

Michigan Income and Obesity Analysis



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SUMMARY

The Michigan Income and Obesity Analysis was created to provide an analysis of Michigan's income, obesity population, and obesity percent by county. This analysis facilitates data science techniques used in data cleansing, exploratory data analysis (EDA), and visualization by mapping the data. By design this report is intended to be readable and accessible to all who is interested in Michigan's income and obesity populations as well as data science.

The Michigan Obesity Prevalence data set was originally obtained from here: <https://www.cdc.gov/diabetes/data/countrydata/countrydataindicators.html>. The Michigan Income by County was originally obtained from here: <https://datausa.io/profile/geo/michigan/>. Both data sets were combined and is accessible here: <https://github.com/WorldCapital/Michigan-Income-n-Obesity-Analysis/blob/master/Mich-Income-n-Obesity.csv>. All images found in the report are free to share, even commercially.

The numbers in square brackets (ex. [1]) represents the associated source from the reference page. Each section of the report is identified by all caps while each subsection header is blue italics. The complete Total Obesity Population by County, Obesity % by County, and Income by County can be found in the Appendix on page 31, 32, and 33, respectively. Cover image is Michigan State Capitol Building Lansing, MI.



Image: Flint, MI.



Image: Detroit, MI.



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INTRODUCTION

Michigan has the 19th highest adult obesity rate in the nation, and the 19th highest obesity rate for youth ages 10 to 17 [3]. Michigan's adult obesity rate is currently 32.08%, up from 22.1% in 2000 and from 13.2% in 1990. Michigan is taking to prevent and reduce obesity. According to the most recent data, adult obesity rates now exceed 35% in seven states, 30% in 29 states and 25% in 48 states. Michigan has the 10th highest prevalence of obesity among adults in the United States. In 2009, three out of every 10 Michigan adults were obese, while approximately 36 percent of adults were overweight [2].

Michigan Income and Obesity Table

FIPS Code	County	Obesity Population	Obesity %	Income
26001	Alcona	2,792	31.1	37,189
26003	Alger	2,340	29.8	37,586
26005	Allegan	24,666	30.2	52,061
26007	Alpena	7,300	32.1	38,016
26009	Antrim	5,889	32.2	45,362
26011	Arenac	4,165	34	38,874
26013	Baraga	2,220	32.5	41,189
26015	Barry	13,715	31.2	52,186
26017	Bay	29,049	35.4	45,376
26019	Benzie	3,942	28.7	47,366
26021	Berrien	40,551	34.8	43,633
26023	Branch	10,223	31.8	41,856
26025	Calhoun	33,731	33.9	42,110
26027	Cass	13,858	35.3	44,346

Complete table can be found on page 28.



Image: Detroit, MI

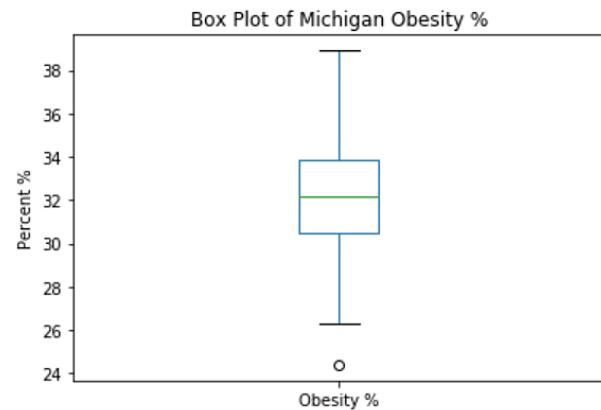
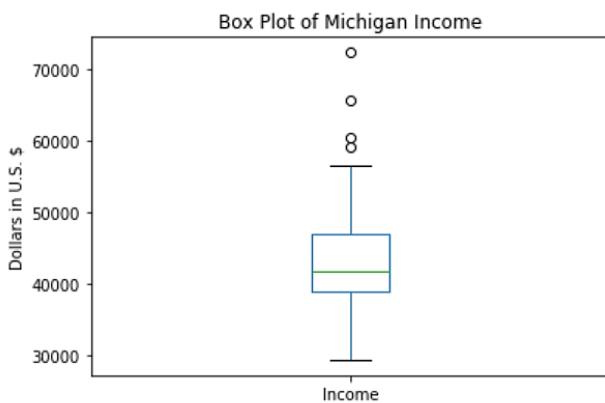


Image: Lansing, MI



STATISTICAL SUMMARY

FIPS Code	Obesity Population	Obesity Percent	Income
Min. : 26,001	Min. : 548	Min. : 24.40	Min. : 29,379
1st Qu.: 26,042	1st Qu.: 5,826	1st Qu.: 30.45	1st Qu.: 38,956
Median : 26,083	Median : 9,848	Median : 32.20	Median : 41,759
Mean : 26,083	Mean : 27,890	Mean : 32.08	Mean : 43,618
3rd Qu.: 26,124	3rd Qu.: 21,448	3rd Qu.: 33.85	3rd Qu.: 46,991
Max. : 26,165	Max. : 434,504	Max. : 38.90	Max. : 72,359



4 Variables 83 Observations

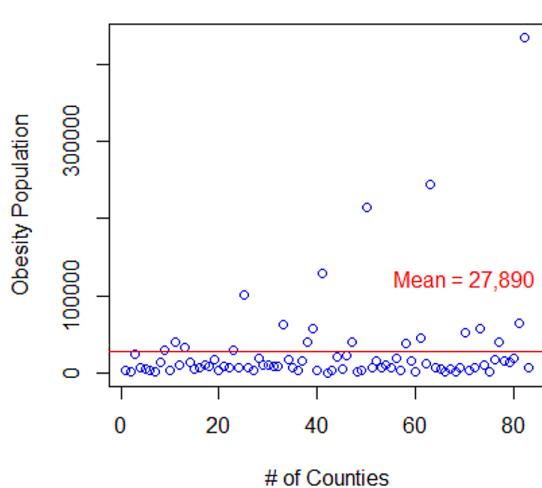
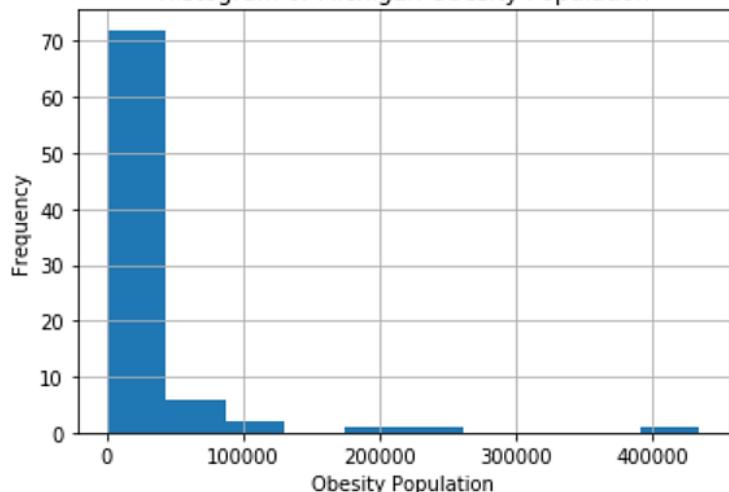
FIPS Code

n	missing	distinct	Info	Mean	Gmd	.05	.10
83	0	83	1	26,083	56	26,009	26,017
.25	.50	.75	.90	.95			
26,042	26,083	26,124	26,149	26,157			
Lowest :	26,001	26,003	26,005	26,007	26,009		
Highest :	26,157	26,159	26,161	26,163	26,165		

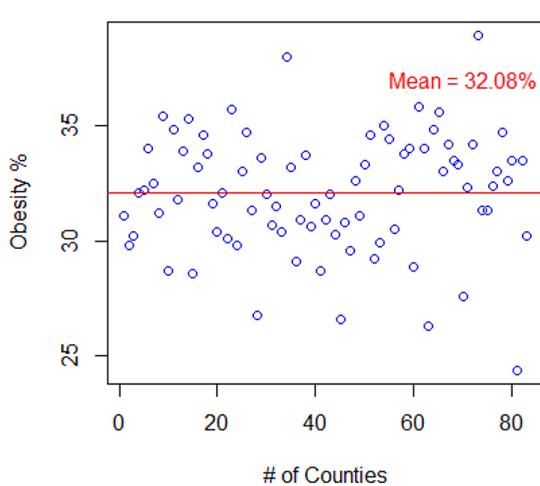
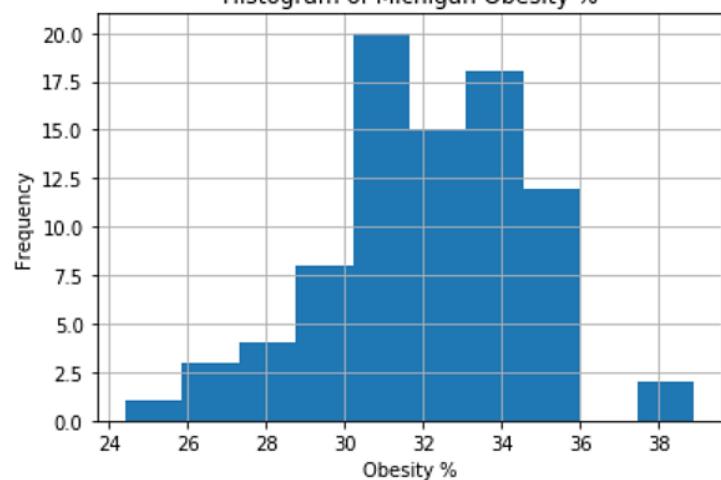
Obesity Population

n	missing	distinct	Info	Mean	Gmd	.05	.10
83	0	83	1	27,890	38,336	2,212	2,746
.25	.50	.75	.90	.95			
5,826	9,848	21,448	56,357	97,443			
Lowest :	548	1,717	1,762	2,041	2,211		
Highest :	101,061	128,665	215,203	243,882	434,504		



Plot of Obesity Population in Michigan**Histogram of Michigan Obesity Population****Obesity Percent**

	n	missing	distinct	Info	Mean	Gmd	.05	.10
	83	0	57	1	32.08	2.859	27.70	28.94
	.25	.50	.75	.90	.95			
	30.45	32.20	33.85	34.80	35.58			
lowest :		24.4	26.3	26.6	26.8	27.6		
highest :		35.6	35.7	35.8	38.0	38.9		

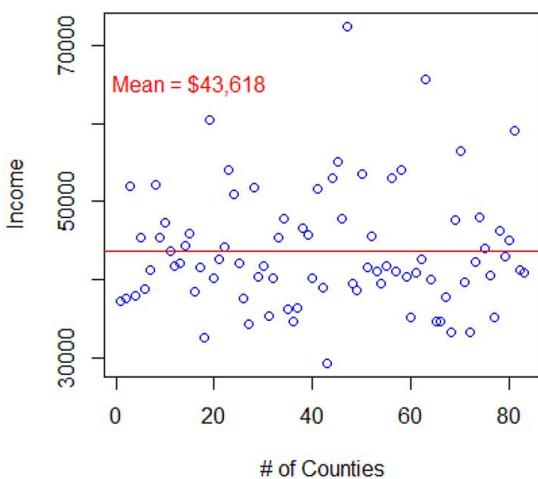
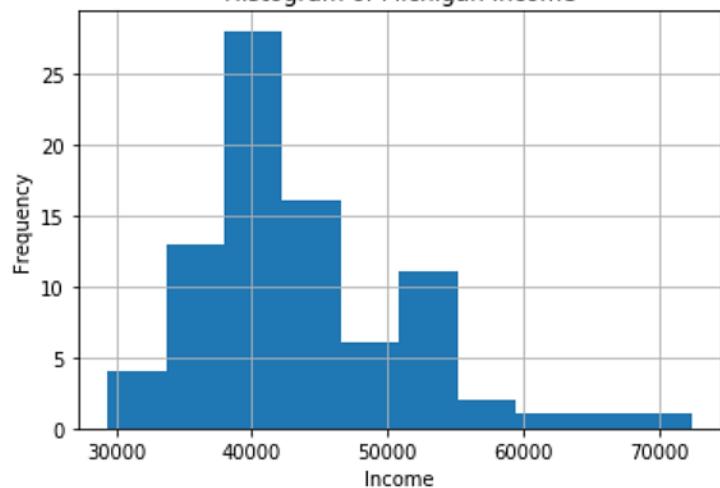
Plot of Obesity % in Michigan**Histogram of Michigan Obesity %****Income**

	n	missing	distinct	Info	Mean	Gmd	.05	.10
	83	0	83	1	43,618	8,172	34,289	35,260



.25	.50	.75	.90	.95
38,956	41,759	46,991	53,376	56,309

Lowest :	29,379	32,668	33,239	33,334	34,252
Highest :	56,453	59,055	60,466	65,594	72,359

Plot of Income in Michigan**Histogram of Michigan Income**

STATISTICAL ANALYSIS

FIPS Code		Obesity Population		Obesity Percent		Income	
	X...Xi		X...Xi		X...Xi		X...Xi
nobs	58	nobs	58	nobs	58	nobs	58
NAs	0	NAs	0	NAs	0	NAs	0
Minimum	26001.0	Minimum	548.0	Minimum	24.4	Minimum	29379.0
Maximum	26163.0	Maximum	434504.0	Maximum	38.9	Maximum	65594.0
1. Quartile	26043.5	1. Quartile	5881.5	1. Quartile	30.725	1. Quartile	38787.5
3. Quartile	26124.0	3. Quartile	29064.75	3. Quartile	33.775	3. Quartile	46106.5
Mean	26082.413	Mean	34220.17241	Mean	32.110345	Mean	43060.965517
Median	26078.0	Median	10312.0	Median	32.05	Median	41807.5
Sum	1512780.0	Sum	1984770.0	Sum	1862.4	Sum	2497536.0
SE Mean	6.222145	SE Mean	9243.427678	SE Mean	0.342411	SE Mean	940.07899
LCL Mean	26069.954	LCL Mean	15710.52776	LCL Mean	31.424678	LCL Mean	41178.48981
UCL Mean	26094.873	UCL Mean	52729.81707	UCL Mean	32.796012	UCL Mean	44943.441224
Variance	2245.4748	Variance	4955575404	Variance	6.800242	Variance	51257413.47247
Stdev	47.386442	Stdev	70395.84792	Stdev	2.607727	Stdev	7159.428292
Skewness	0.110410	Skewness	3.938977	Skewness	-0.227288	Skewness	0.829494
Kurtosis	-1.188877	Kurtosis	17.221615	Kurtosis	0.829285	Kurtosis	0.786036

Kurtosis

FIPS Code	Obesity Population	Obesity Percent	Income
-1.1888771	17.2216154	0.829285	0.786036

- Larger values mean sharper peaks and flatter tails.



- Positive values indicate an acute peak around the mean.
- Negative values indicate a smaller peak around the mean.

