PM566 Final Report

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Introduction

The dataset Nutrition, Physical Activity, and Obesity, was acquired from the Centers for Disease Control and Prevention through the Youth Risk Behavior Surveillance System. In this dataset, there is information on high school students in grades 9-12 from public and private schools regarding their diet, physical activity, and weight. This data helps inform the Division of Nutrition, Physical Activity, and Obesity which in turn contributes to the national and state data on these markers.

Current research shows that non-Hispanic Black adults have a higher prevalence of obesity followed by Hispanic adults. Midwestern and Southern regions have a higher prevalence of obesity according to the Centers for Disease Control and Prevention. The goal of this analysis is to analyze if the data collected from high school students through the Youth Risk Behavior Surveillance System shows a trend for obesity according to location and race/ethnicity. For my analysis I will be exploring the following questions:

1) Does obesity and weight status differ by state?
2) Does obesity and weight status differ by ethnicity?

Methods

How and Where the Data were Acquired

The data were acquired from the Youth Risk Behavior Surveillance System where surveys were given to national, state, territorial, tribal, and large urban schools from grades 9-12 in U.S. high schools. Students were randomly selected to participate based on their required classes or a specific period of the school day. I used the API pertaining to the data but had to modify the default limit to allow all 44,702 observations and 31 columns to allow for all data to be analyzed with no limit.

Missing Values and Filtering Data

I assessed missing values for the key variables which included:locationdesc, geolocation, data_value, race_ethnicity, class, and question. I then filtered the dataset for only relevant class observations including "Obesity/Weight Status." Because this analysis is focused on obesity/weight pertaining to state and ethnicity, I kept only relevant key variables mentioned above. After missing values were removed, the observations went from 44,702 to 3,028 observations.

Transformation from Longer to Wider

To better visualize and compare data, I transformed the variable "question" into a binary variable where 1 = "Percent of students in grades 9-12 who have an overweight classification" and 2 = "Percent of students in grades 9-12 who have obesity." To include more variables rather than observations, I transformed the

data from longer to wider. By aggregating the data so that each column had a single data value, I created Question 1 and Question 2 as two separate variables so that each location pertaining to the obesity/weight status has a column for Question 1 and another for Question 2 with their corresponding data values in percentages.

Exploratory Data Analysis Tools

For exploratory data analysis, I used ggplots and bar plots to assess individual variables and explore their distribution. In doing this, I assessed the contribution of counts each location and race/ethnicity provided to the overall dataset as well as to Question 1 and 2 individually. Summary statistics were also generated in descending order according to question 1 or 2. The summary statistic tables aided in the comparison of which race/ethnicity and location had the highest means based on question 1 or 2 in the dataset.

