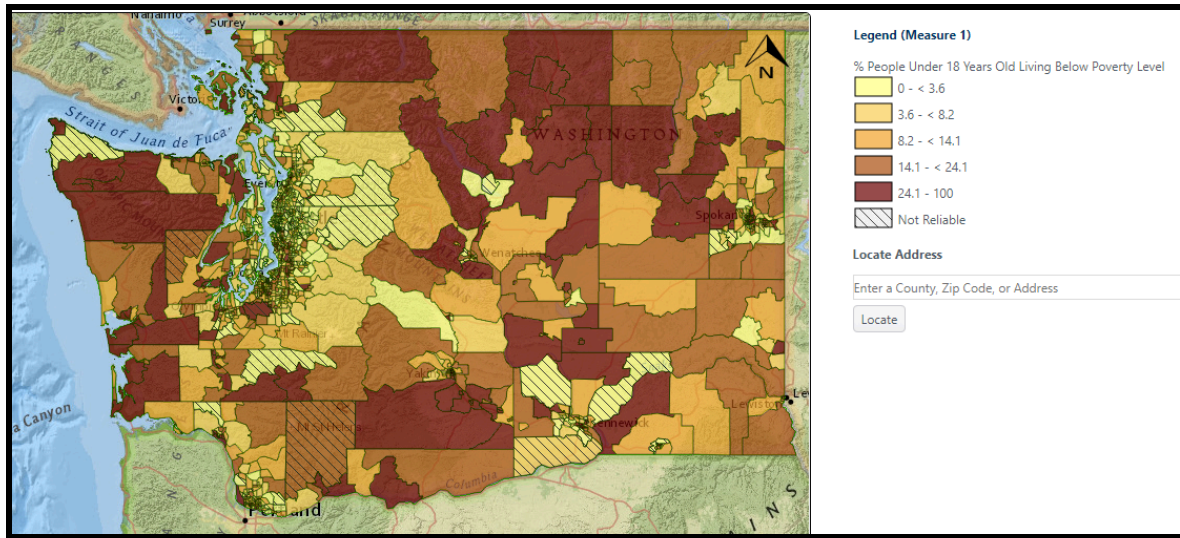


Figure 3: WTN data showing Yakima County BMI and poverty percentage for people under 18 years old. [3]

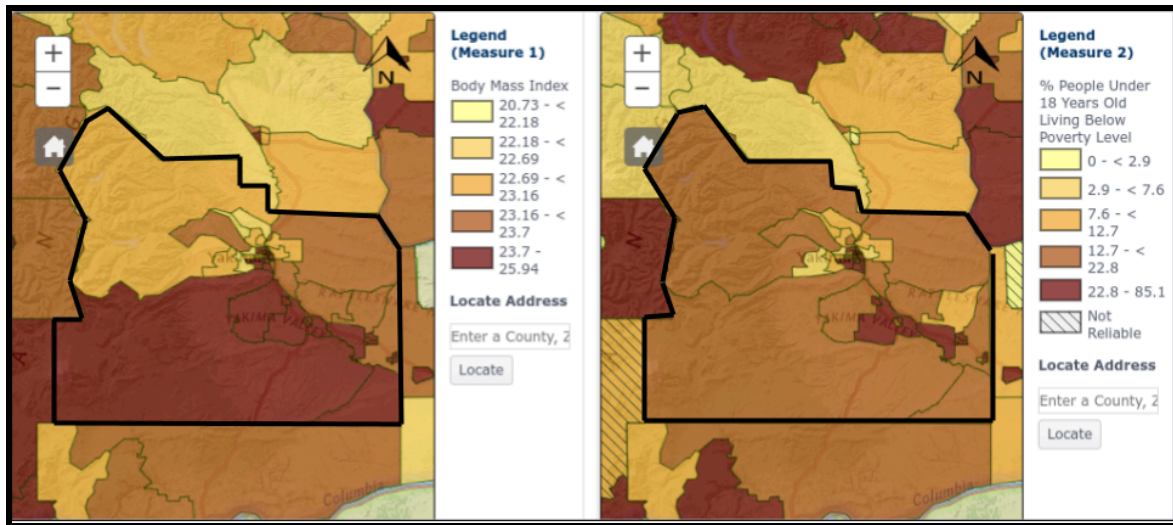


Figure 4: WTN data showing Okanogan County BMI and poverty percentage for people under 18 years old. [3]

