



# Diabetes:

## Correlations with Hypertension and Obesity

### *Louisiana 2015 Behavior Risk Factor Surveillance System*

Bureau of Health Informatics

Office of Public Health

Louisiana Department of Health

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The Behavioral Risk Factor Surveillance System (BRFSS) is the nation's premier system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services. Established in 1984 with 15 states, BRFSS now collects data in all 50 states as well as the District of Columbia and three U.S. territories. BRFSS completes more than 400,000 adult interviews each year, making it the largest continuously conducted health survey system in the world.  
(<https://www.cdc.gov/brfss/about/index.htm>)

Information is collected from non-institutionalized residents of Louisiana aged 18 years and older using randomly selected cell phone and land line telephone numbers. All data is self-reported and subject to associated bias. If the respondent did not know the answer to a question or declined to answer the question, the data was set to missing.

This document discusses correlations between type 2 diabetes and the co-morbidities hypertension and obesity. BRFSS data is cross-sectional and cause and effect cannot be identified; however the likelihood of a respondent to report diabetes given the concurrent report of hypertension and/or obesity can be described.

Further information and data download links for Louisiana BRFSS can be found at:

<http://www.dhh.louisiana.gov/index.cfm/page/578>

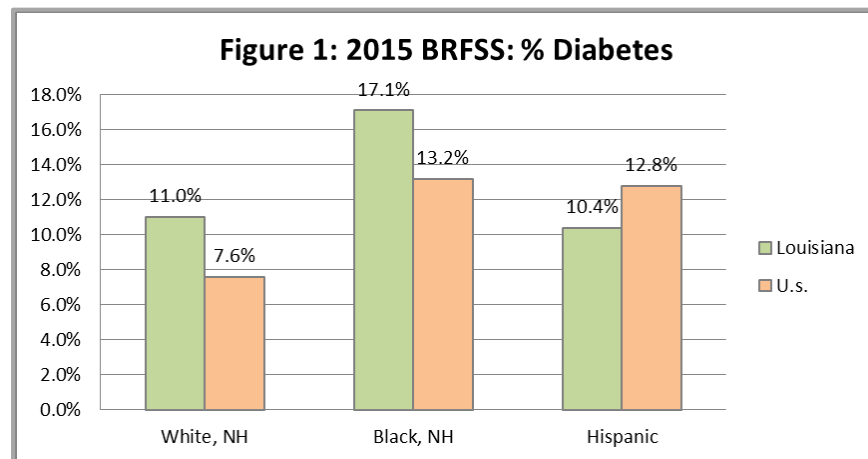
Where sample size was insufficient to supply a valid estimate (un-weighted denominator less than 50 or Coefficient of Variation (CV) greater than or equal to 30%), NA or 'not available' was entered.

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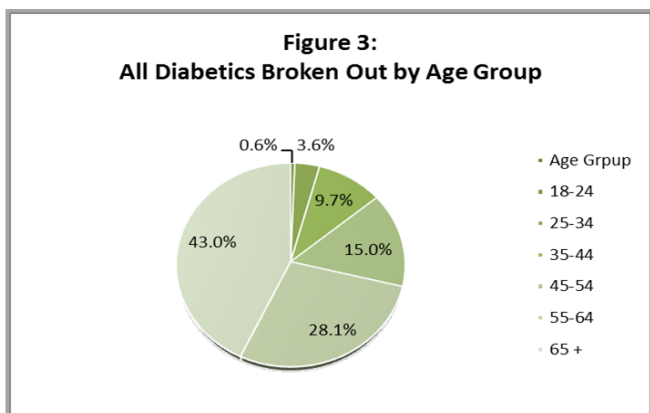
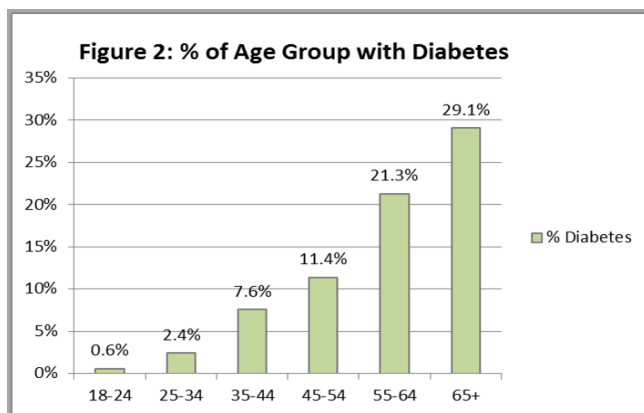
## Introduction

Diabetes is a serious illness characterized by blood glucose levels that are above normal. It is the seventh leading cause of death in the United States and can have serious side-effects including heart disease, blindness, kidney failure and lower extremity amputations. (1, 2) The CDC places the 2015 overall prevalence (unadjusted) of diabetes in the United States at 9.9%. (3) In Louisiana, statewide prevalence (unadjusted) is higher at 12.7%. This elevated prevalence carries over to racial breakouts for non-Hispanic Blacks and non-Hispanic Whites, but the Louisiana prevalence for Hispanics is lower compared to the national estimate.