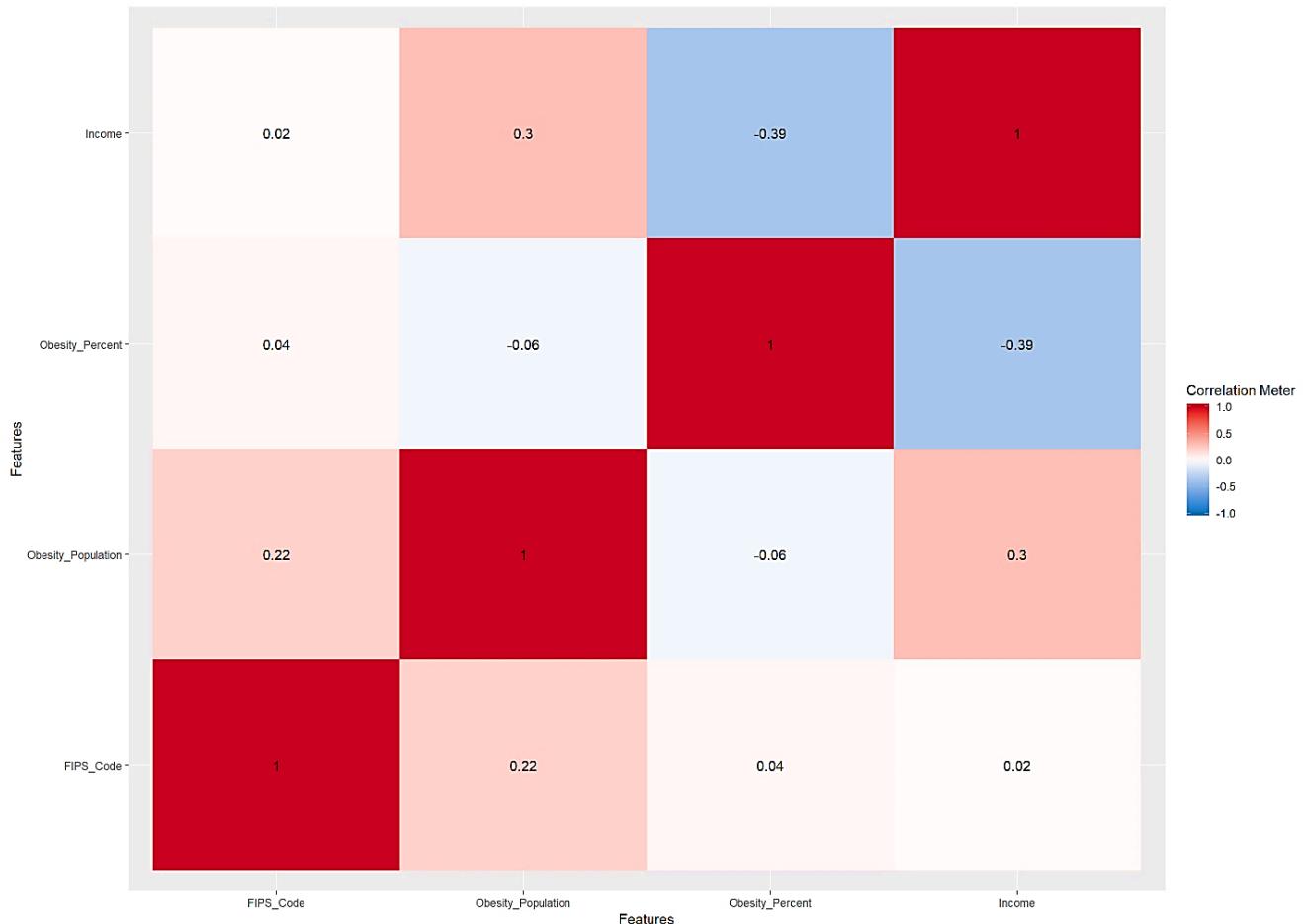
Skewness

FIPS Code	Obesity Population	Obesity Percent	Income
0.1104104	3.9389773	-0.2272882	0.8294945

Skewness for each numeric variable of the dataset.

- Larger values mean sharper peaks and flatter tails.

Positive means the right tail is longer. *Correlation Analysis*



Pearson Correlation Covariance

	Income	Obesity %	Obesity Population	FIPS Code
Income	1	-0.33	0.33	-0.02
Obesity %	-0.33	1	-0.05	0.09
Obesity Population	0.33	-0.05	1	0.27
FIPS Code	-0.02	0.09	0.27	1

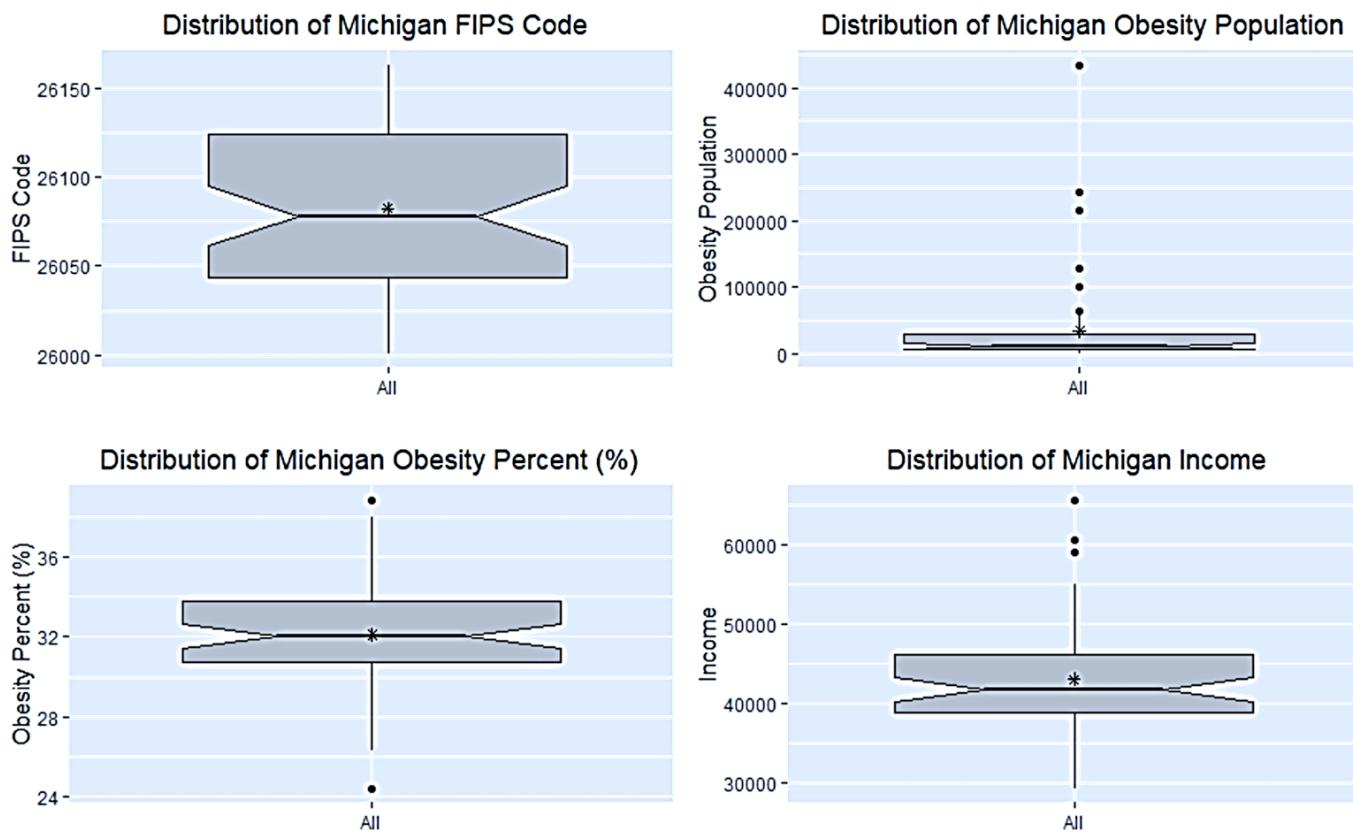


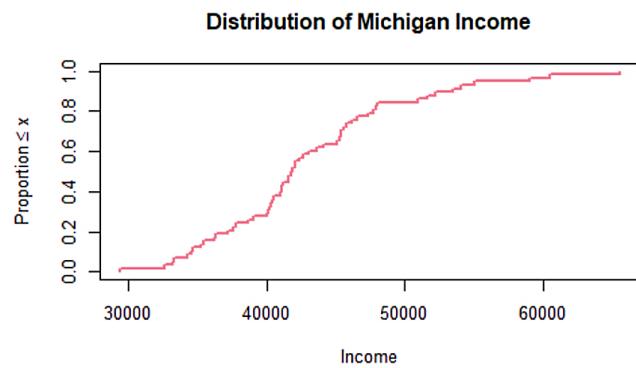
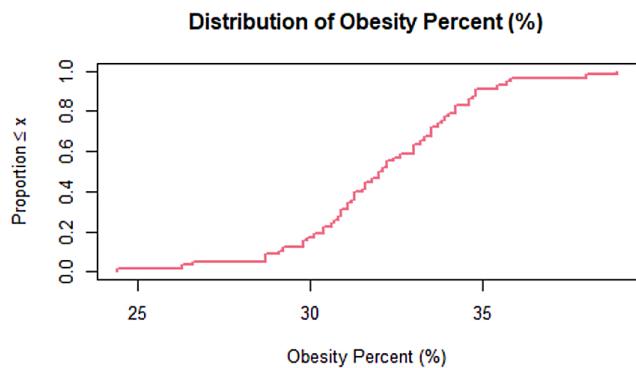
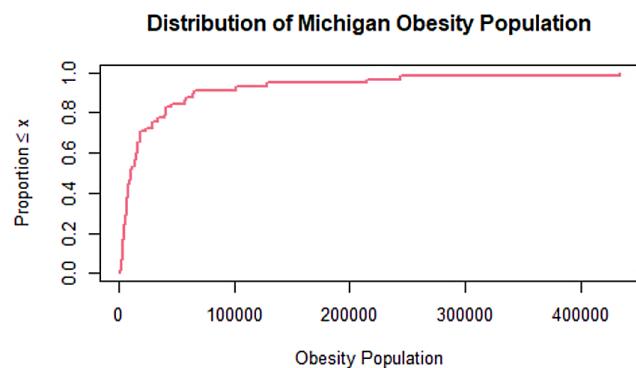
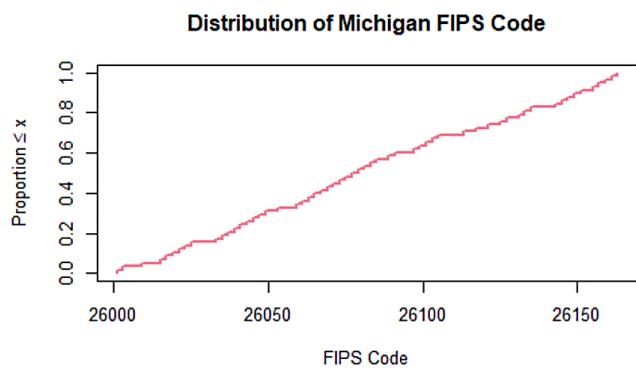
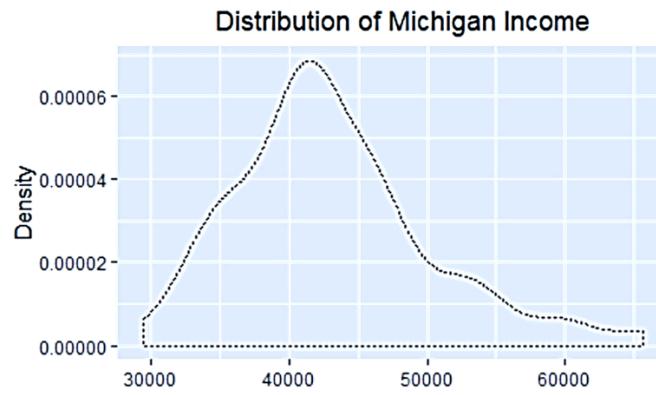
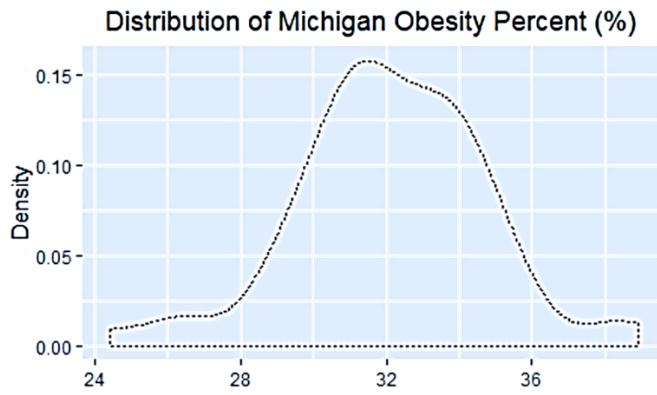
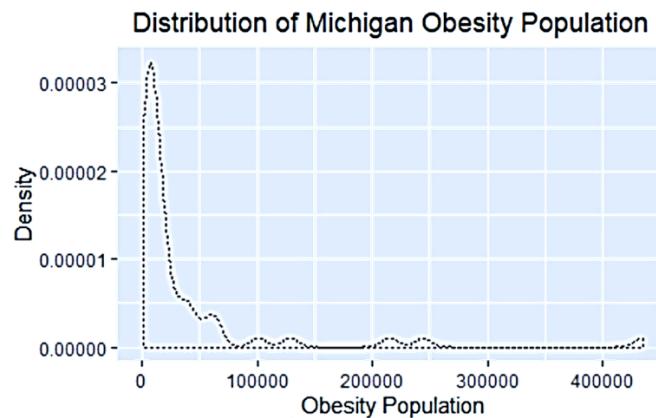
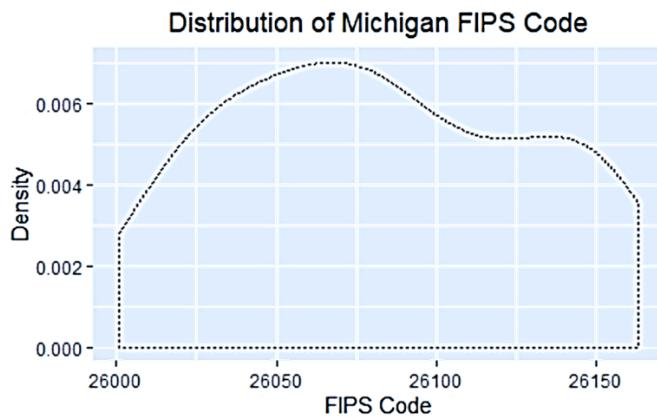
Kendall Correlation Covariance