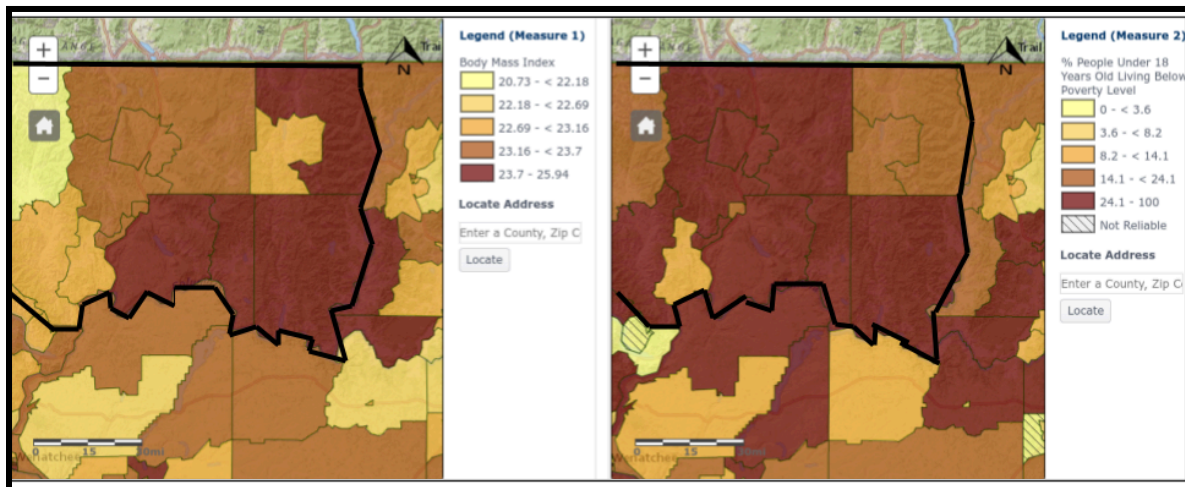
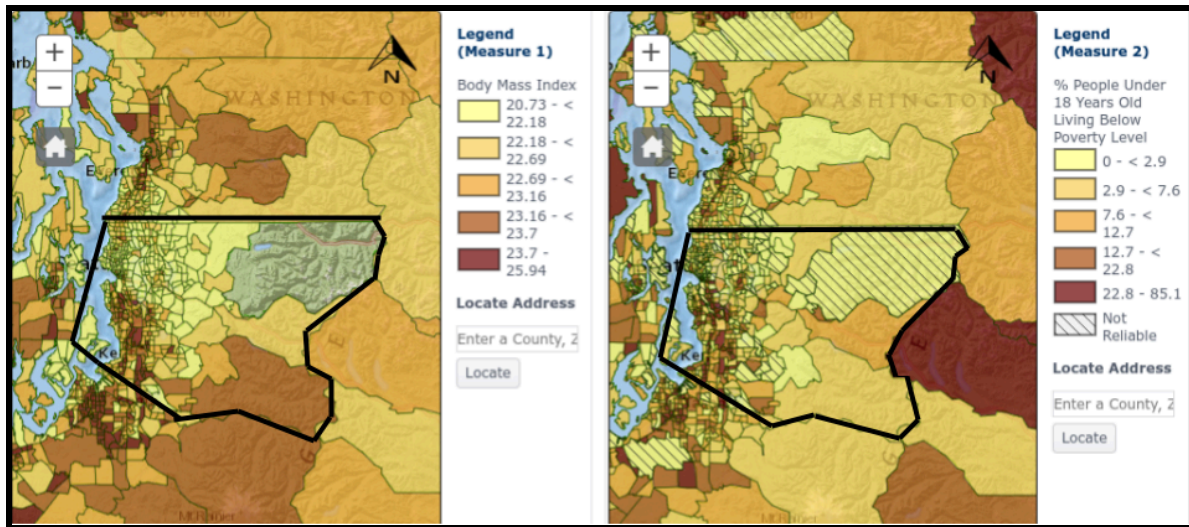