Figure 1: Data Value for Question 1 by Location

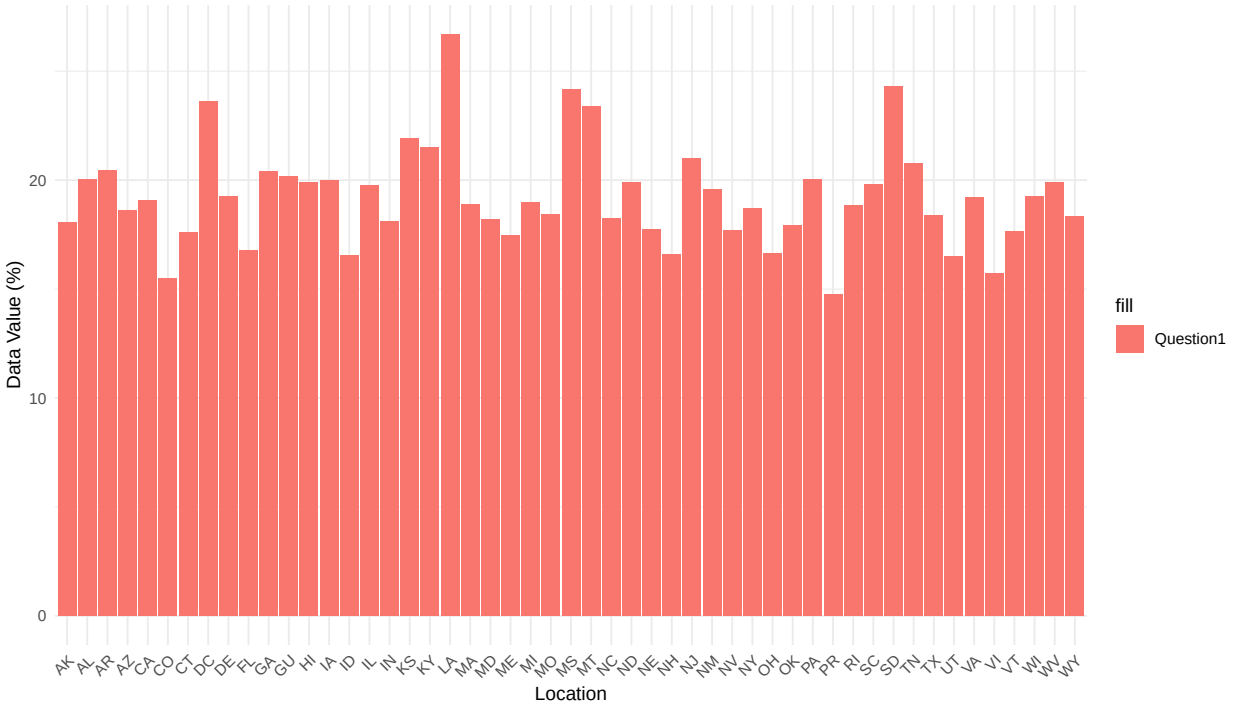


Figure 2: Data Value for Question 2 by Location

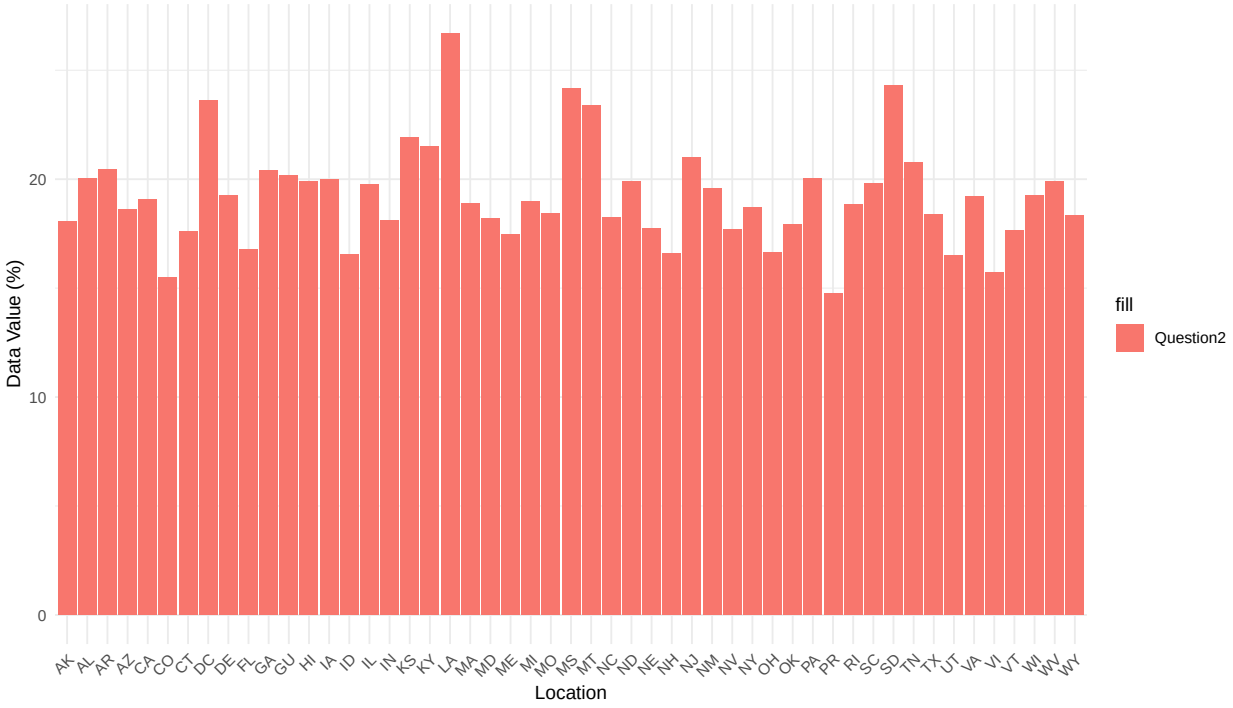


Figure 3: Contribution of counts per State

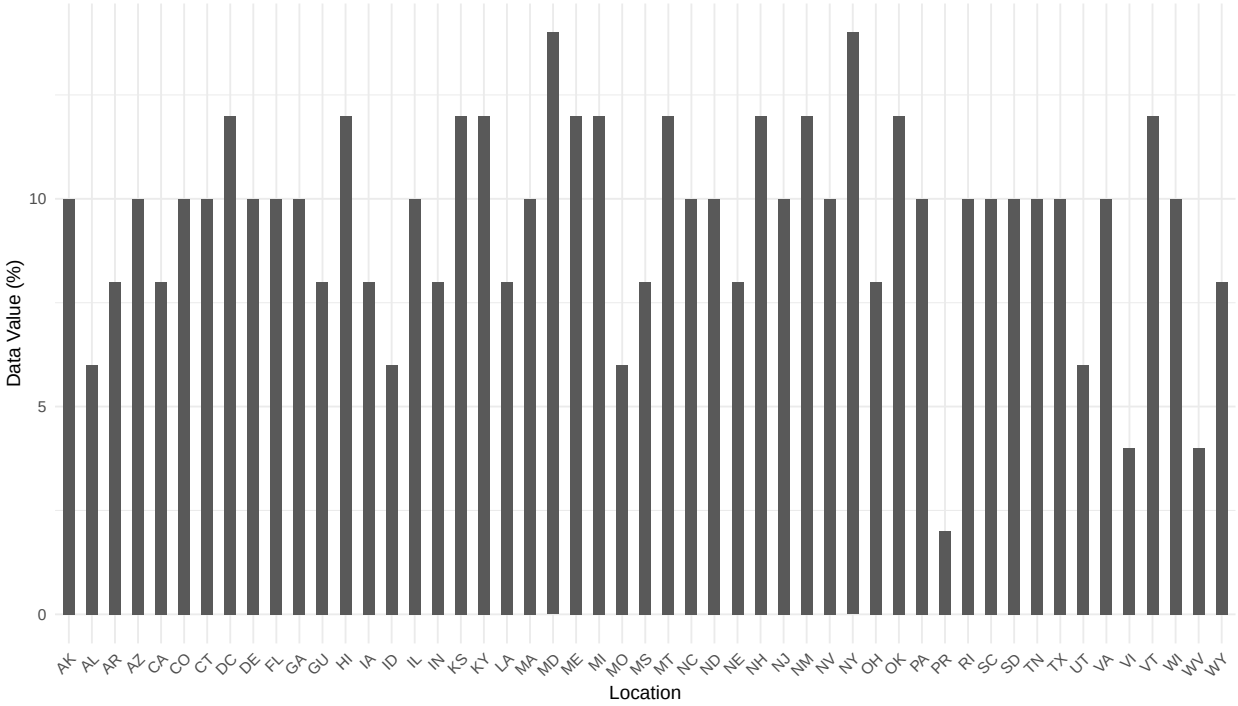
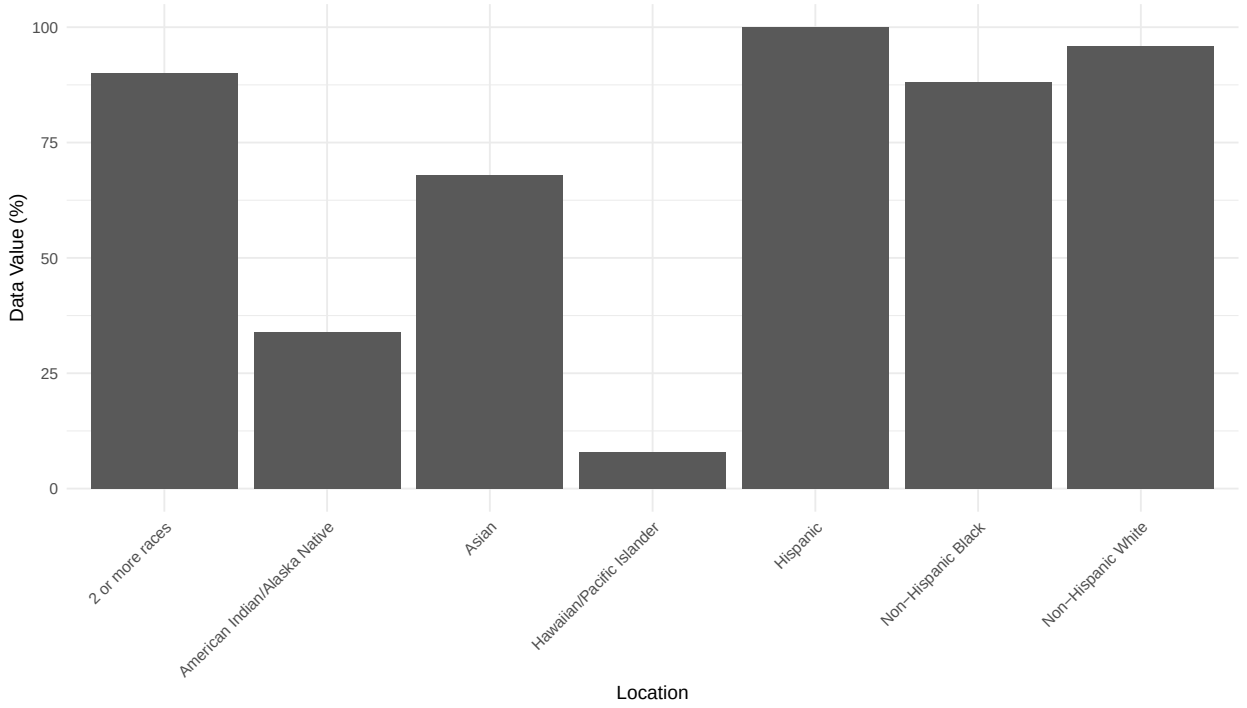


Figure 4: Race/Ethnicity of High School Students that Participated



Results

Table 1

Table 1 was created to assess the mean data values of Question 1 (Percent of students in grades 9-12 who have an overweight classification) and Question 2 (Percent of students in grades 9-12 who have obesity) according to location. From Table 1, we can see that Guam had the highest percentage of students in grades 9-12 who have obesity (20.33%) followed by Mississippi in the same question category (19.63%). Louisiana had the highest percent of students in grades 9-12 who have an overweight classification (18.72%) followed by Arkansas (18.14%).

```
##
## Attaching package: 'kableExtra'

## The following object is masked from 'package:dplyr':
##
##     group_rows
```

Table 1: Table 1: Summary Statistics for Location and Question

locationabbr	questions_coded	Mean	Median	Count	SD
MS	2	21.890278	22.977778	4	5.0485714
GU	2	20.491667	20.033333	4	3.4792906
LA	1	20.241071	19.146429	4	4.7195583
ND	2	18.651515	19.550000	5	4.8538149
MS	1	18.631944	18.163889	4	4.1857351