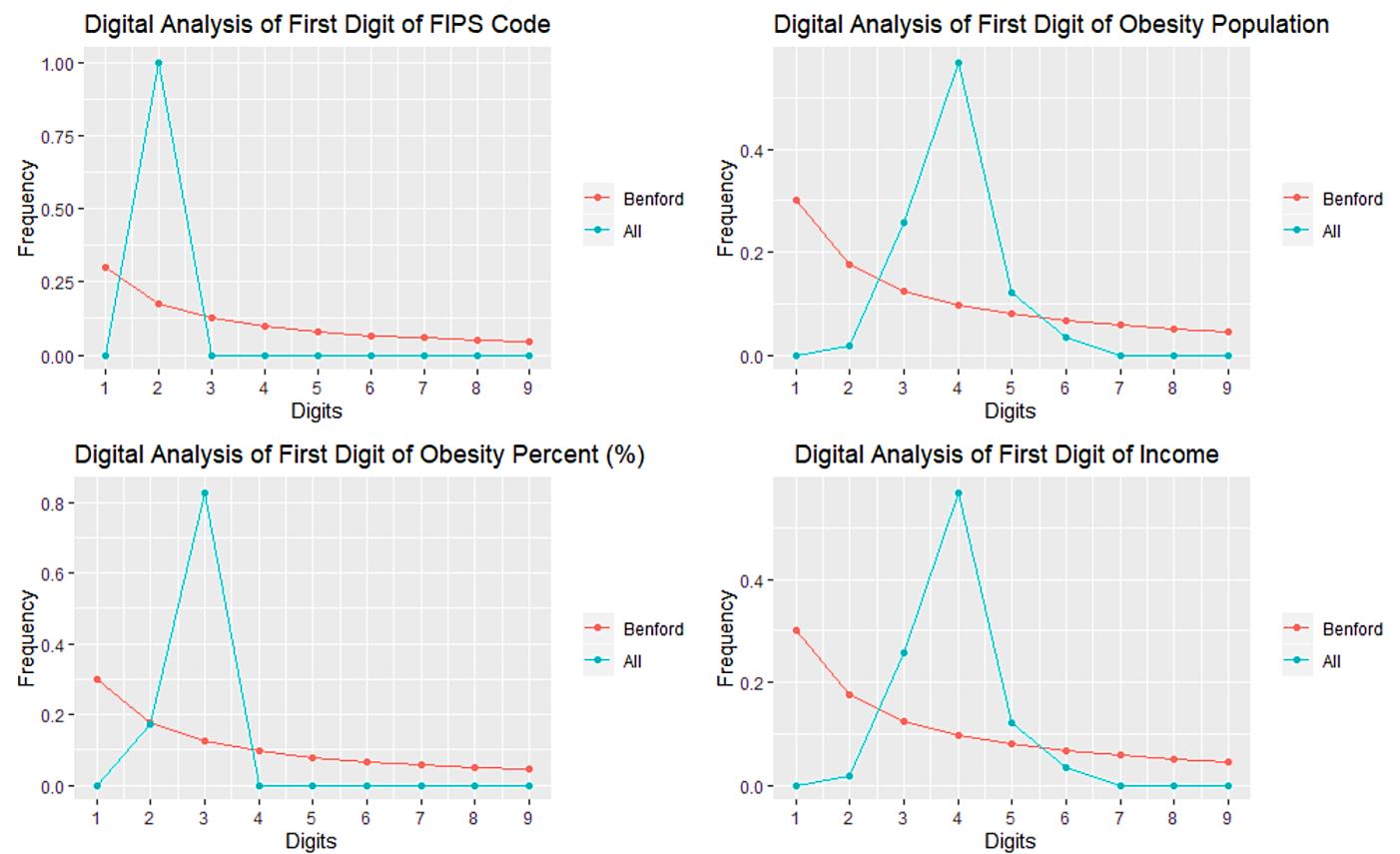
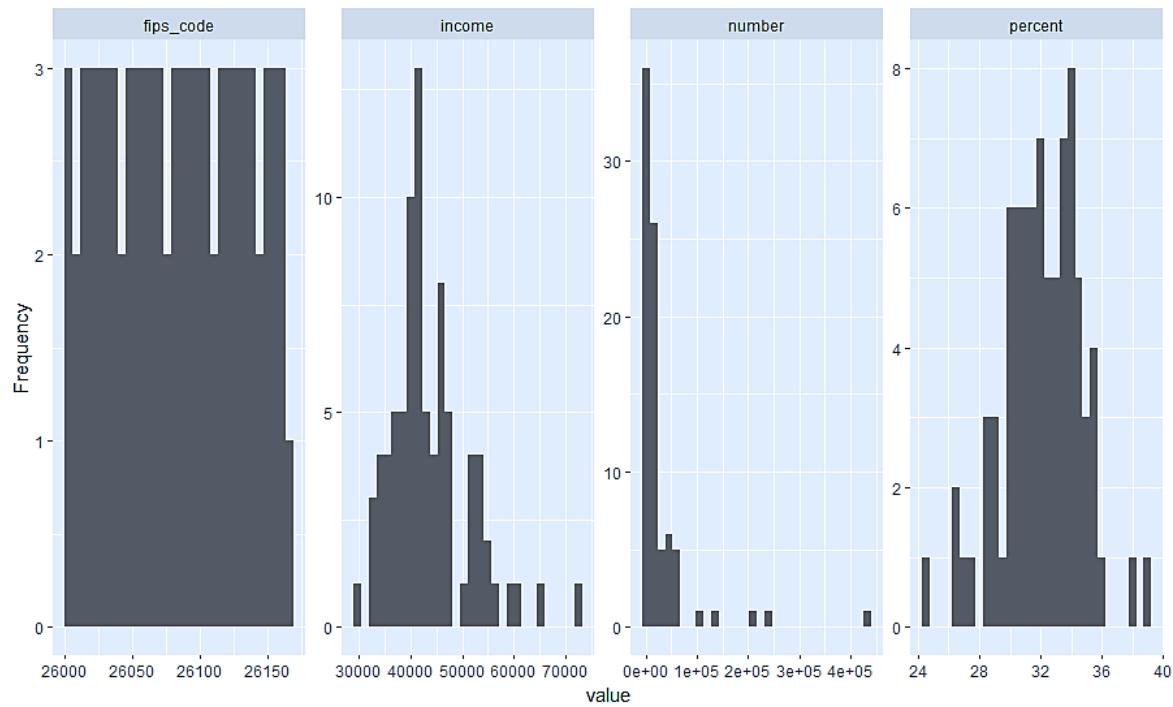
	Income	Obesity %	Obesity Population	FIPS Code
Income	1	-0.10	0.40	-0.05
Obesity %	-0.10	1	0.16	0.09
Obesity Population	0.40	0.16	1	0.12
FIPS Code	-0.05	0.09	0.12	1

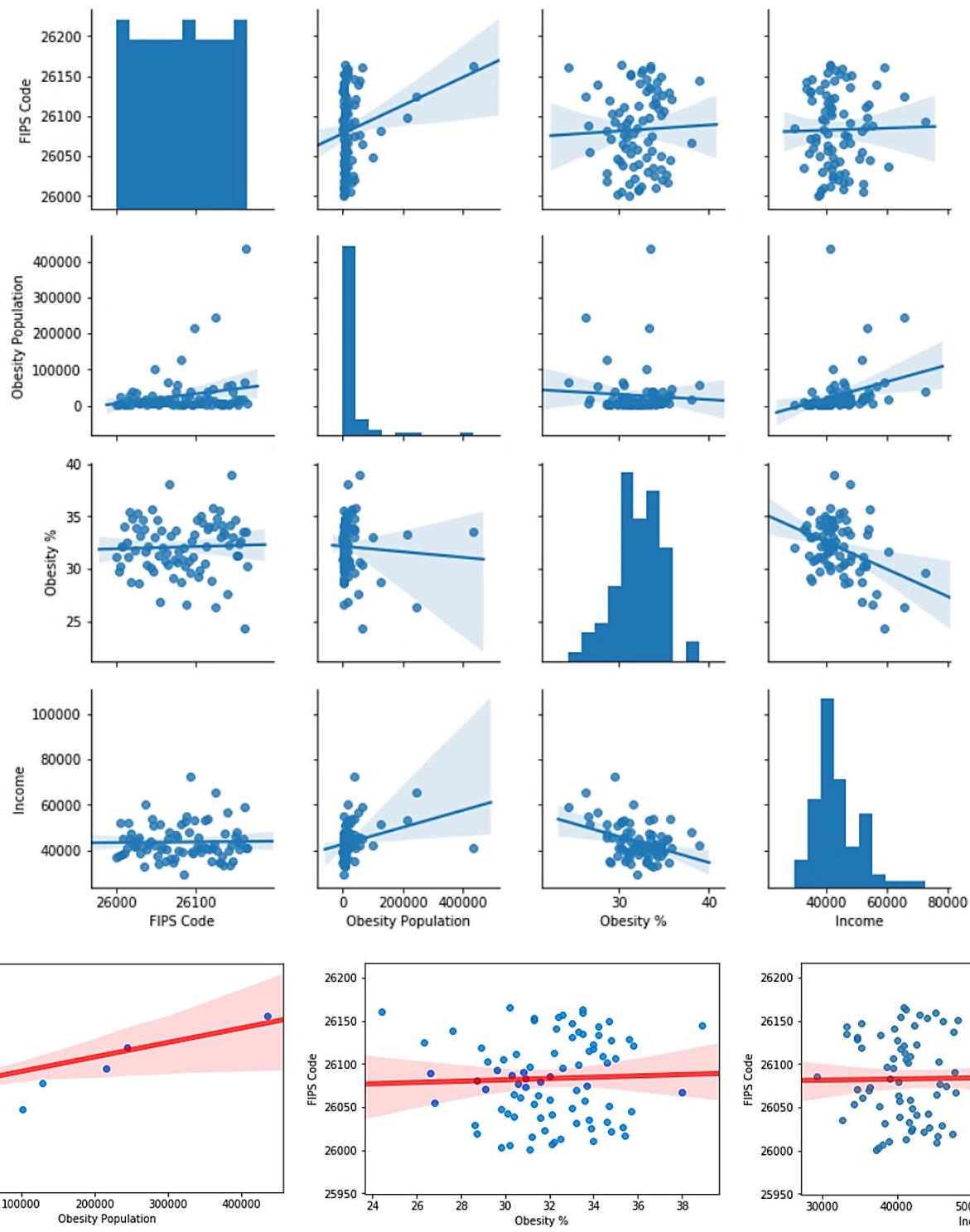
Spearman Correlation Covariance

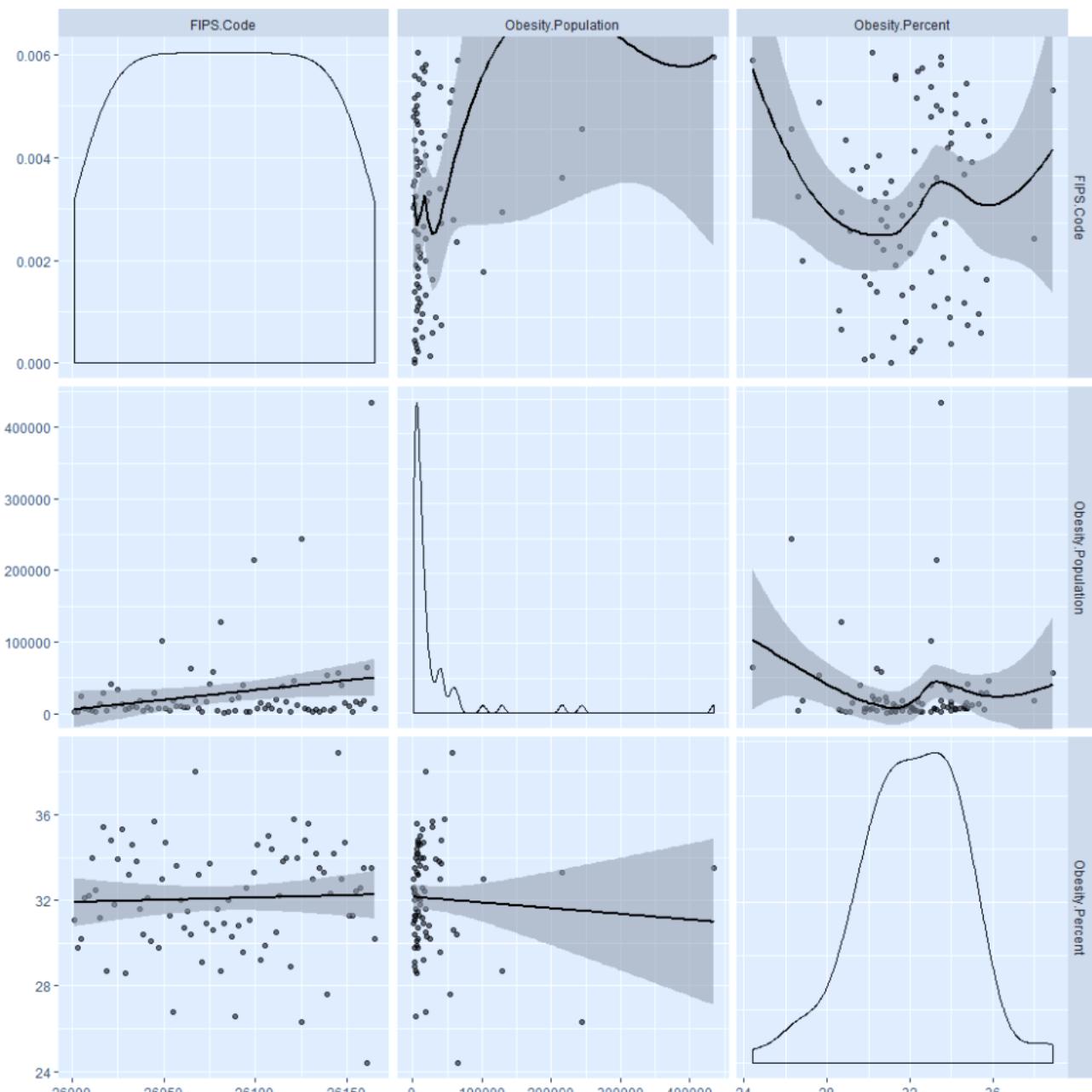
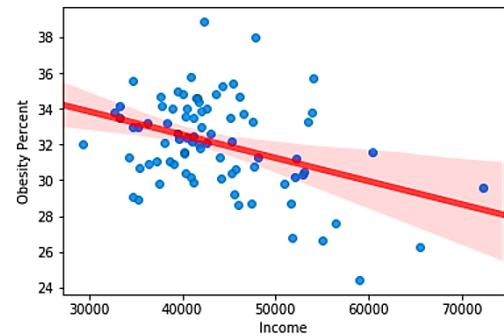
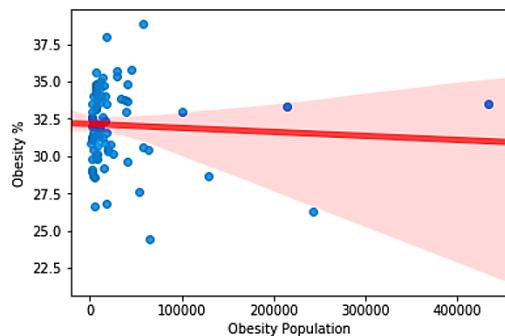
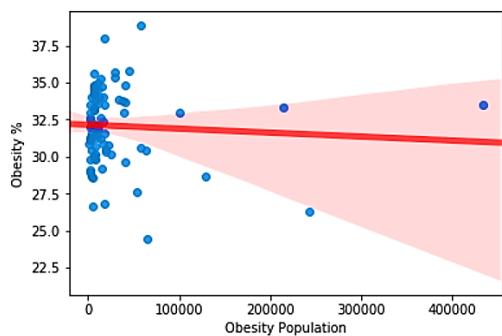
	Income	Obesity %	Obesity Population	FIPS Code
Income	1	-0.17	0.57	-0.06
Obesity %	-0.17	1	0.22	0.15
Obesity Population	0.57	0.22	1	0.17
FIPS Code	-0.06	0.15	0.17	1