Figure 5: WTN data showing King County BMI and poverty percentage for people under 18 years old. [3]



## Data Analysis

The data provided by the WTN is broken up into segments called census tracts, a region defined for the purpose of taking a survey. Census tracts do not cross county borders, and provide accurate data for each region. When looking at data, it is important to remember that correlation does not equal causation and that there could be other factors that lead to abnormalities in the mean BMI in a given region. Additionally, BMI is not the most accurate measure of body fat, as it does not account for all forms of body weight like muscle, bone mass, or excess fat.

If we look at Figure 1, we can see hotspots of high average BMI spread pretty evenly across the state with no clear connection to each other or the surrounding areas. However, when you compare the high BMI areas in Figure 1 to the areas with a high percentage of teens living in poverty shown in Figure 2, we can begin to see a clearer relationship between the two metrics. Some of the specific areas we are going to focus on are Yakima County, Okanogan County, and King County. According to Figure 3, the average BMI in Yakima County is between 23.7 and 25.95, which equates to being between the 75th and 90th percentile. Looking at the same area, Figure 3 shows the percentage of individuals under 18 living in poverty is above 24 percent. In this area, a high percentage of teens living in poverty is present, and a high average BMI is also present. While it is true that this could easily be a coincidence, and that there could be no correlation between BMI and poorer socioeconomic status, when you compare Yakima to other counties in Washington State similar trends are present. Okanogan County, according to Figure 4 has an average BMI between 23.16 and 25.94, equating to being in the 75th-90th percentile. Figure 4 shows a high percentage of individuals under 18 living in poverty, at least 24 percent, with teen poverty in this county being even more widespread than in Yakima County. Again, we see an area with a high percentage of teens living in poverty having a relatively high average BMI, supporting our hypothesis that there is a connection between socioeconomic status and BMI in teens. However, when we look at more prosperous counties, like King County, we can see lower levels of both poverty and BMI. According to Figure 5, the average BMI in King County is between 20.73 and 22.18, equal to being in the 50th percentile. More importantly, Figure 5 shows that the percentage of individuals under 18 living in poverty is only between

1 to 8.6 percent. Of course, there are tracts within the county that have higher levels of both BMI and poverty, but as a whole, we can see that average BMI is lower when poverty is less prevalent. When comparing counties like King to counties like Okanogan or Yakima, we can see the correlation between BMI and socioeconomic status. King has a low rate of poverty, and a low average BMI, and both Yakima and Okanogan have higher rates of poverty and a high average BMI.