Factors that are known to affect the risk of developing diabetes include age, education and income (SES), race and obesity. In the 2015 Louisiana BRFSS data, statewide prevalence of diabetes does not differ by gender (Males 12.7%, Females 12.7%), increases with age, and is inversely related to education level and income.

Diabetes prevalence increases significantly with age ( $p < 0.0001$ ); 71.1% of all diabetics are over the age of 54 years.

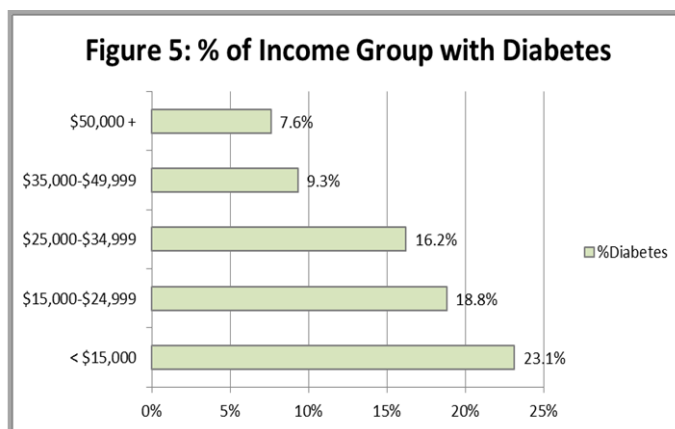
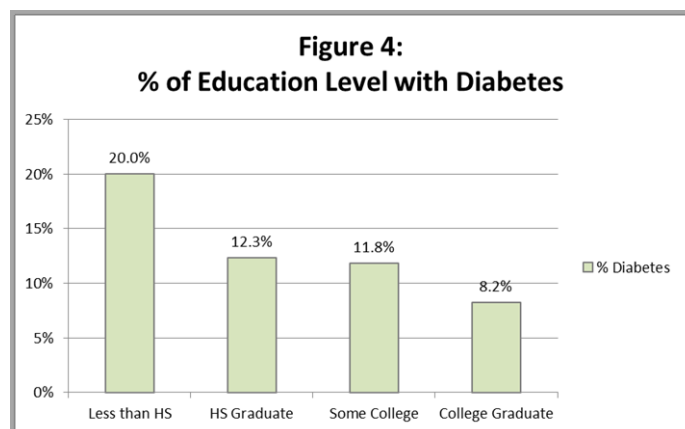


**TABLE 1: Percent of Age Group with Diabetes**

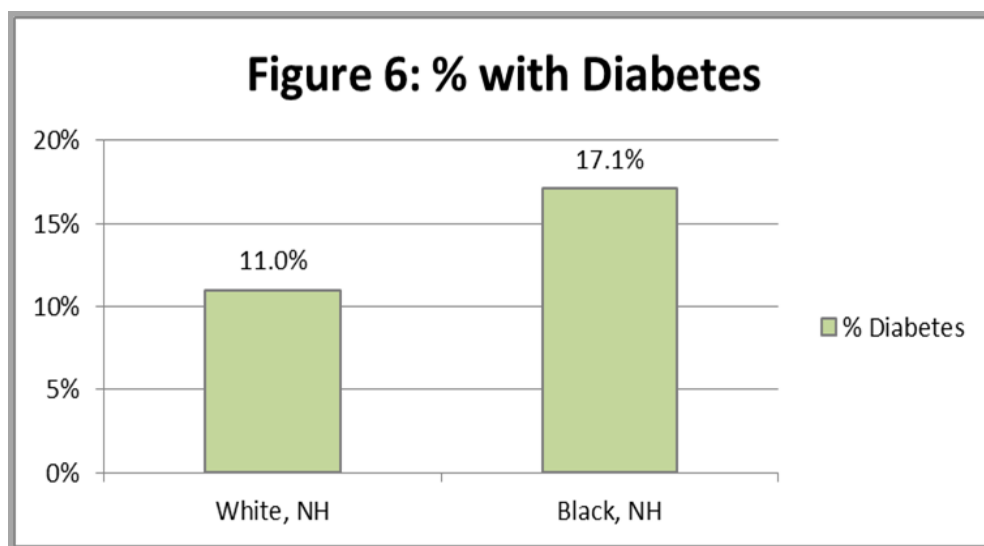
AGE GROUP	% of Age Group with Diabetes	CI	CV
18-24 years	0.6*	0.0-1.8*	0.9967*
25-34 years	2.4*	0.7-4.1*	0.3547*
35-44 years	7.6	4.8-10.3	0.1850
45-54 years	11.4	8.6-14.2	0.1253
55-64 years	21.3	18.2-24.4	0.0748
65+ years	29.1	26.2-32.1	0.0511