DISTRIBUTIONS**Box Plots**

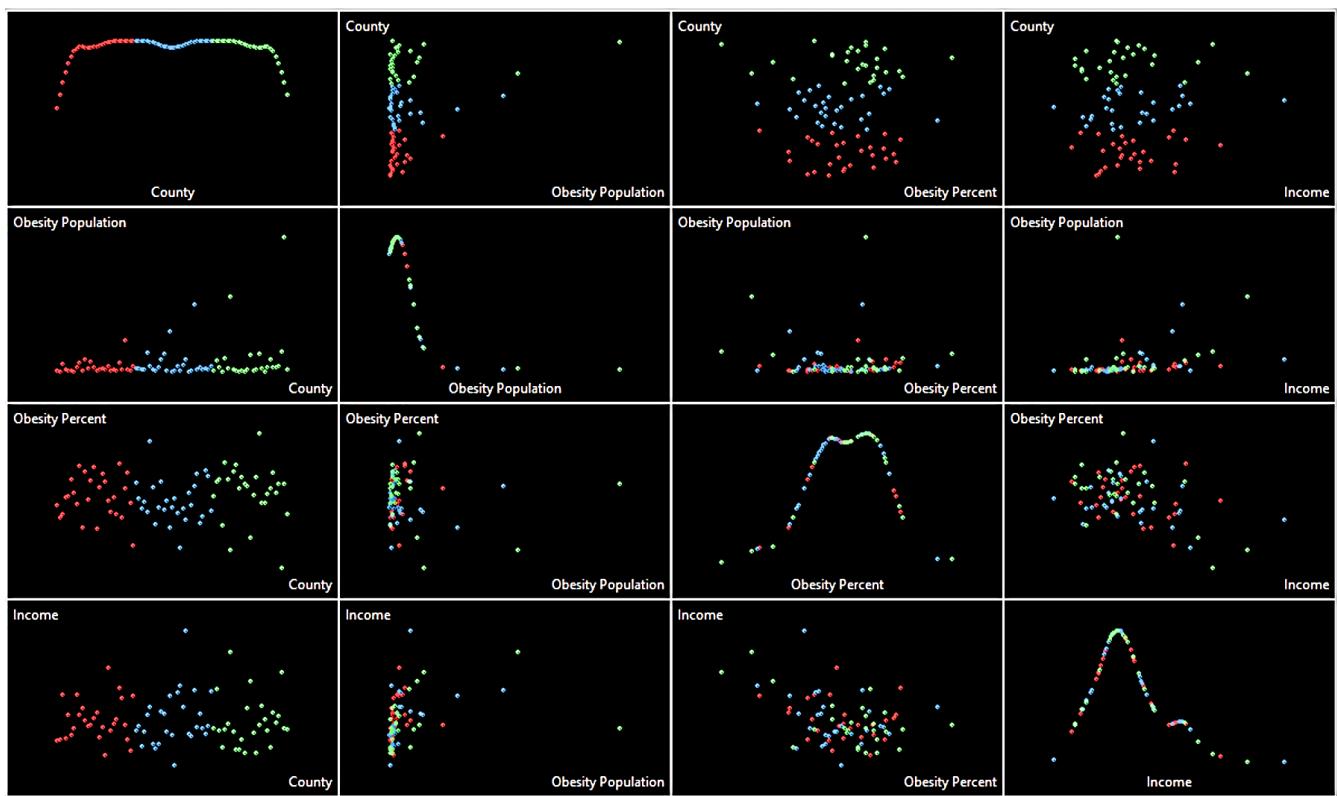
Cumulative**Histogram**

Benford***Frequency***

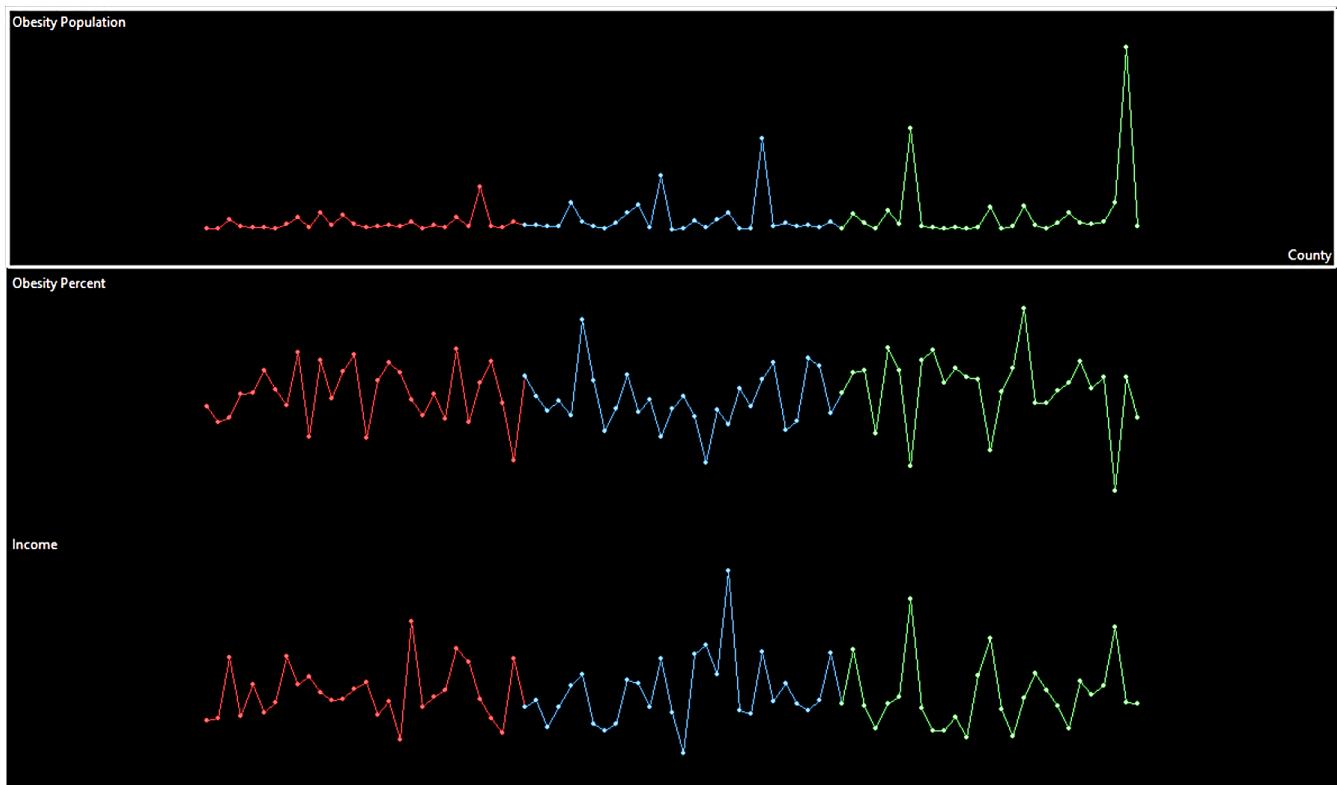
PLOTS***Pair Plot***

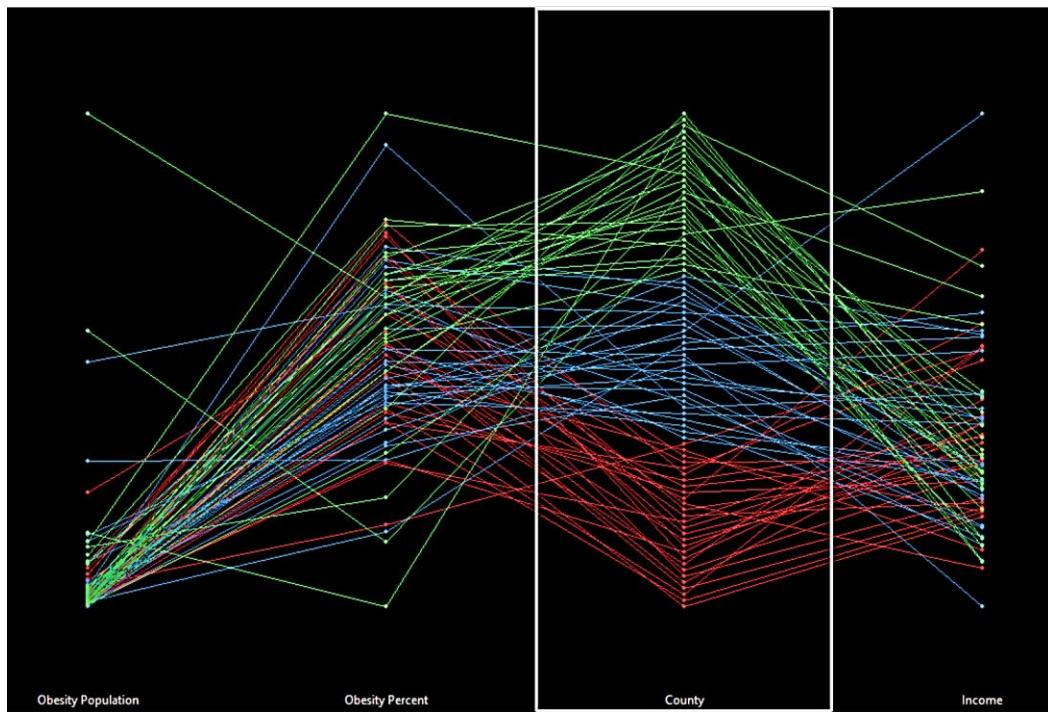
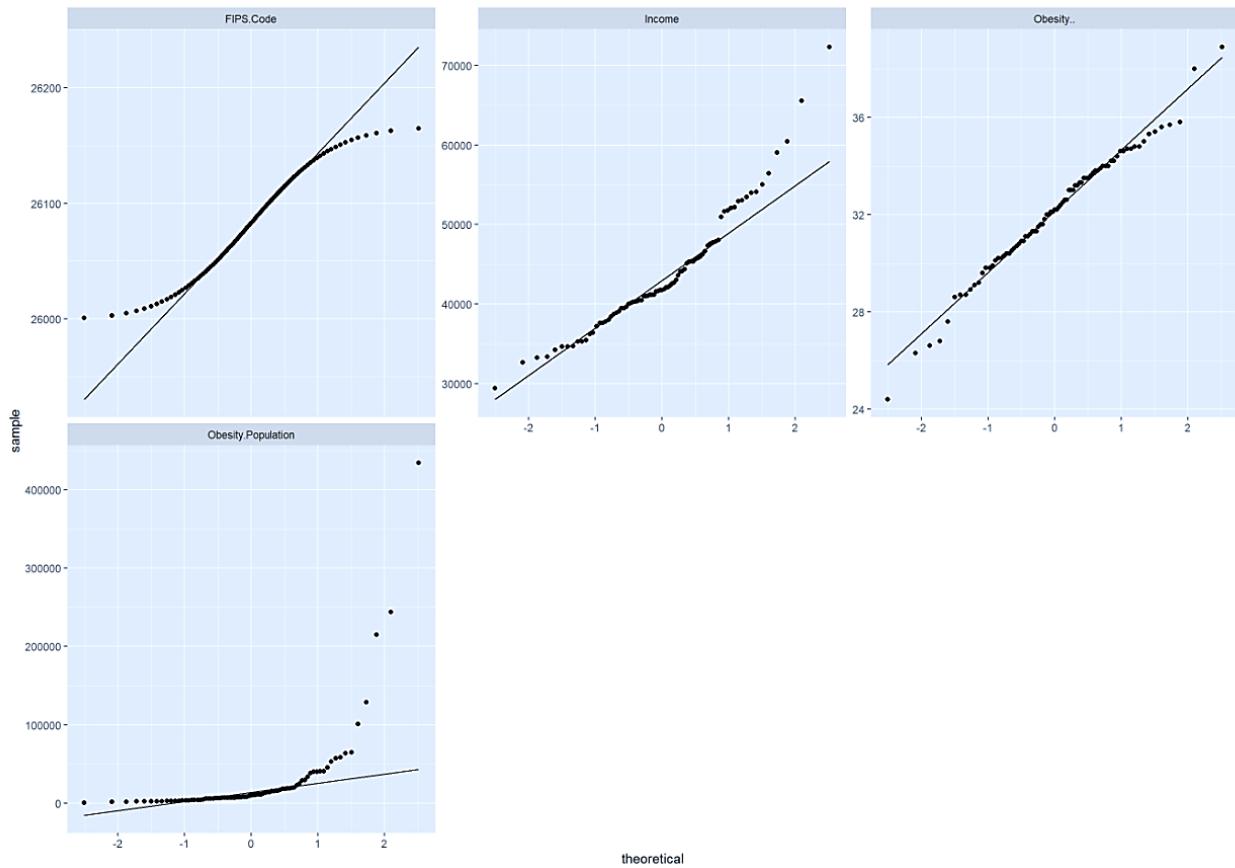