## Equity

Both Yakima and Okanogan Counties are home to Native American reservations, which are notoriously poor and underfunded. These reservations have limited access to supermarkets with healthy food items, and if they do have access, a majority of their populations live in poverty and have a plethora of other health complications that limit them. As a result of poverty and limited access to healthy food, we can see a high average BMI in these counties. When you compare that to counties like King, where there are fewer and smaller Native American reservations, low poverty rates, and good local access to supermarkets and healthy food, we can see a much lower average BMI. According to a study done by the National Institute of Health (NIH), of the 22 native tribes who have federally recognized land in Washington State, seventeen of those reservations lacked access to a supermarket, and of these, 15 also lacked access to a grocery store. Five others lacked any on-reservation food stores, while eight of the 16 grocery stores and five of the nine supermarkets were all on one large reservation. The NIH concludes its study with the finding that American Indians living on reservations in Washington State have limited access to healthy foods. <sup>[5]</sup> Figure 6 shows the Colville Reservation in Okanogan County, and it supports the NIH's findings about access to healthy food. According to the map, there is zero access to grocery stores within a 10 minute drive across a majority of the reservation. Similarly, Figure 7 shows the Yakima Reservation in Yakima County having almost no access to grocery stores within a 10 minute drive throughout the reservation. Both of these counties report average BMI for people under age 18 as between 23.16 and 25.94, higher than a majority of the state. The effect that access to grocery stores and healthy food has on BMI is apparent when we compare both Yakima and Okanogan Counties to King County. Figure 8 shows that King County has abundant access to grocery stores within a 10 minute drive, with the entirety of the greater Seattle area having access to grocery stores. King County also reports an average BMI for people under 18 years old as between 20.73 and 22.18, lower than both Yakima and Okanogan counties. One reason for this may be the accessibility of grocery stores that can provide healthy food, as well as the low levels of poverty that allow for the purchase of healthy foods in King County and the extremely limited access to grocery stores, and high levels of poverty that prevent the purchase of any healthy foods in Yakima and Okanogan County.

**Figure 6: Map showing grocery stores within a 10 minute drive of the Colville Reservation in Okanogan County.** <sup>[6]</sup>

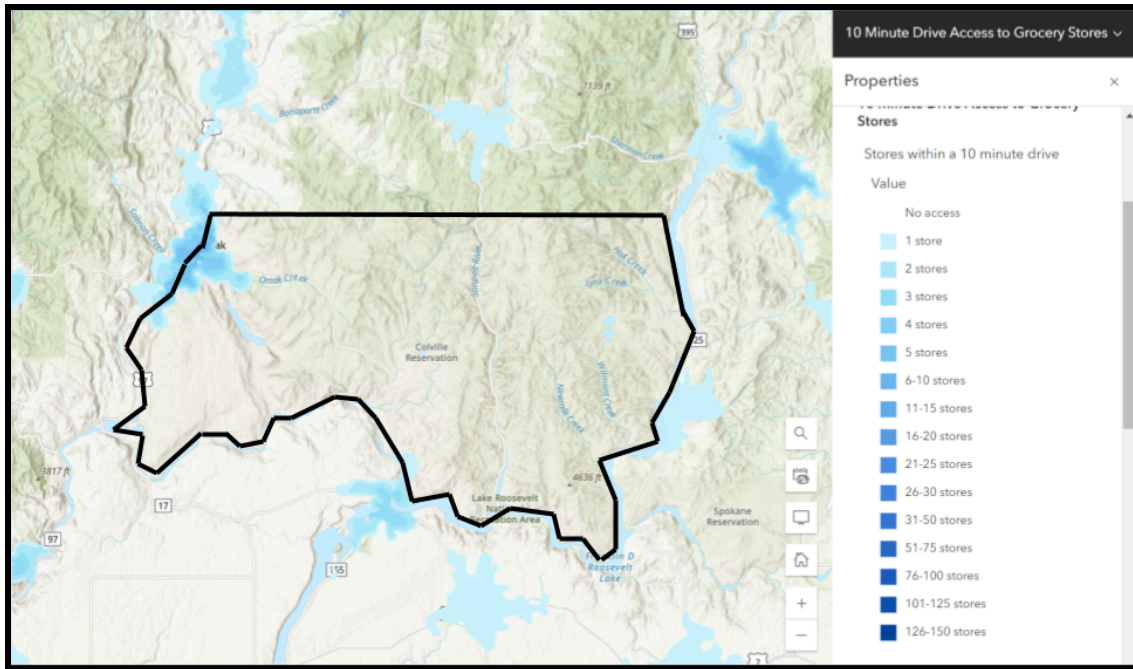


Figure 7: Map showing grocery stores within a 10 minute drive of the Yakima Reservation in Yakima County. <sup>[6]</sup>