\*Use estimate with caution; low sample size

Those with an income of less than \$35,000 per year are significantly more likely to have diabetes than those who earn more (16.5% vs 8.0%,  $p < 0.0001$ ).



Unadjusted chi square analysis shows that at 17.1%, blacks report a significantly higher prevalence of diabetes than whites at 11.0% ( $p=0.0001$ ).

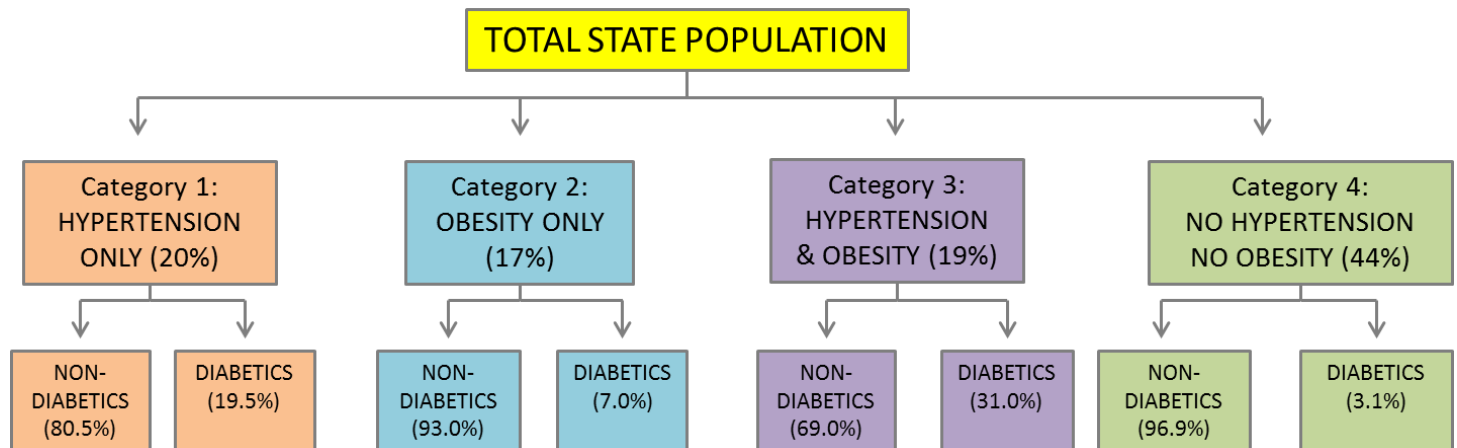


Obese respondents are significantly more likely to report having diabetes when compared to those who are not obese (20.0% vs 8.6%, respectively;  $p < 0.0001$ ). Hypertension often occurs in conjunction with diabetes, and is also treated as a risk factor. 25.8% of those reporting hypertension also reported having diabetes compared to 4.2% of those without hypertension ( $p < 0.0001$ ).

## Methodology

Logistic regression analysis was used to help describe the likelihood of a respondent to report diabetes. The population was restricted to Blacks and Whites due to the small sample size for other races, and all diabetics with an age of onset less than or equal to 18 years (probable Type I diabetes) were eliminated from analysis.

Obesity and hypertension often overlap (ie, some respondents have both conditions), so categories were defined to organize the population into four mutually exclusive categories: those with hypertension only, those with obesity only, those with both hypertension and obesity and those with neither hypertension nor obesity.