OH	2	18.523214	17.525000	4	5.4775093
KS	2	18.435417	17.943750	6	5.9968764
IN	2	18.390952	18.520000	4	4.1110703
AL	1	18.325926	19.377778	3	2.4119643
KS	1	18.320417	18.461250	6	2.8378339
IA	2	18.239583	18.150000	4	4.4918000
KY	1	18.160370	18.227778	6	2.1508725
AR	1	18.050625	18.070000	4	2.1373858
WV	1	17.905000	17.905000	2	2.8213561
KY	2	17.875185	17.858333	6	5.3262702
SD	1	17.851333	17.450000	5	4.0540628
AR	2	17.675625	17.720000	4	1.3639257
SC	1	17.476444	19.460000	5	2.9052713
TN	1	17.424333	17.775000	5	2.4455116
AL	2	17.400000	18.388889	3	4.4444028
PA	1	17.136667	18.700000	5	2.9909623
TN	2	16.912000	19.600000	5	5.9993100
MO	1	16.867407	17.840000	3	2.2080731
WI	1	16.836048	17.275000	5	2.1019907
IN	1	16.640714	16.850000	4	1.6002863
OK	2	16.618102	17.707500	6	2.5065889
DC	1	16.489583	16.762500	6	5.6855102
RI	1	16.479299	17.640000	5	2.4339589
GA	2	16.397857	17.000000	5	2.7490401
NJ	1	16.397143	17.585714	5	3.8011867
ND	1	16.379242	17.550000	5	3.6709232
NE	1	16.346875	16.900000	4	1.7375862
VI	2	16.200000	16.200000	2	5.3740115
AK	1	16.173333	16.600000	5	1.6523384
MO	2	16.141482	17.360000	3	2.2721419
CT	1	16.034444	16.750000	5	1.8650638
GU	1	16.016667	16.450000	4	3.7758001
IA	1	15.950000	14.950000	4	2.7525746
OK	1	15.922222	16.754167	6	2.1782377
VA	1	15.843333	15.900000	5	3.2186652
MT	1	15.836239	15.865079	6	4.5720687
NC	1	15.731636	16.472727	5	2.6006841
DE	2	15.686000	16.600000	5	2.2247539
DE	1	15.668000	18.190000	5	4.4222246
LA	2	15.653571	15.350000	4	1.8726232
GA	1	15.539643	15.800000	5	4.3864316
VI	1	15.500000	15.500000	2	0.2828427
MI	1	15.431840	15.895454	6	3.4581680
AZ	1	15.406000	17.310000	5	3.3326536
MA	1	15.371515	16.866667	5	4.1946699
IL	1	15.364167	17.025000	5	4.0738448
NM	1	15.326389	15.612500	6	2.6610507
MD	1	15.280884	15.840000	7	2.7601883
NV	1	15.222143	14.900000	5	1.9625226
SD	2	15.175333	15.566667	5	4.2002828

NY	1	15.123560	15.370000	7	2.8388393
ID	1	15.039394	16.200000	3	2.3240449
HI	1	14.961111	14.683333	6	3.3031579
NE	2	14.896875	14.375000	4	2.8493123
VT	1	14.889731	15.482222	6	2.3890904
ME	1	14.849783	15.200000	6	2.2102440
AZ	2	14.824000	14.850000	5	4.6619234
PR	1	14.750000	14.750000	1	NA
ME	2	14.736797	15.742857	6	3.5560622
AK	2	14.550833	15.016667	5	2.6717471
PA	2	14.536667	16.233333	5	4.6397797
PR	2	14.500000	14.500000	1	NA
NH	1	14.459167	14.190000	6	1.5646898
TX	2	14.358889	14.933333	5	4.6318869
MI	2	14.265527	15.193333	6	4.3111553
FL	1	14.044762	14.357143	5	2.9759340
WY	1	14.019107	13.173214	4	3.2177940
CT	2	13.993333	16.566667	5	4.8305011
TX	1	13.987222	12.877778	5	3.9230010
UT	1	13.962500	15.100000	3	3.2468013
NC	2	13.955636	14.881818	5	3.6487105
SC	2	13.950667	14.000000	5	5.0538552
NH	2	13.793333	14.187500	6	4.1587398
WV	2	13.785000	13.785000	2	5.0699556
OH	1	13.726190	13.535714	4	2.2572383
IL	2	13.477500	14.450000	5	3.8486138
WI	2	13.414452	13.733333	5	2.0896007
RI	2	13.388390	14.190000	5	2.6692186
VA	2	13.360667	14.600000	5	4.3456219
CA	2	13.350000	13.350000	4	5.4003086
CA	1	13.333333	11.983333	4	3.9077321
HI	2	13.204630	12.888889	6	5.2737978
UT	2	13.180000	13.250000	3	6.5552803
MD	2	13.155601	14.520000	7	3.8342686
NM	2	13.115807	13.819643	6	5.9504977
VT	2	12.891169	14.175000	6	3.9703721
WY	2	12.750000	11.150000	4	5.2016023
MA	2	12.515353	13.322222	5	3.7321363
NY	2	12.337483	12.666667	7	3.0028566
DC	2	12.212500	13.850000	6	5.3169893
NV	2	12.133571	12.800000	5	3.8756415
MT	2	11.765628	13.321429	6	6.7307176
CO	1	11.633333	9.833333	5	3.3791024
FL	2	11.610447	11.771429	5	2.1064214
ID	2	10.527273	8.600000	3	4.6974320
NJ	2	10.409048	9.000000	5	4.9775244
CO	2	8.413333	6.900000	5	4.9545910

Table 2

To help address the question of whether obesity and weight status differed by ethnicity, Table 2 was created. From this table, we can see that Hawaiian/Pacific Islanders had the highest mean data value for percent of students in grades 9-12 who have obesity (18.05%) followed by the American Indian/Alaska Native community (17.98%). For race/ethnicity with the highest present of students in the overweight classification, Non-Hispanic Black students had the highest mean (18.04%) with Hispanic students following (17.70%).