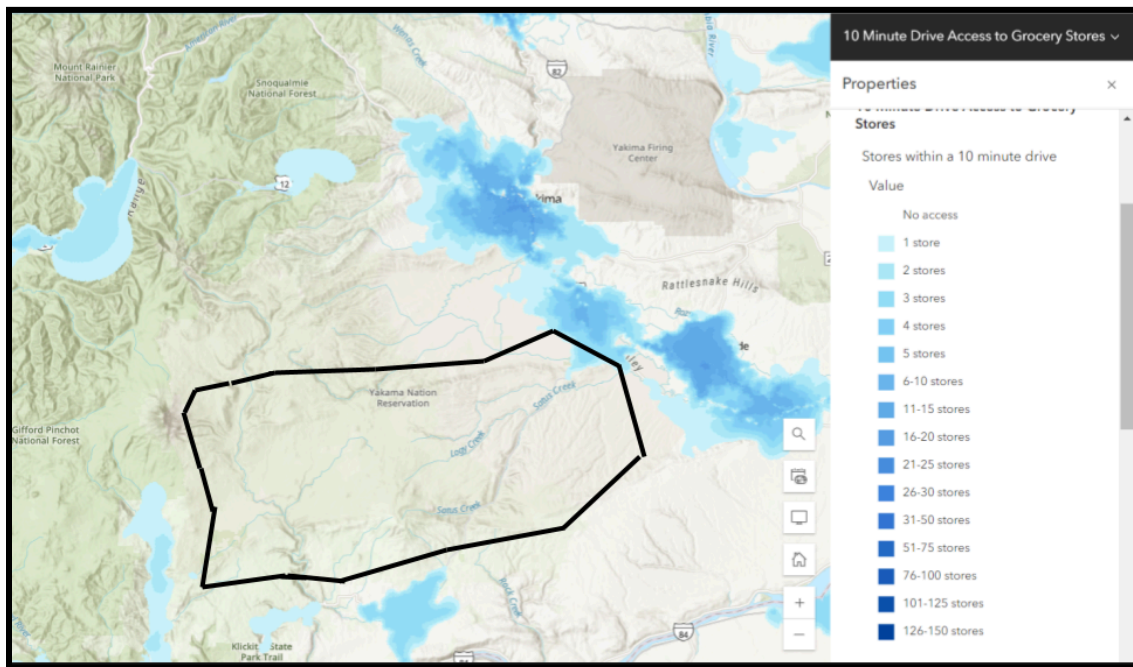
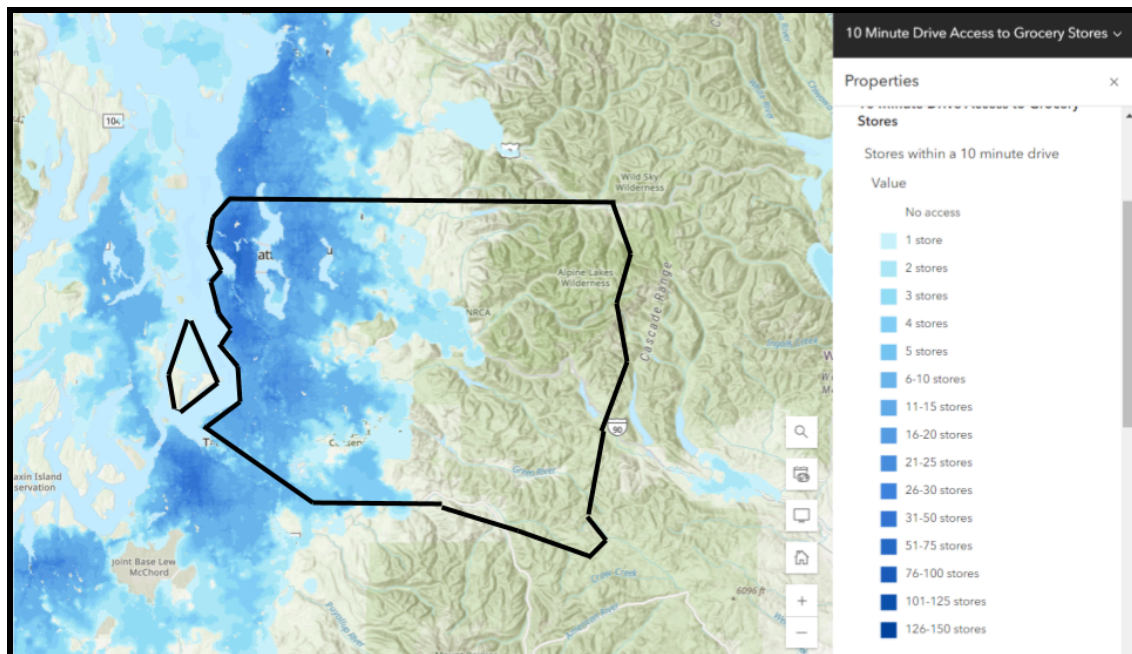