Scatterplot Matrix



Time Series

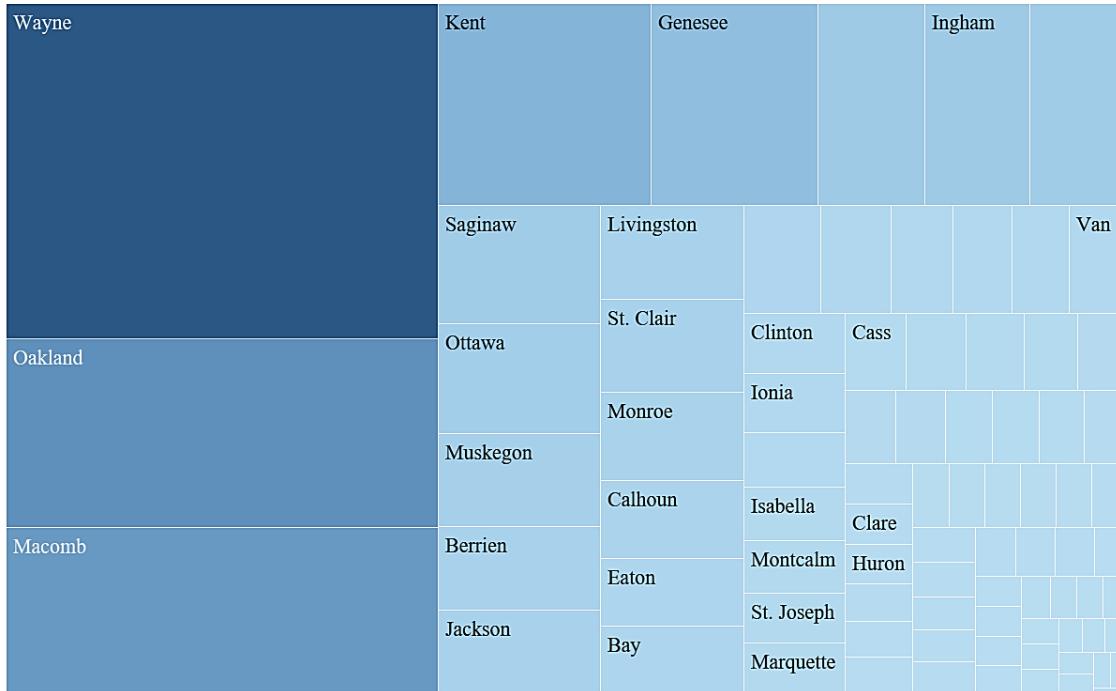


Parallel Coordinate**QQ Plot**

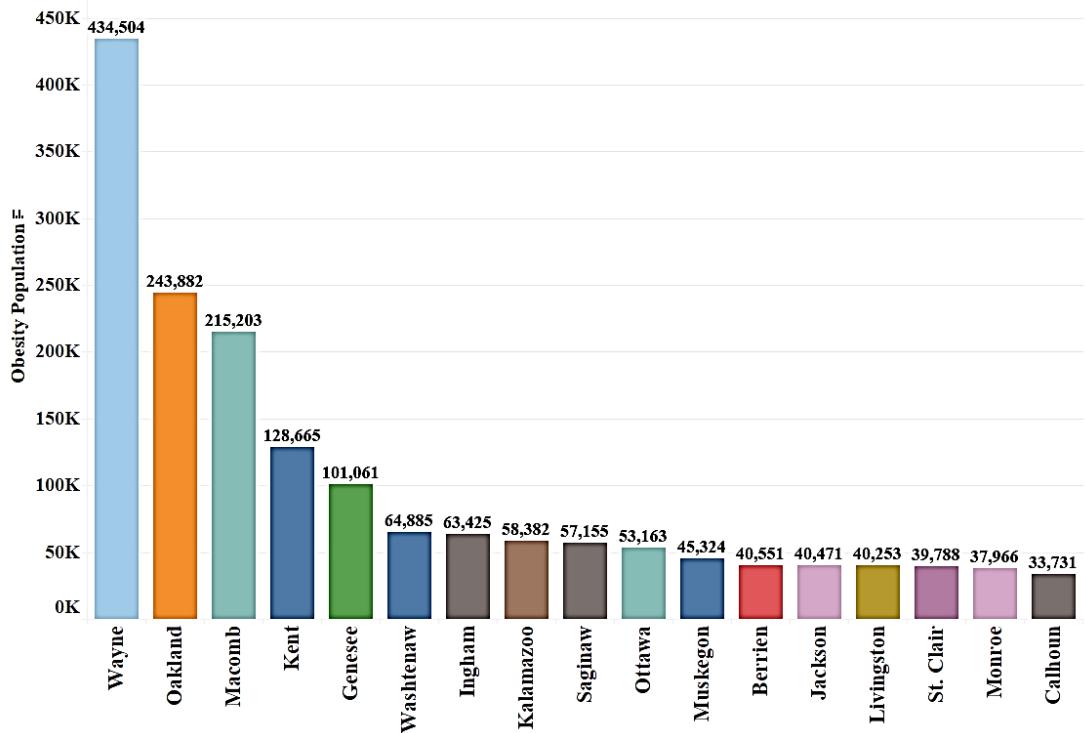
VISUALIZATION

Michigan Obesity Population

Treemap of Obesity Population by County

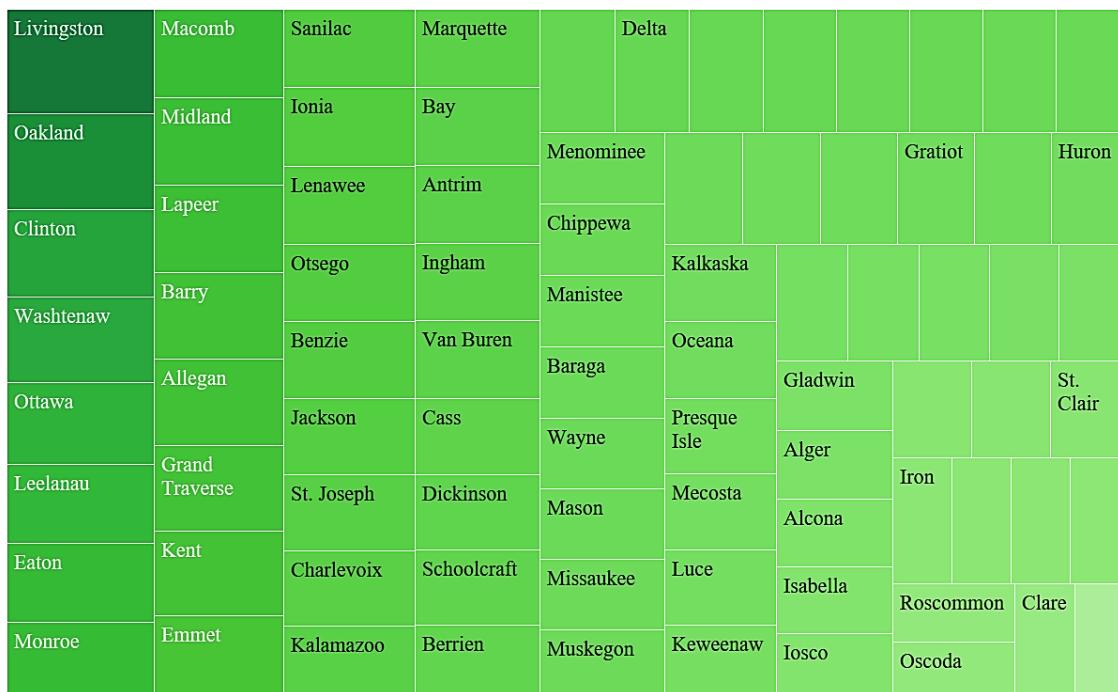


Top County's with Highest Obesity Population

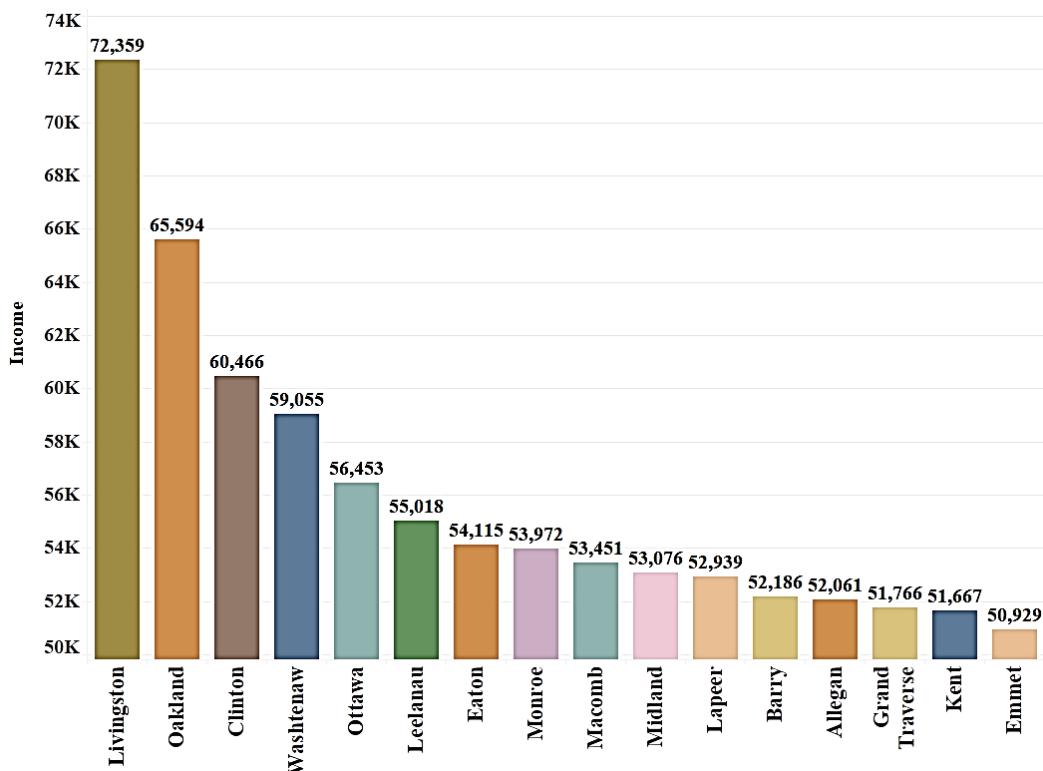


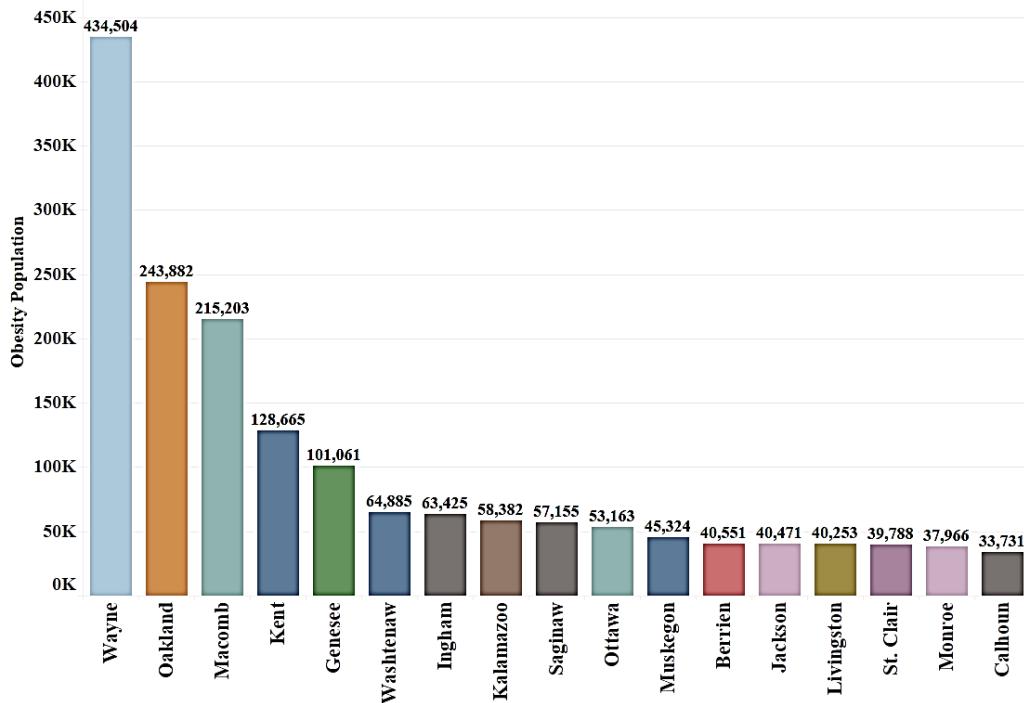
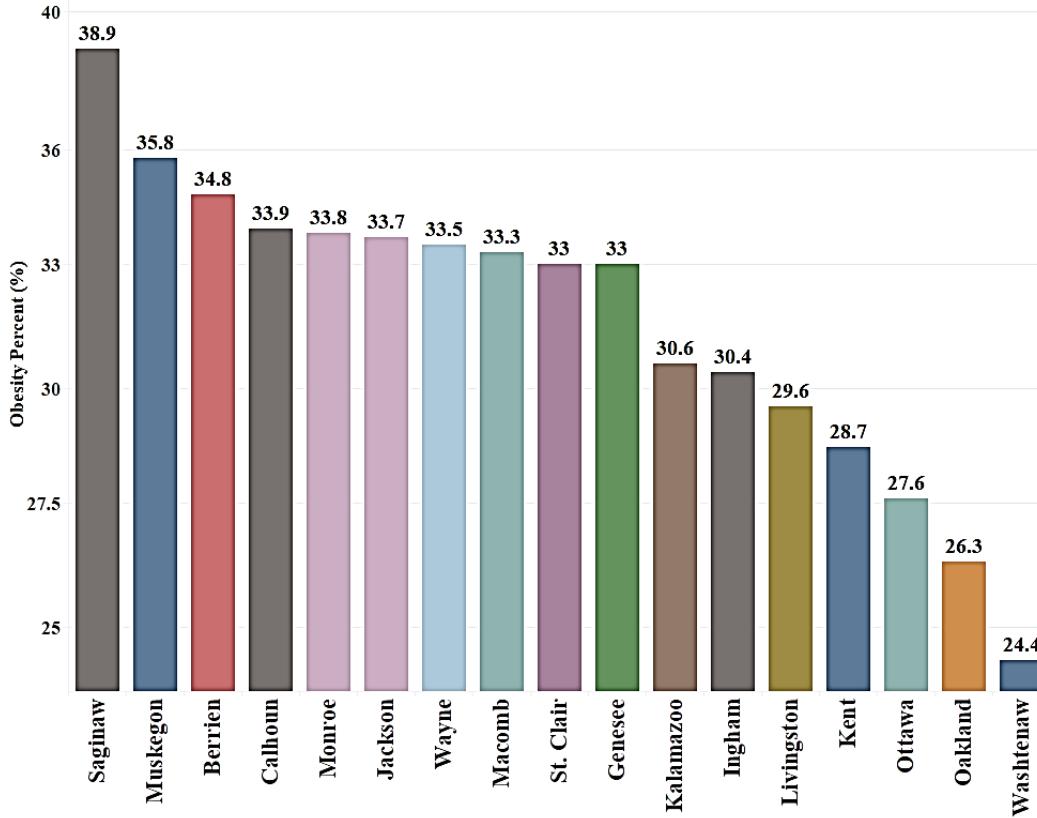
Michigan Income