Table 2: Table 2: Summary Statistics for Race/Ethnicity and Question

race_ethnicity	questions_coded	Mean	Median	Count	SD
American Indian/Alaska Native	2	18.955033	18.50000	17	4.412538
Hawaiian/Pacific Islander	2	18.587540	19.04889	4	6.164833
Non-Hispanic Black	1	17.701772	17.98939	44	2.020579
American Indian/Alaska Native	1	17.699734	17.45000	17	2.517201
Hispanic	1	17.637082	17.80750	50	2.154198
Hispanic	2	17.140585	16.78896	50	2.860944
Non-Hispanic Black	2	16.732314	17.40500	44	2.595401
2 or more races	1	16.267992	16.20000	45	3.044253
Hawaiian/Pacific Islander	1	16.224286	16.28667	4	3.290938
2 or more races	2	15.170445	14.88182	45	3.805146
Non-Hispanic White	1	13.453582	13.67500	48	1.595103
Asian	1	13.009645	12.20000	34	3.783425
Non-Hispanic White	2	11.234926	11.49886	48	2.805701
Asian	2	9.188049	7.86250	34	4.466382

Confirming Results

To help with data visualization, I separated states into regions pertaining to Northeast, Midwest, South, and West. From here, I was able to create a bar plot with the average data values according to Question 1 and Question 2 stratified by region (Figure 5). The results supported Table 1 where the highest values of Question 1 were reported in the Midwest/South regions and the highest values for Question 2 being reported in the same regions.

Figure 5: Average Data Value by Region and Question

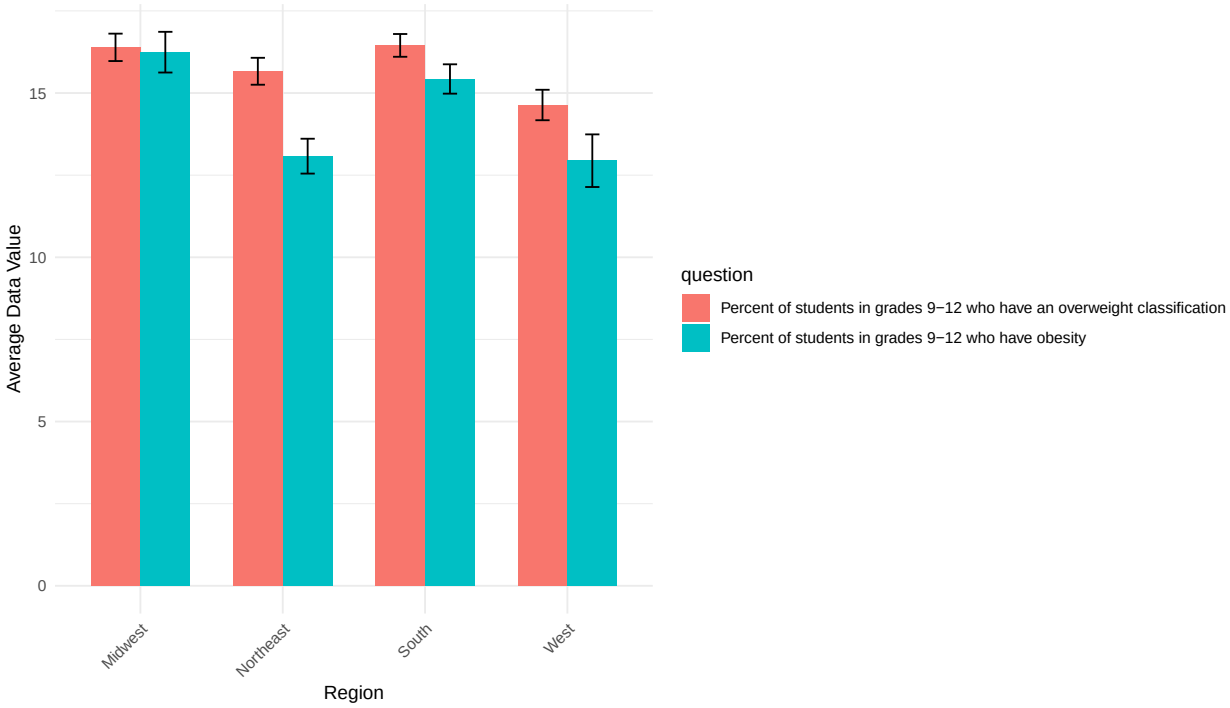
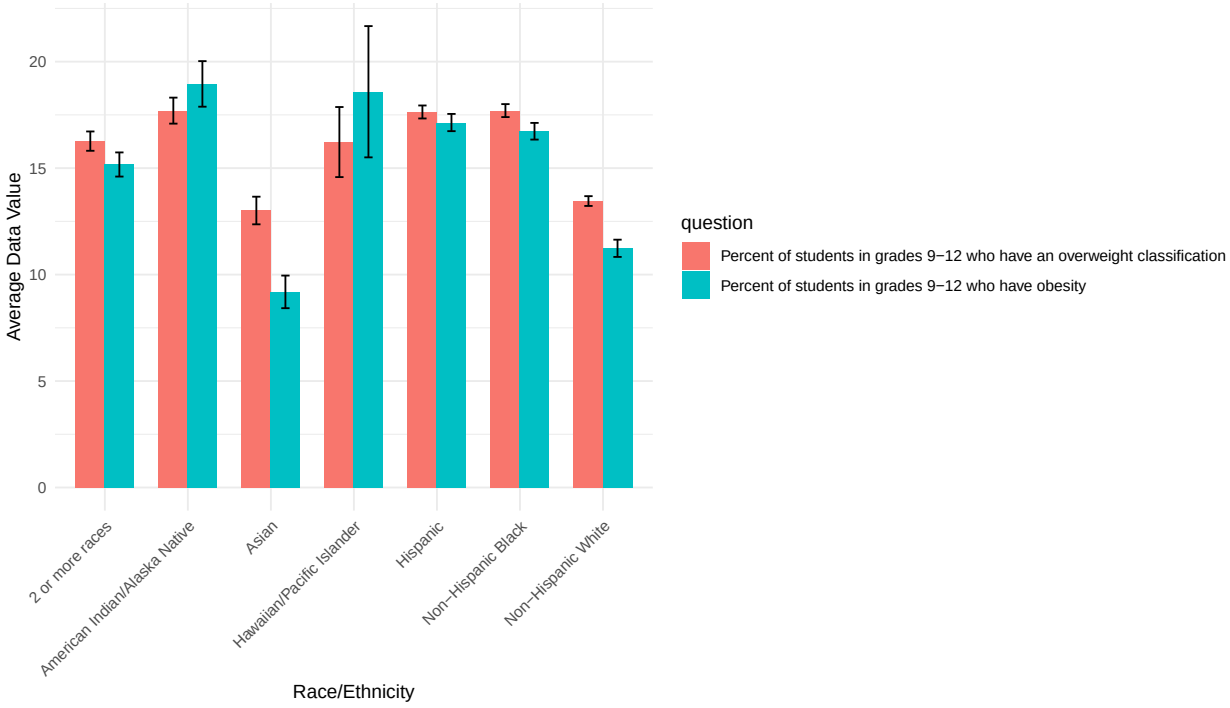