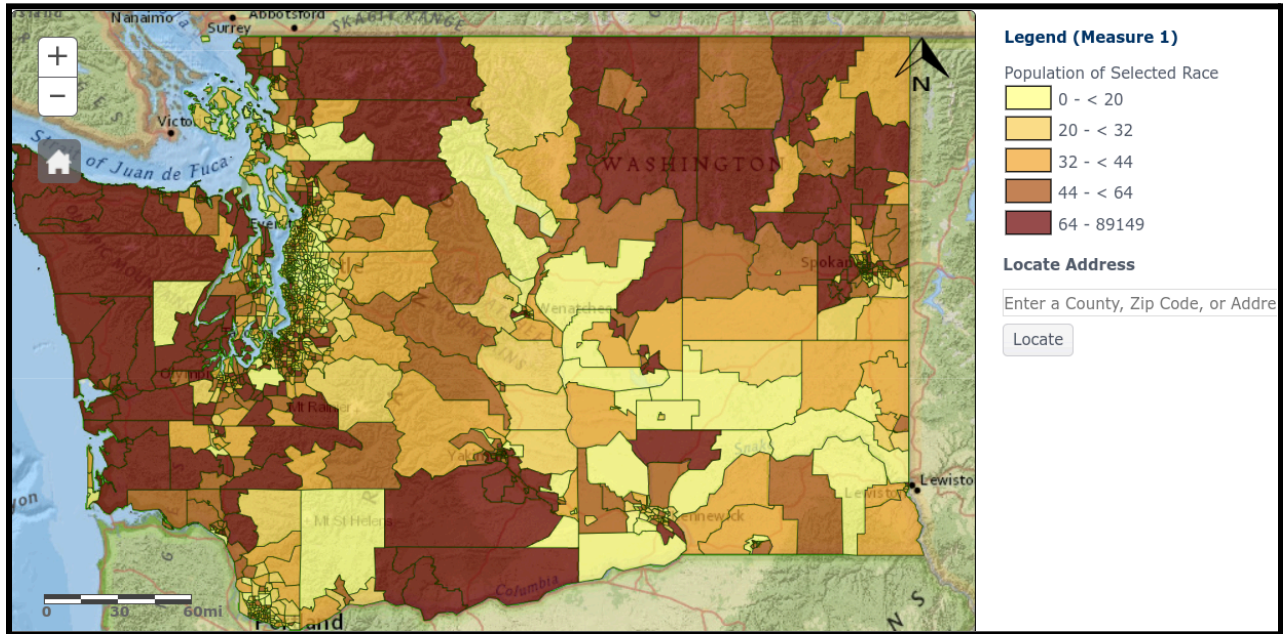
Figure 8: Map showing grocery stores within a 10 minute drive of King County. <sup>[6]</sup>