Treemap of Michigan Income



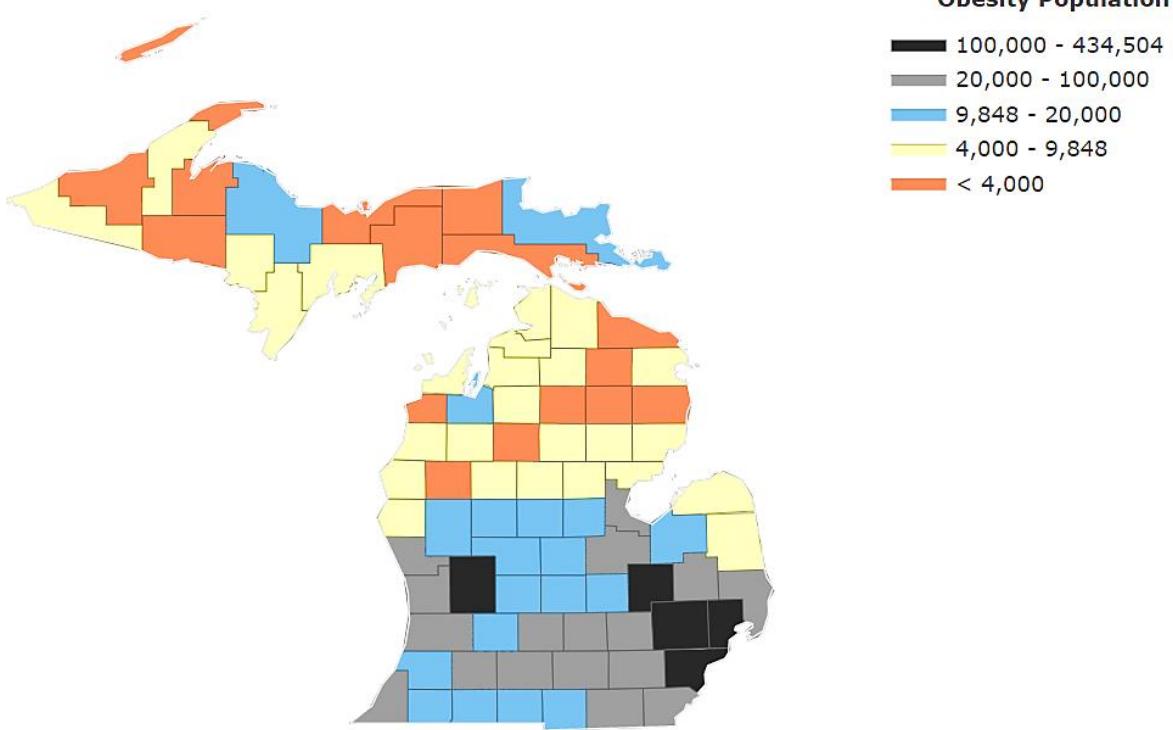
Michigan County's with the Highest Income



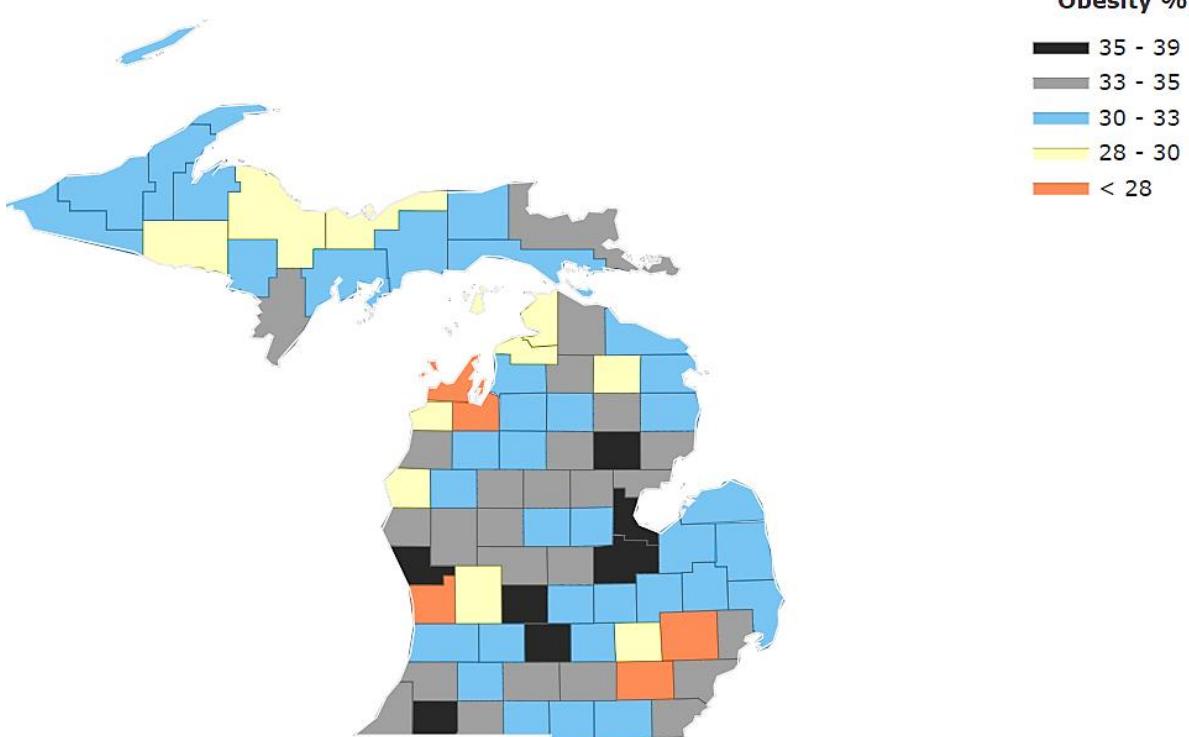
County's with Highest Obesity Population*Michigan Obesity Percent***Michigan Obesity Percent (%) by County**