Figure 6: Average Data Value by Race and Question

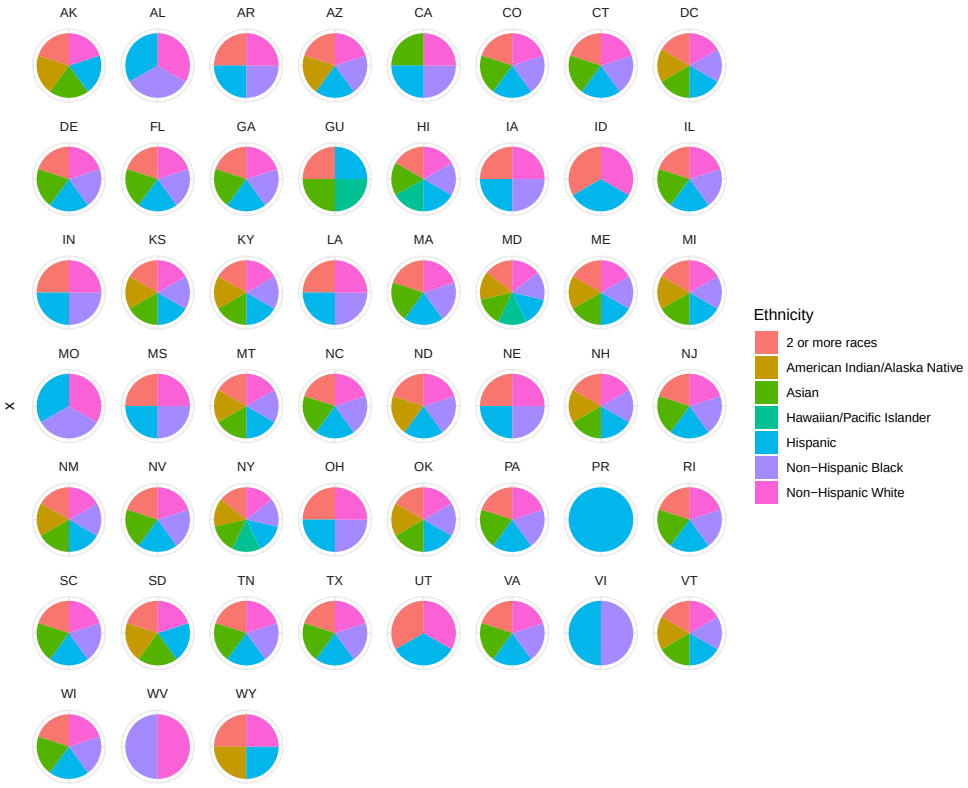


Data Visualization

By creating pie charts of the proportions of ethnicities in each location, I was able to visualize how the ethnicities with higher mean data values related to states with the higher mean data values as seen in Tables 1 and 2. We can see how the locations with higher mean values of Questions 1 and 2 (Guam, Arkansas,