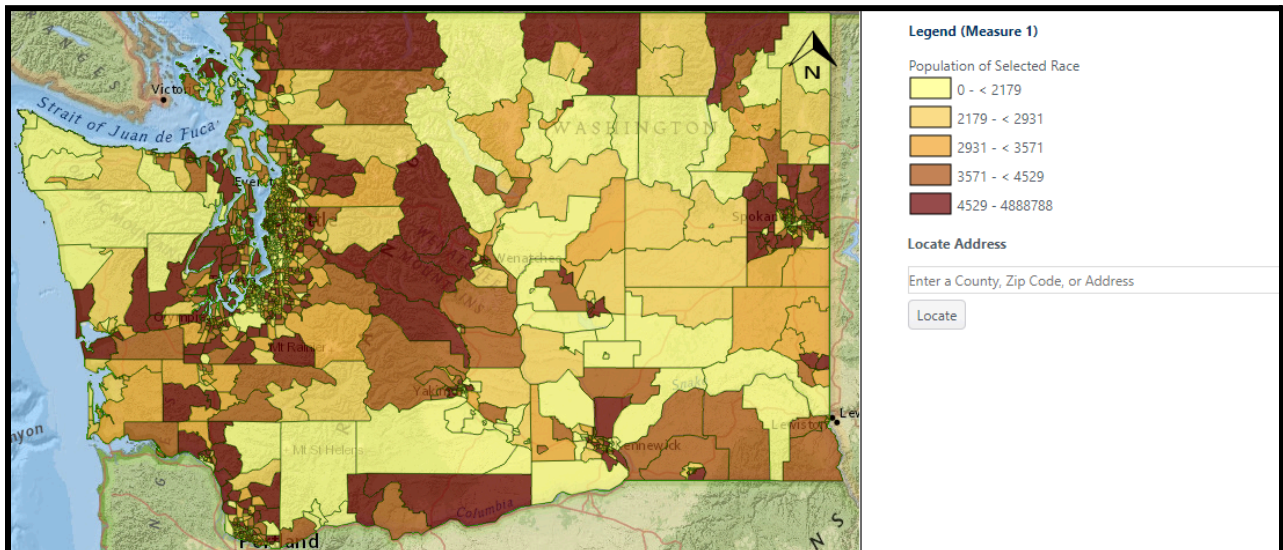
Additionally, across the state we can see that certain population minorities are far more likely to experience obesity as a teen than others. Obesity in teens is defined as being in the 85th-94th percentile on BMI-for-age charts. <sup>[4]</sup> In Washington state, 12% of 10th graders are considered to be obese, but when you break down the distribution of that 12% we can see those population minorities have a higher proportion of obese teens. For example, Asian and White teens are 7% and 9% obese respectively with a slim margin of error of 1%. When you compare this to Hispanic or Native Hawaiians and American Indians, at 16%, 24%, and 15% each, we can conclude that these minority groups are far more likely to have a high BMI.<sup>[7]</sup> In addition, we can see that those same population minorities are far more likely to experience poverty. According to the Washington State Department of Health, 31% of American Indians and Alaska Natives are considered to be experiencing poverty. 23% of both Hispanics and African Americans are also considered to be experiencing poverty. Whites have the lowest percentage of poverty at only 11% followed closely by Asians at 12%. <sup>[8]</sup> If you compare these rates of poverty to the rates of high BMI in the same minority groups, we can see a clear connection between socioeconomic status and BMI. The more affluent White and Asian groups have a much lower percentage of poverty, and a lower percentage of obese teens compared to the less affluent Hispanics and Natives who experience poverty at a much higher rate, and have a much higher percentage of teens with BMI. Furthermore, if we look at the distribution of these population minorities across the state, they are most densely populated in the areas we looked at during our data analysis. If we compare Figures 1, 2, and 9, we can see that American Indians and Alaska Natives are most densely populated in Yakima County, Okanogan County and on the far West Coast. These are the same counties that we observed during our data analysis, where we found high average BMI, high rates of poverty, and extremely limited access to healthy food sources. Figure 9 shows us that both Yakima and Okanogan counties have high populations of American Indians and Alaska Natives, who according to the Department of Health have the highest rates of poverty by race in the state. <sup>[8]</sup> Figure 10 shows the distribution of White people in Washington State, with a large population