Choropleth Maps

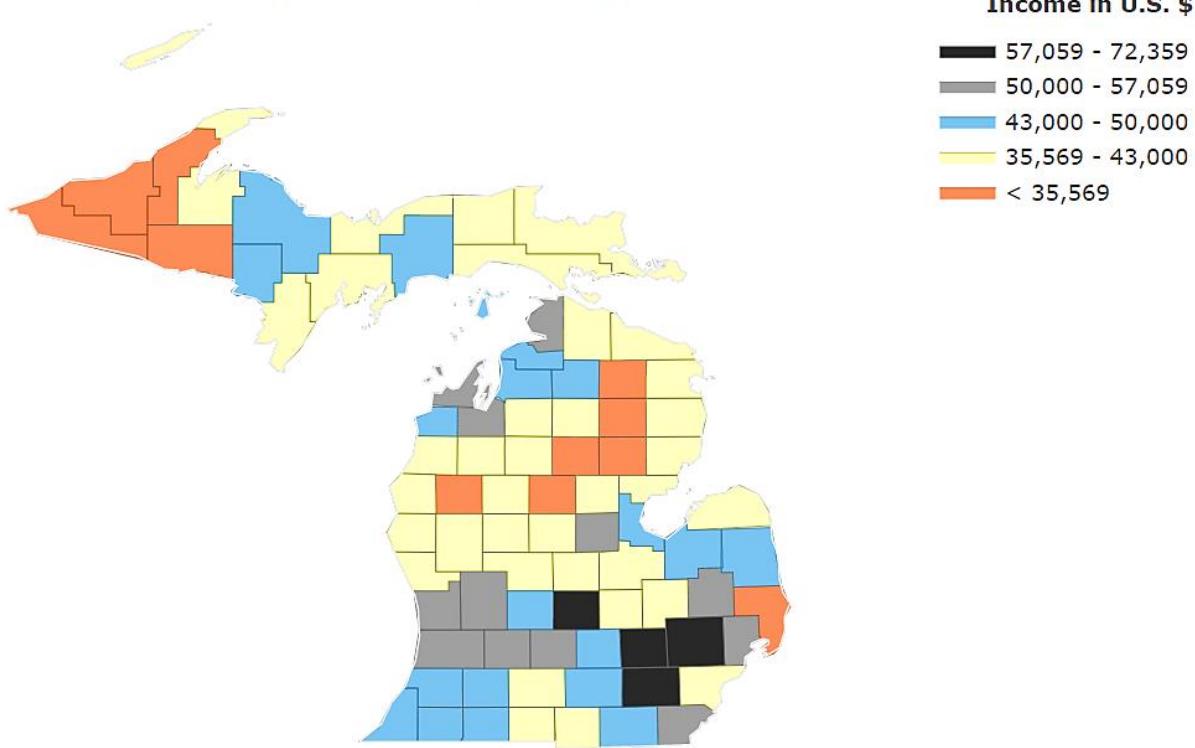
Michigan Obesity Population by County



Michigan Obesity % by County

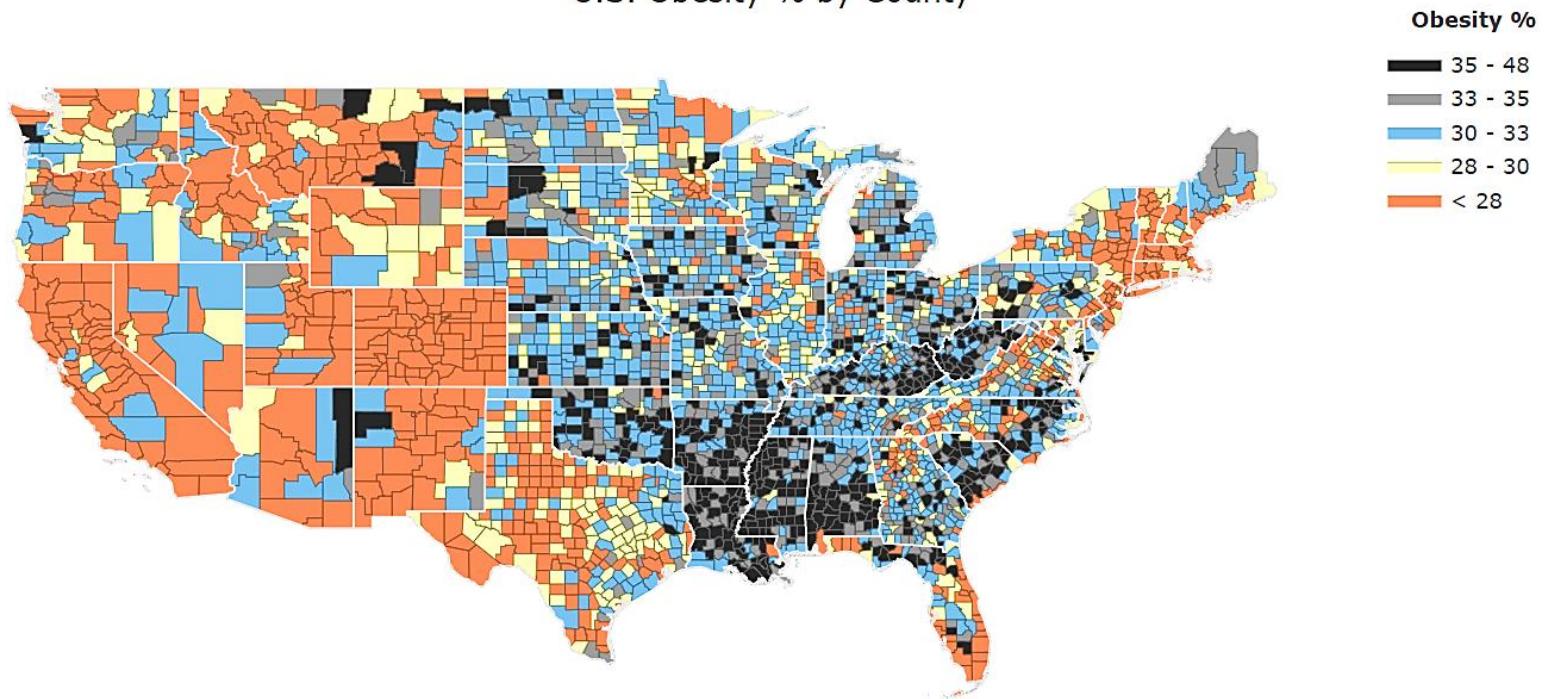


Michigan Income by County

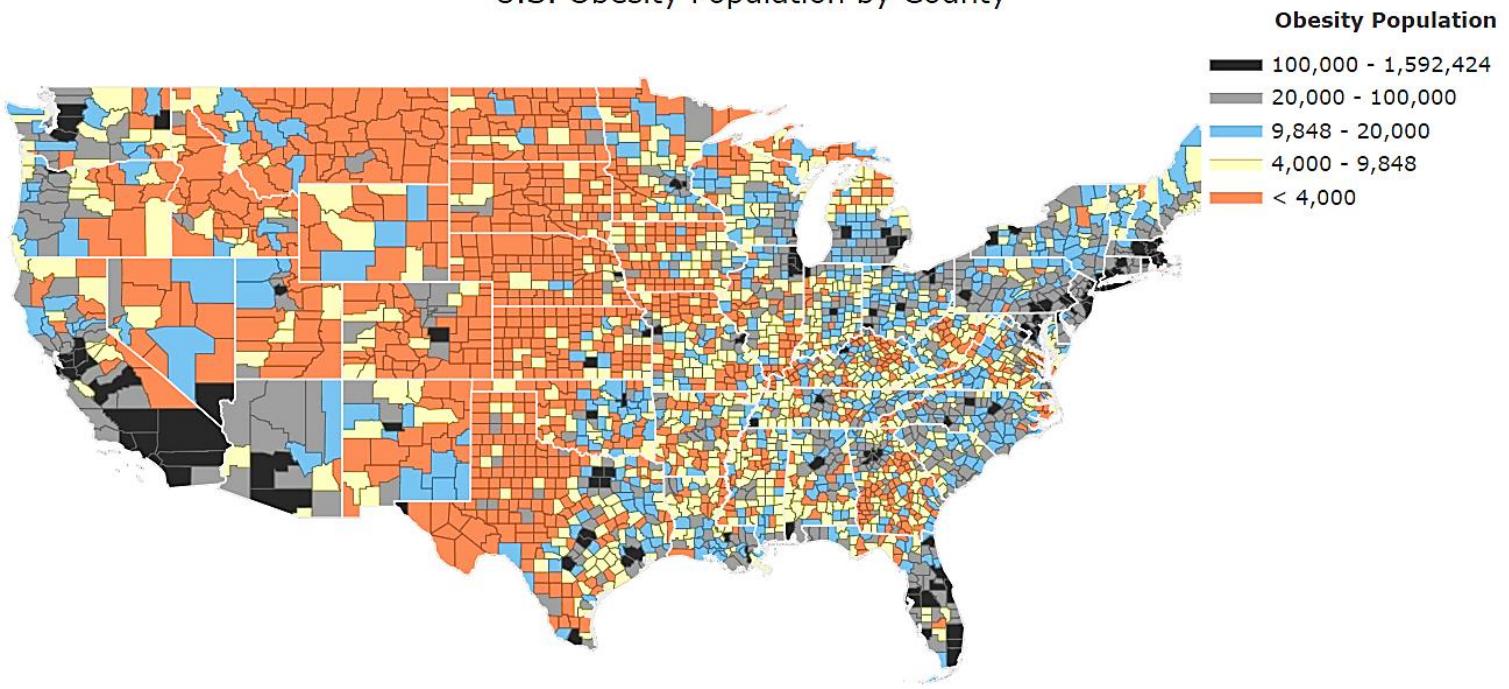


U.S. Choropleth Maps

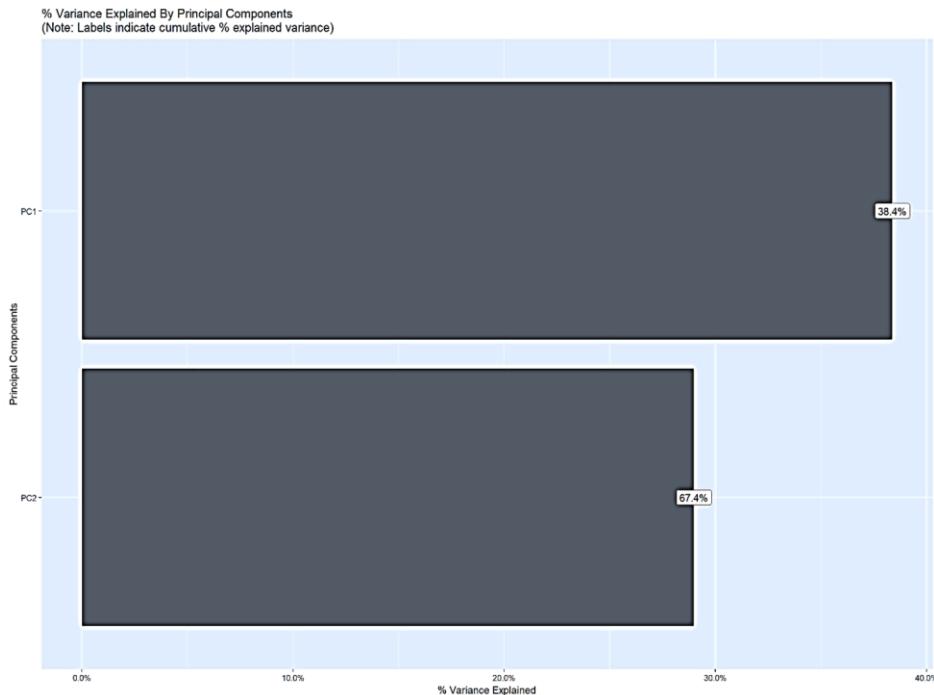
U.S. Obesity % by County

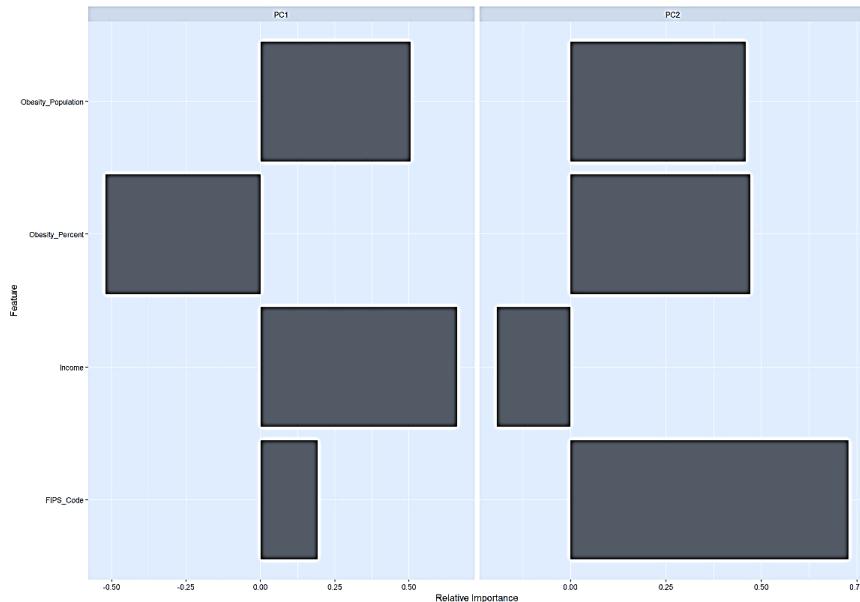


U.S. Obesity Population by County

**PRINCIPAL COMPONENTS***Principal Component Analysis (PCA)*

Principal components on only the numeric variables is calculated, and so we can not use this approach to remove categoric variables from consideration [1]. Any numeric variables with relatively large rotation values (negative or positive) in any of the first few components are generally variables that you may wish to include in the modelling.

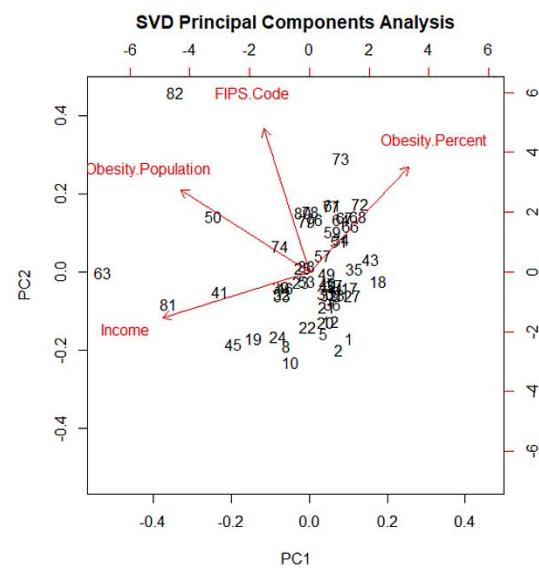
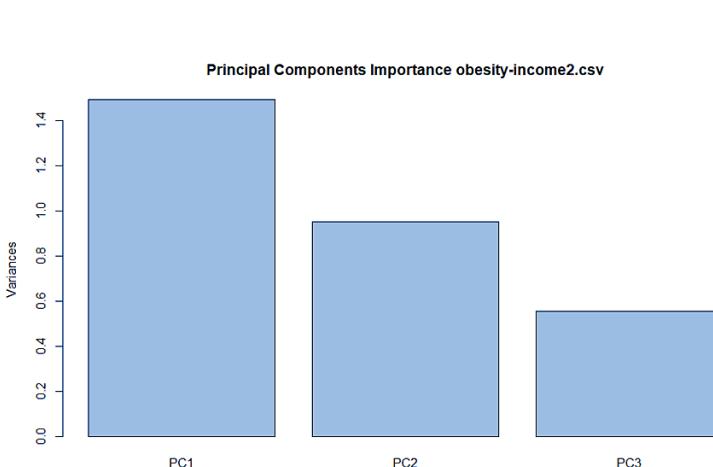




SVD Method

Standard deviations (1, .., p=4):			
1.2285	1.104718	0.8633712	0.7245482

Rotation (n x k) = (4 x 4):	PC1	PC2	PC3	PC4
Income	-0.2042244	0.7135145	-0.6021670	-0.2942521
Obesity %	-0.5750873	0.4084712	0.3897283	0.5920622
Obesity Population	0.4454437	0.5226143	0.6382356	-0.3480079
FIPS Code	-0.6550930	-0.2256603	0.2795748	-0.6646567

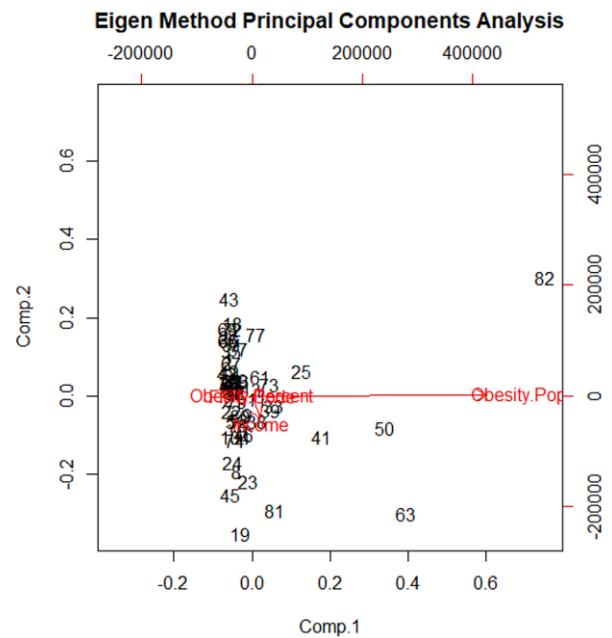
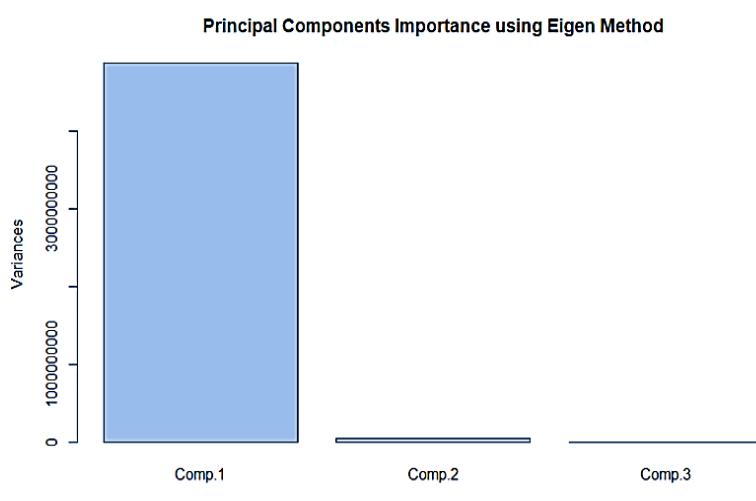


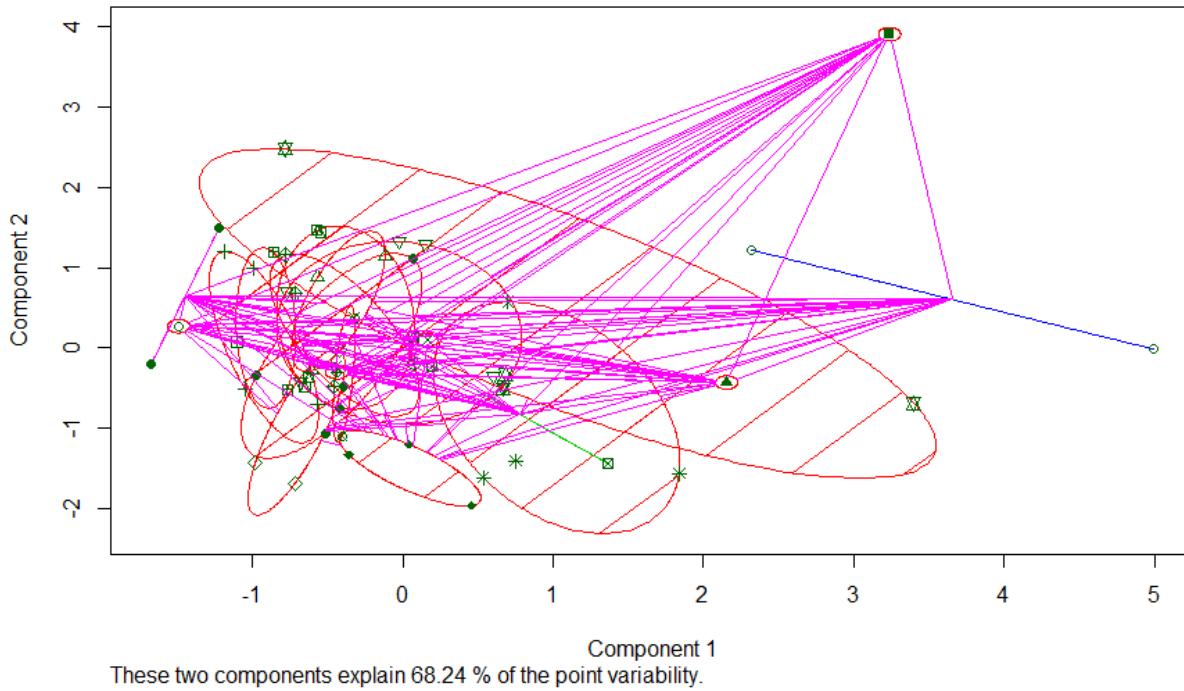
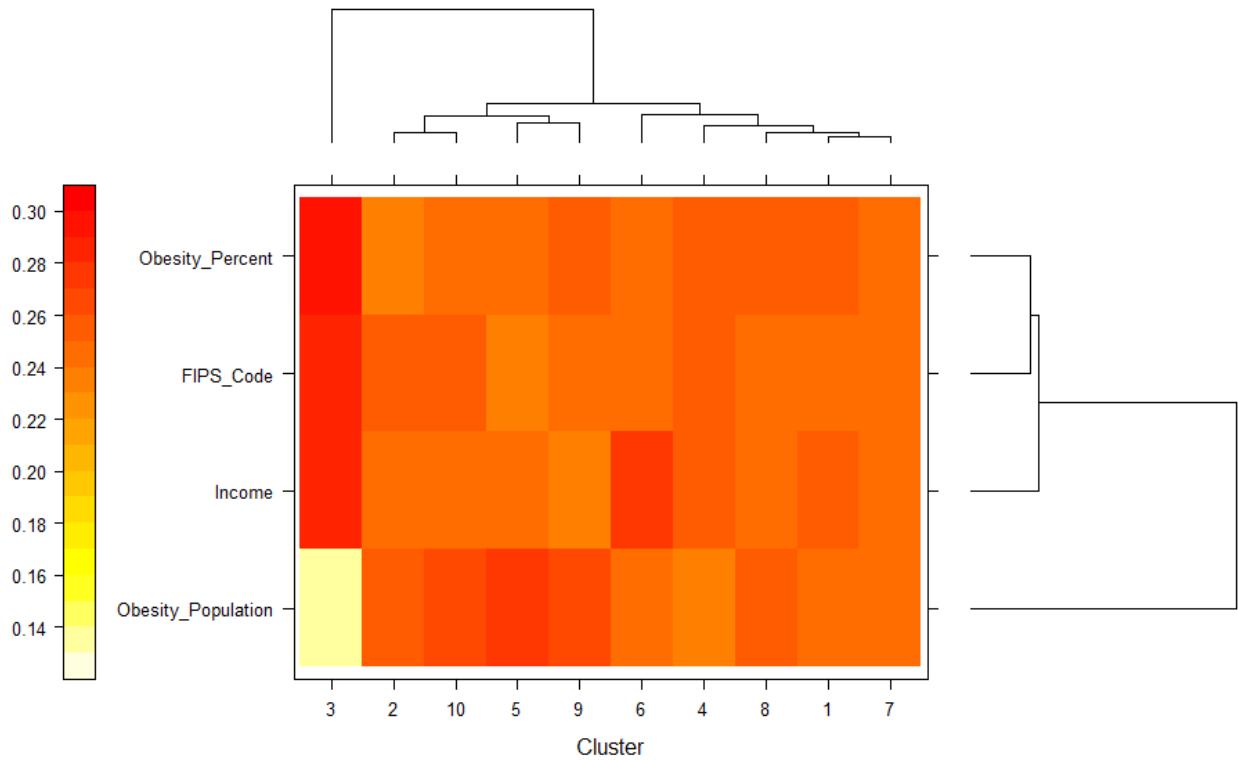
	PC1	PC2	PC3	PC4
Standard Deviation	1.2285	1.1047	0.8634	0.7245
Proportion of Variance	0.3773	0.3051	0.1863	0.1312
Cumulative Proportion	0.3773	0.6824	0.8688	1.0000