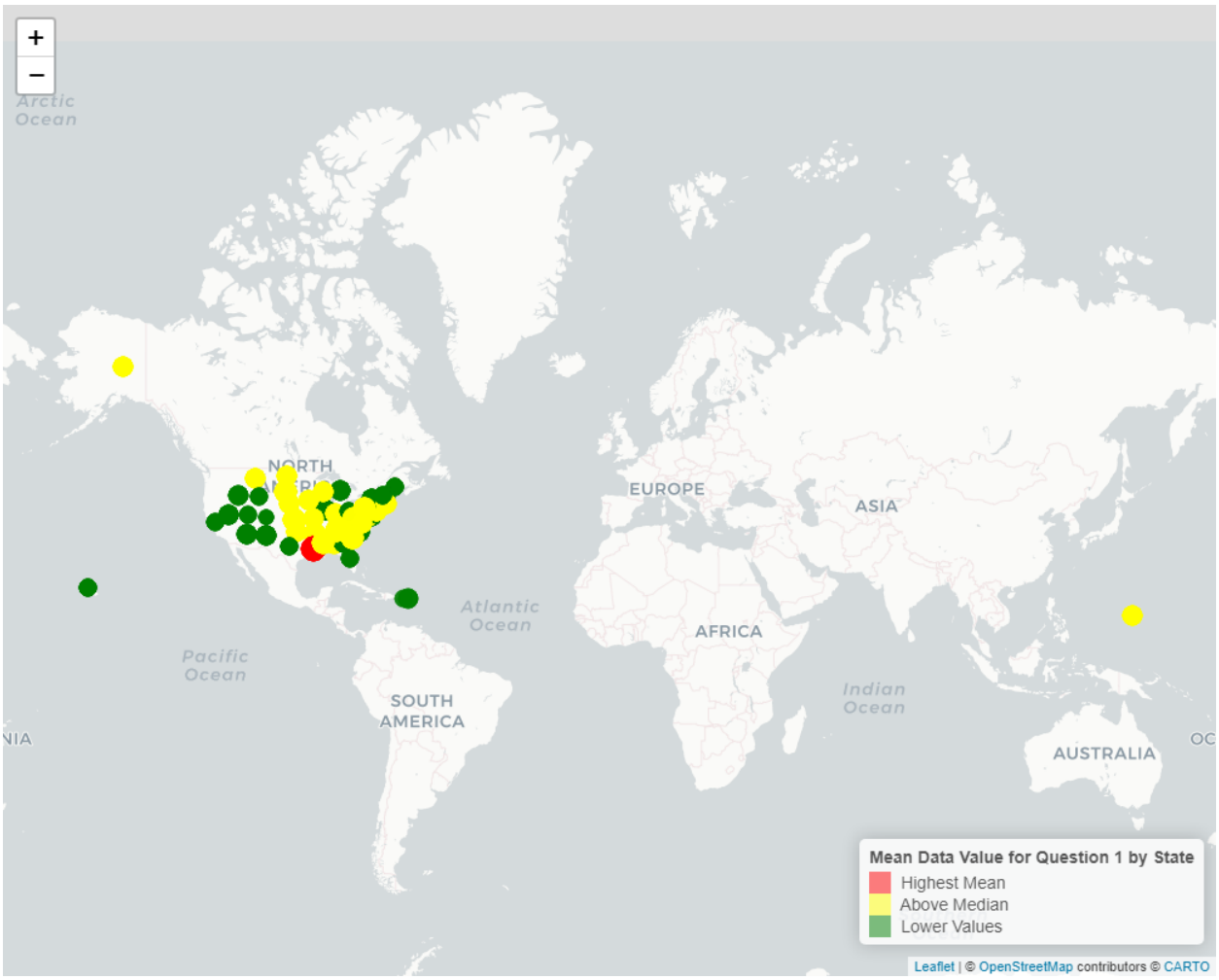
Mississippi, and Louisiana) relate to the ethnicities with higher mean values for the corresponding questions. We can see that in states such as Arkansas, Mississippi, and Louisiana there was a larger population of American Indian/Alaska Native and Non-Hispanic Black students with Guam having a greater portion of Hawaiian/Pacific Islander students. This also supports the tables above in distinguishing how obesity/weight status differs by location and ethnicity.