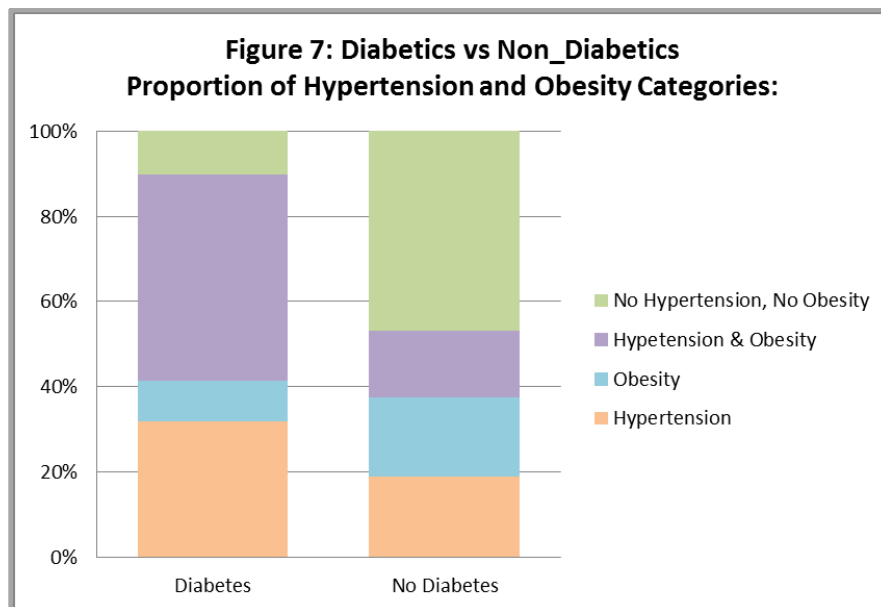


Each category includes both diabetics and non-diabetics. Category 3 (both hypertension and obesity) has the highest proportion of diabetics at 31.0%, followed by Category 1 (hypertension only) at 19.5%, Category 2 (obesity only) at 7.0% and finally Category 4 (no hypertension and no obesity) at 3.1%.

**TABLE 2: Percent of Hypertension and Obesity Category Reporting Diabetes**

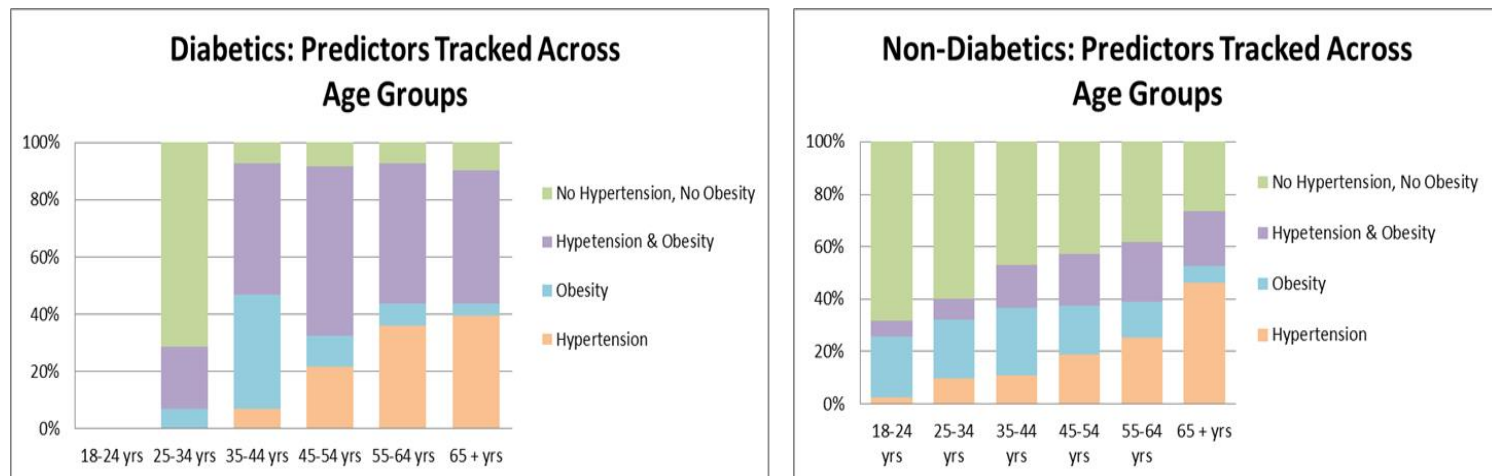
TOTAL POPULATION	% Diabetes	95% Confidence Interval
Category 1: Hypertensive Only	19.5	16.6-22.4
Category 2: Obese Only	7.0	4.6-9.5
Category 3: Hypertensive and Obese	31.0	27.2-34.8
Category 4: No Hypertension, No Obesity	3.1	1.9-4.2

Diabetics have higher proportions of Categories 1 and 3 when compared to non-diabetics. Non-diabetics have higher proportions of Categories 2 and 4.