Eigen Method**Standard Deviation**

Comp 1	Comp 2	Comp 3	Comp 4
69826.1796	6694.246895	44.971017	2.429266

	Comp 1	Comp 2	Comp 3	Comp 4
Standard Deviation	69826.1796	6694.246895	44.971016701756	2.42926554855469
Proportion of Variance	0.9908922	0.009107377	0.0000004110127	0.00000000119933
Cumulative Proportion	0.9908922	0.999999588	0.999999988007	1.000000000000000



Discriminant Coordinates for Mich-Income-n-Obesity.csv**Ewkm 10 Cluster Weights Heatmap**

CONCLUSION

Michigan's adult obesity rate has experienced tremendous growth over the past three decades. Currently, the Michigan obesity rate is 32.08%, up from 22.1% in 2000 and from 13.2% in 1990. The top 5 counties with the highest obesity percent (%) average 27.88% compared to the state average of 32.08%. With the highest obesity population in Michigan, Wayne County (434,504) is 56% higher than the 2nd highest Oakland County (243,882). The states with a significant portion of obesity percent being 35% – 48% are, Oklahoma, Arkansas, Mississippi, Louisiana, and Alabama. Counties with the highest income are: Livingston (\$72,359), Oakland (\$65,594), Clinton (\$60,466), and Washtenaw (\$59,055). While the counties with the lowest income are: Lake (\$29,379), Clare (\$32,668), Oscoda (\$33,239), Roscommon (\$33,334), and Gogebic (\$34,252). Muskegon and Saginaw are the only counties in Michigan with obesity percent > 35%. Oakland and Washtenaw counties have the lowest obesity percent 26.3% and 24.4%, respectively. As evidence of recent data, adult obesity rates now exceed 35% in seven states, 30% in 29 states and 25% in 48 states.



Image: Kalamazoo, MI



Image: Saginaw, MI

REFERENCE

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APPENDIX***Complete Michigan Income and Obesity Table***

FIPS Code	County	Obesity Population	Obesity %	Income
26001	Alcona	2,792	31.1	37,189
26003	Alger	2,340	29.8	37,586
26005	Allegan	24,666	30.2	52,061
26007	Alpena	7,300	32.1	38,016
26009	Antrim	5,889	32.2	45,362
26011	Arenac	4,165	34	38,874
26013	Baraga	2,220	32.5	41,189
26015	Barry	13,715	31.2	52,186
26017	Bay	29,049	35.4	45,376
26019	Benzie	3,942	28.7	47,366
26021	Berrien	40,551	34.8	43,633
26023	Branch	10,223	31.8	41,856
26025	Calhoun	33,731	33.9	42,110
26027	Cass	13,858	35.3	44,346
26029	Charlevoix	5,773	28.6	45,949
26031	Cheboygan	6,775	33.2	38,410
26033	Chippewa	10,401	34.6	41,637
26035	Clare	8,059	33.8	32,668
26037	Clinton	18,058	31.6	60,466
26039	Crawford	3,353	30.4	40,295
26041	Delta	9,160	32.1	42,676
26043	Dickinson	6,076	30.1	44,136
26045	Eaton	29,070	35.7	54,115
26047	Emmet	7,535	29.8	50,929
26049	Genesee	101,061	33	42,089
26051	Gladwin	6,958	34.7	37,626
26053	Gogebic	4,059	31.3	34,252
26055	Grand Traverse	18,489	26.8	51,766
26057	Gratiot	10,753	33.6	40,359
26059	Hillsdale	10,976	32	41,759
26061	Houghton	8,243	30.7	35,430
26063	Huron	7,939	31.5	40,204
26065	Ingham	63,425	30.4	45,321
26067	Ionia	18,007	38	47,892
26069	Iosco	6,845	33.2	36,236

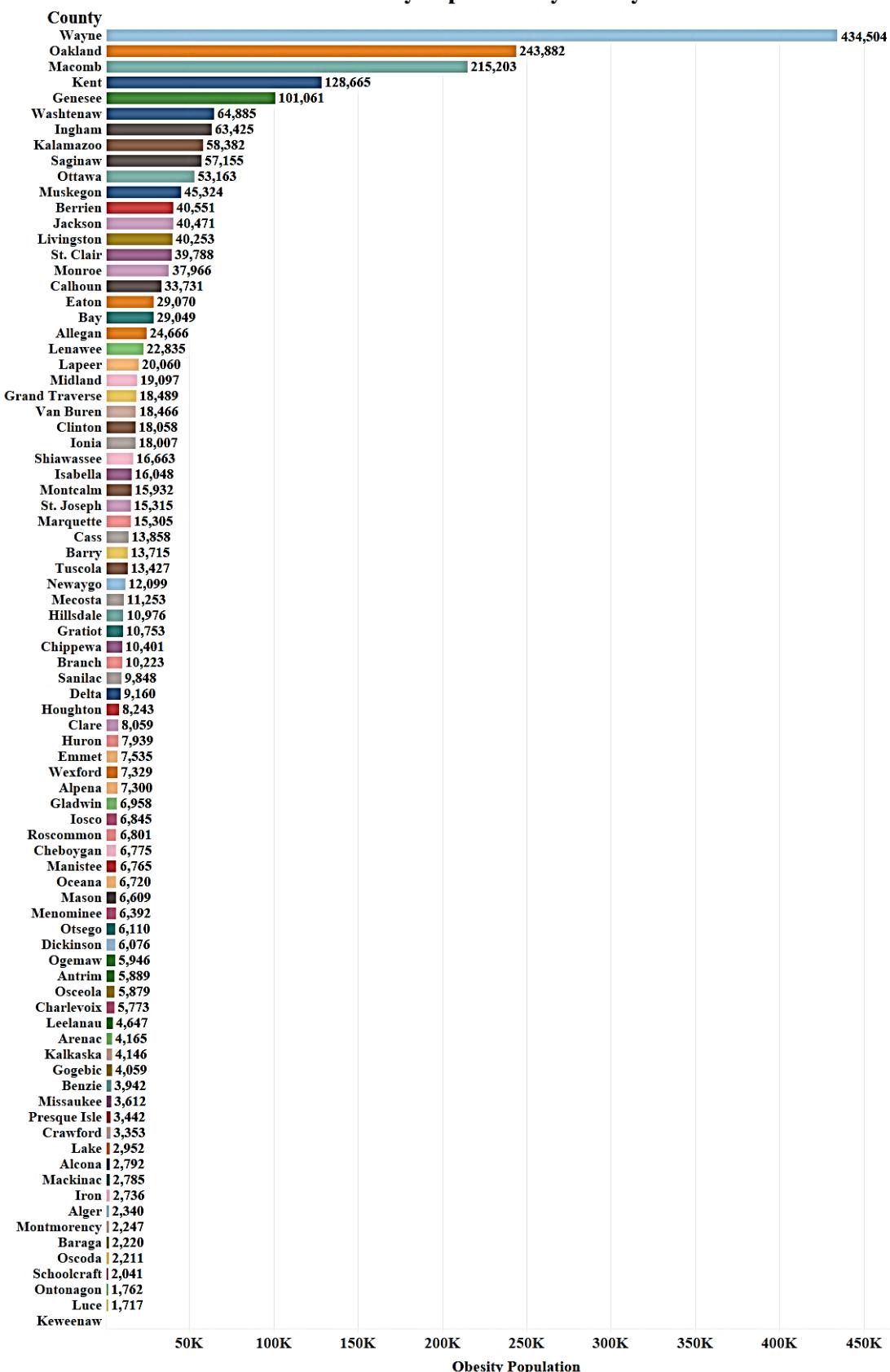


26071	Iron	2,736	29.1	34,685
26073	Isabella	16,048	30.9	36,372
26075	Jackson	40,471	33.7	46,615
26077	Kalamazoo	58,382	30.6	45,775
26079	Kalkaska	4,146	31.6	40,140
26081	Kent	128,665	28.7	51,667
26083	Keweenaw	548	30.9	39,038
26085	Lake	2,952	32	29,379
26087	Lapeer	20,060	30.3	52,939
26089	Leelanau	4,647	26.6	55,018
26091	Lenawee	22,835	30.8	47,766
26093	Livingston	40,253	29.6	72,359
26095	Luce	1,717	32.6	39,469
26097	Mackinac	2,785	31.1	38,704
26099	Macomb	215,203	33.3	53,451
26101	Manistee	6,765	34.6	41,551
26103	Marquette	15,305	29.2	45,622
26105	Mason	6,609	29.9	41,136
26107	Mecosta	11,253	35	39,470
26109	Menominee	6,392	34.4	41,739
26111	Midland	19,097	30.5	53,076
26113	Missaukee	3,612	32.2	41,061
26115	Monroe	37,966	33.8	53,972
26117	Montcalm	15,932	34	40,451
26119	Montmorency	2,247	28.9	35,261
26121	Muskegon	45,324	35.8	40,979
26123	Newaygo	12,099	34	42,571
26125	Oakland	243,882	26.3	65,594
26127	Oceana	6,720	34.8	40,023
26129	Ogemaw	5,946	35.6	34,619
26131	Ontonagon	1,762	33	34,620
26133	Osceola	5,879	34.2	37,788
26135	Oscoda	2,211	33.5	33,239
26137	Otsego	6,110	33.3	47,584
26139	Ottawa	53,163	27.6	56,453
26141	Presque Isle	3,442	32.3	39,652
26143	Roscommon	6,801	34.2	33,334
26145	Saginaw	57,155	38.9	42,331
26151	Sanilac	9,848	31.3	48,066

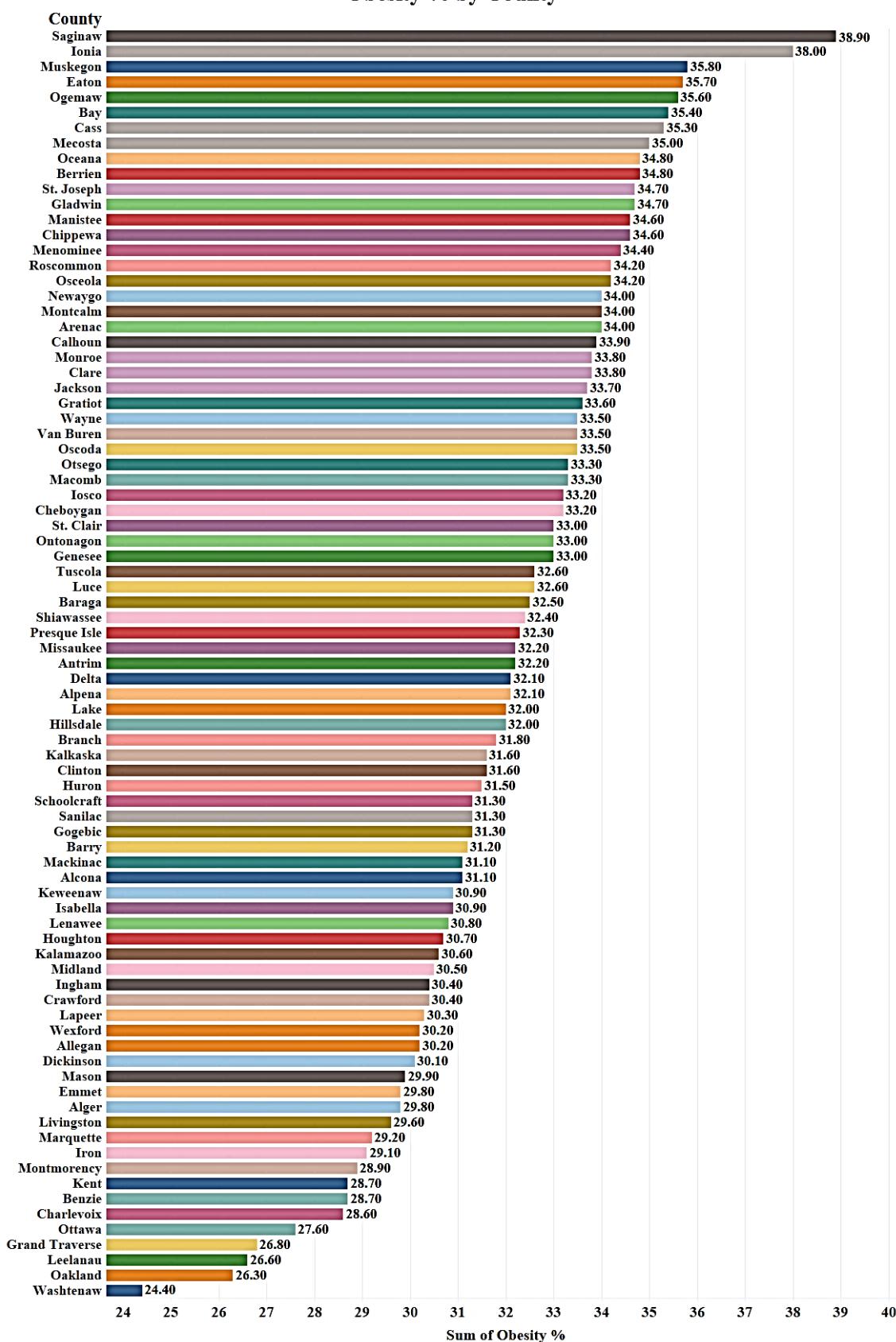


26153	Schoolcraft	2,041	31.3	44,051
26155	Shiawassee	16,663	32.4	40,478
26147	St. Clair	39,788	33	35,260
26149	St. Joseph	15,315	34.7	46,217
26157	Tuscola	13,427	32.6	43,039
26159	Van Buren	18,466	33.5	45,129
26161	Washtenaw	64,885	24.4	59,055
26163	Wayne	434,504	33.5	41,184
26165	Wexford	7,329	30.2	40,965



Total Obesity Population by County

Obesity % by County



Income by County