in King County. King County, as noted during our data analysis, has a low average BMI, low rates of poverty, and abundant access to healthy food sources. In addition, according to the Department of Health, Whites have the lowest rates of poverty by race in the state, as well as the lowest percentage of obese teens. [8] Notably, according to Figure 10, there are large areas with little to no white populations, areas where Figure 9 shows high proportions of American Indian and Alaska Native people. This suggests that areas that have high proportions of White residents, who have the lowest rates of poverty in the state, also have the lowest BMI.

**Figure 9: WTN data showing population distribution of American Indians and Alaska Natives. [3]**



**Figure 10: WTN data showing population distribution of White individuals. [3]**



## Conclusion

As earlier stated, correlation does not equal causation; we still do not know if low socioeconomic status is a cause of abnormal BMI in teens. However, what we can discern from the data is that there is a correlation between socioeconomic status and BMI in the counties that we observed. Data from the Washington State Department of Health seems to suggest that population minorities, who are more likely to experience poverty also have the highest proportion of obesity and high BMI in teens. Data from the WTN suggests the same, with census tracts who report high levels of poverty also having a high average BMI. Data from the National Institute of Health suggests that counties with high rates of poverty also have limited access to healthy food, as well as higher average BMI. While we only looked at 3 of the 39 counties in Washington, those counties support our claim that a lower socioeconomic status correlates with a higher BMI in teens, and that more efforts to support the health of teens in Washington are required. Those efforts could include state funding for accessible grocery stores or locations to purchase healthy foods near areas with poor socioeconomic status, or lowering the price of healthy foods into a range where people who are experiencing poverty can afford it.

## References

- [1] “About Child & Teen BMI | Healthy Weight | DNPAO | CDC.” *Centers for Disease Control and Prevention*, [https://www.cdc.gov/healthyweight/assessing/bmi/childrens\\_bmi/about\\_childrens\\_bmi.html](https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html).
- [2] “Body Mass Index (BMI) | Healthy Weight, Nutrition, and Physical Activity | CDC.” *Centers for Disease Control and Prevention*, <https://www.cdc.gov/healthyweight/assessing/bmi/index.html>.
- [3] “Washington Tracking Network (WTN) | Washington State Department of Health.” | *Washington State Department of Health*, <https://doh.wa.gov/data-and-statistical-reports/washington-tracking-network-wtn>.
- [4] “Health of Washington State Report - Obesity and Overweight.” | *Washington State Department of Health*, <https://doh.wa.gov/sites/default/files/legacy/Documents/1500/RPF-Obs2015-DU.pdf>.
- [5] “Food access and cost in American Indian communities in Washington State.” *NCBI*, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3164540>
- [6] <https://www.arcgis.com/apps/mapviewer/index.html?layers=fb8896dac7094fa3abf2bb825784cafb>
- [7] “Obesity Data | Washington State Department of Health.” | *Washington State Department of Health*, <https://doh.wa.gov/data-and-statistical-reports/diseases-and-chronic-conditions/obesity>.
- [8] Sabel, Jennifer. “Health of Washington State Report - Socioeconomic Position in Washington.” | *Washington State Department of Health*, <https://doh.wa.gov/sites/default/files/legacy/Documents/1500/Context-SEP2016-DU.pdf>.