Chronic conditions and associated risk factors are known to gradually increase with age. The chart below for non-diabetics shows how, with the exception of Category 2 (obesity only), the hypertension and obesity categories progressively increase across age groups. For diabetics, however, there is a major increase in obesity and hypertension after age 34. While Category 2 (obesity alone) decreases successively over age groups 45-65+, overall hypertension (alone or in conjunction with obesity) increases.

**Figure 8: Age Group Comparison**



**Table 3: Predictors Tracked Across Age Groups for Diabetics and Non-Diabetics**

	Age Group (years)	Hypertension	Obesity	Hypertension & Obesity	No Hypertension, No Obesity
<b>Diabetics</b>	18-24	NA	NA	NA	NA
	25-34	NA	7.1	21.6	71.3
	35-44	7.0	39.9	45.9	7.2
	45-54	21.7	11.0	59.1	8.2
	55-64	36.0	7.7	49.1	7.2
	65 +	39.7	4.2	46.5	9.7
<b>Non-Diabetics</b>	18-24	2.8	22.9	6.3	68.0
	25-34	10.0	22.4	7.8	59.8
	35-44	11.1	25.7	16.6	46.6
	45-54	19.1	18.7	19.8	42.4
	55-64	25.5	13.6	22.9	38.0
	65 +	46.5	6.5	20.7	26.4

Category 4, with no hypertension and no obesity, will be used as the comparison standard for the other three categories. Overall, Category 4 has a similar gender distribution, smaller proportion of black individuals, is younger, has attained a higher level of education and earns more than the other 3 categories. Category 4 also has a lower proportion of diabetics.

**TABLE 4: DEMOGRAPHIC DESCRIPTION FOR HYPERTENSION AND OBESITY CATEGORIES**

		Category 1		Category 2		Category 3		Category 4	
		High BP Only		Obesity Only		High BP and Obesity		No High BP and No Obesity	
		Non-Diabetics	Diabetics	Non-Diabetics	Diabetics	Non-Diabetics	Diabetics	Non-Diabetics	Diabetics
% FEMALE		52.7	52.7	53.0	46.2	49.8	48.9	50.1	41.6
% BLACK		29.8	47.6	35.9	36.9	37.5	41.7	26.6	34.8
AGE	18-24	NA	NA	17.6	NA	NA	NA	20.6	NA
	25-34	9.8	NA	22.8	NA	9.2	NA	24.0	NA
	35-44	10.0	NA	24.1	38.8	18.2	8.8	17.2	NA
	45-54	17.5	9.9	18.0	16.8	22.3	17.8	16.1	NA
	55-64	20.8	31.4	11.7	22.5	22.9	28.4	12.8	19.8
	65+	39.8	56.7	5.8	20.0	21.7	43.9	9.3	43.8
EDUCATION	Did not Graduate HS	18.8	31.2	14.1	NA	20.7	26.6	13.4	NA
	Graduated HS	37.5	31.9	39.5	32.2	34.0	39.6	31.1	26.2
	Attended College	26.3	23.5	29.1	46.6	26.6	24.2	30.1	NA
	Graduated College	17.4	13.4	17.3	12.7	18.7	9.7	25.3	19.9
INCOME	LT \$15,000	15.7	22.7	11.1	NA	15.2	23.2	8.9	NA
	\$15,000-\$24,999	21.0	31.9	20.5	NA	20.9	29.6	16.0	NA
	\$25,000-\$34,999	10.9	12.4	9.1	NA	12.7	12.8	9.1	NA
	\$35,000-\$44,999	11.5	9.0	14.4	NA	12.9	9.3	14.5	NA
	\$50,000 or more	40.9	24.0	44.8	43.7	38.3	25.1	51.5	30.1

\*NA: Sample size insufficient to generate valid estimate

## Results

Logistic regression analysis shows that all predictors had a significant effect ( $p < 0.05$ ) on the likelihood of having diabetes.