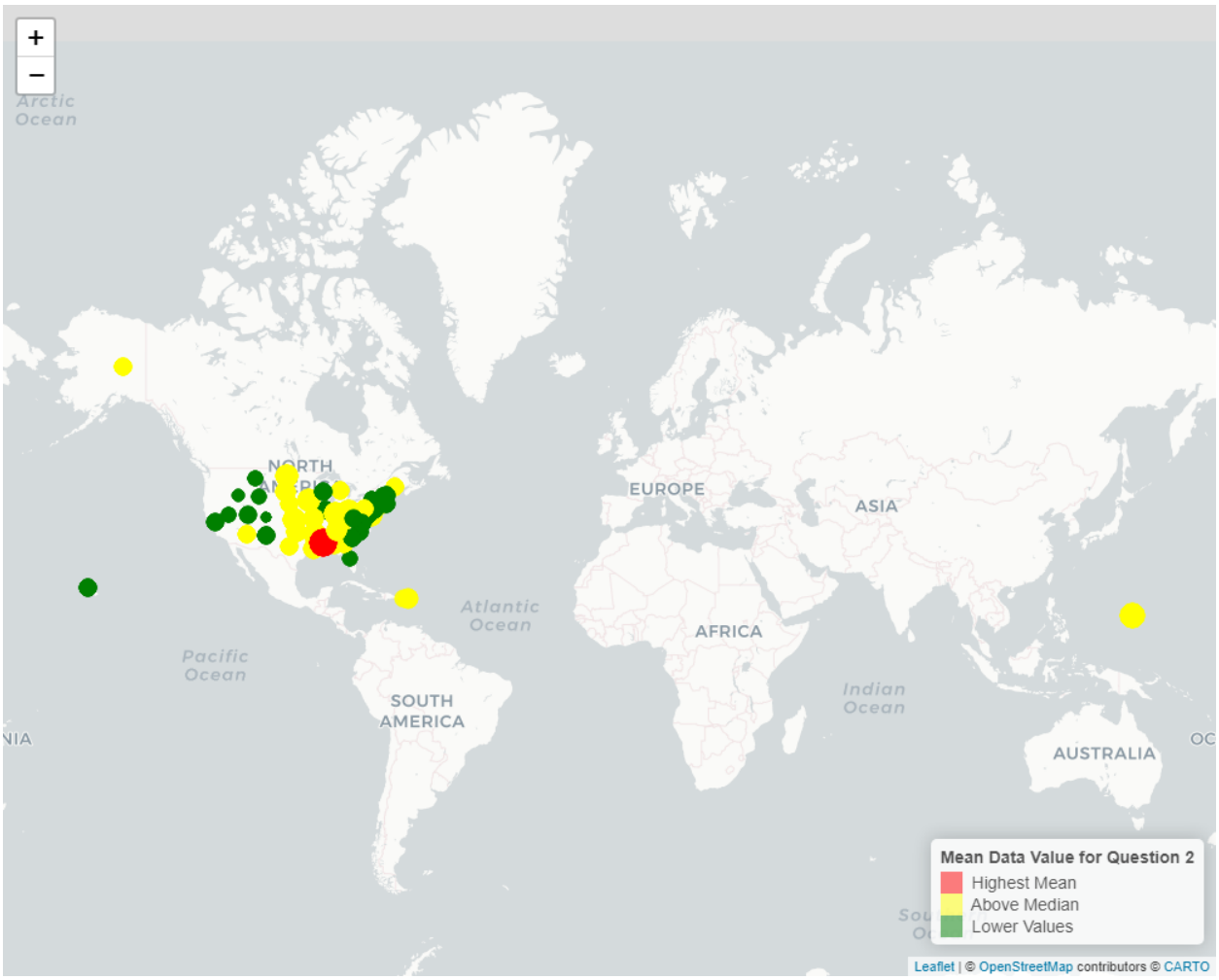
Figure 7: Proportion of Ethnicities by Location



Visualizations

Filtering by Question 1 or 2, maps were created to better visualize mean data values based on location. High mean values are represented by red markers, above median values represented by yellow markers, and low values represented by green markers. From Figure 8, we can see that the state with the highest mean data value for Question 1 is Louisiana (18.72%) which is consistent with our results from Table 1. Figure 9 shows Guam as having the highest mean data value (20.33%) which is also supported by Table 2.


Arctic Ocean
NORTH
EUROPE
ASIA
Atlantic Ocean
AFRICA
Pacific Ocean
Indian Ocean
SOUTH AMERICA
AUSTRALIA
Mean Data Value for Question 1 by State
Highest Mean
Above Median
Lower Values
Leaflet | © OpenStreetMap contributors © CARTO



Conclusion

After exploratory data analysis and the creation of graphs and tables, obesity/weight status seems to follow a trend in certain race/ethnicities and locations. Higher mean data values of Question 1 and Question 2 are characteristic of the Midwest and South regions as well as ethnicities with a higher population in these areas (Figure 7). Ethnicities with a higher percentage of students falling into the Question 1 category included Non-Hispanic Black students (18.04%) and Hispanic students (17.70%). Students falling into Question 2 category included Hawaiian/Pacific Islanders (18.05%) followed by American Indian/Alaska Native students (17.98%).

However, from exploratory data analysis graphs, race/ethnicity are seen to be disproportionately represented in this dataset (Figure 4). The greatest difference in the student population can be seen in the Hawaiian/Pacific Islander population compared to the Non-Hispanic White population and their data value percentages. This is also true for certain regions as seen in Figure 3. We can see that New York had substantially more students participating in the study compared to those in the Virgin Islands.

Although the data could have used from a more robust sample size focused on equal inclusion, the results presented in this analysis from the data published by the CDC could be a starting point to program development. Such efforts can be streamlined in targeting specific regions and ethnicities presented in the analysis. The Youth Risk Behavior Surveillance System can continue to integrate programs that help diminish the obesity epidemic in adolescents.

References

Centers for Disease Control and Prevention. (n.d.). Adult obesity prevalence maps. Centers for Disease Control and Prevention. https://www.cdc.gov/obesity/data-and-statistics/adult-obesity-prevalence-maps.html

Centers for Disease Control and Prevention. (n.d.-b). National YRBSS datasets and documentation by year. Centers for Disease Control and Prevention. https://www.cdc.gov/yrbs/data/national-yrbs-datasets-documentation.html