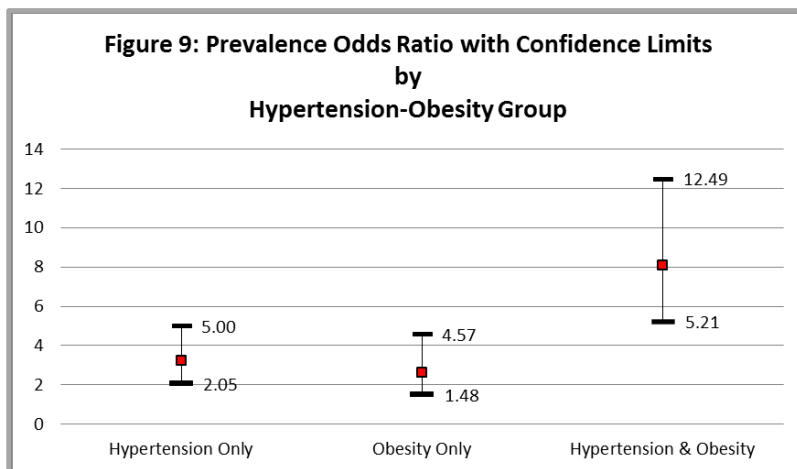
**TABLE 5: BRFSS 2015 Diabetes Prevalence Odds Ratio Estimates (Sample N=3,984)**

Predictor	Prevalence Odds Ratio (POR)	95% Confidence Limits		p
Female v Male	0.743	0.576	0.959	0.0226
Black v White	1.834	1.380	2.437	<0.0001
Age (continuous)	1.052	1.043	1.062	<.0001
Less than \$25,000 vs higher	1.706	1.297	2.244	0.0001
Category 1 vs Category 4	3.202	2.050	5.004	<.0001
Category 2 vs Category 4	2.602	1.482	4.568	0.0009
Category 3 vs Category 4	8.064	5.206	12.491	<.0001

The obesity-hypertension categories have the largest effect. After adjusting for gender, race, age and income:

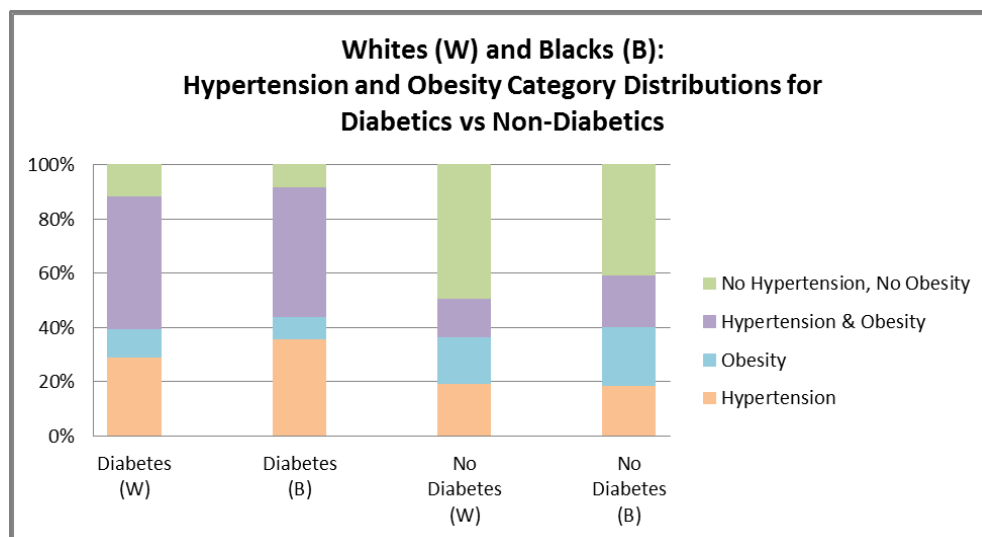
- The odds of reporting diabetes are 3.2 higher for those with hypertension alone as compared to those with no hypertension or obesity
- The odds of reporting diabetes are 2.6 higher for those who are obese as compared to those with no hypertension or obesity
- The odds of reporting diabetes are 8.1 higher for those who are obese and have hypertension as compared to those with no hypertension or obesity.

The confidence intervals for Category 1 and Category 2 overlap indicating that these two groups are not significantly different from each other. The confidence interval for Category 3 does not overlap with either Category 1 or Category 2 indicating a significant difference from the other two categories.



Race also had a significant effect with a prevalence odds ratio of 1.8,  $p < 0.0001$ . White and Black diabetics have similar proportions of the four categories. Blacks have a higher proportion for Category 1 (hypertension only). For non-diabetics, Whites have a higher proportion of Category 4 (no hypertension and no obesity) and a lower proportion of Category 3 (hypertension and obesity) than Blacks.

**Figure 10**

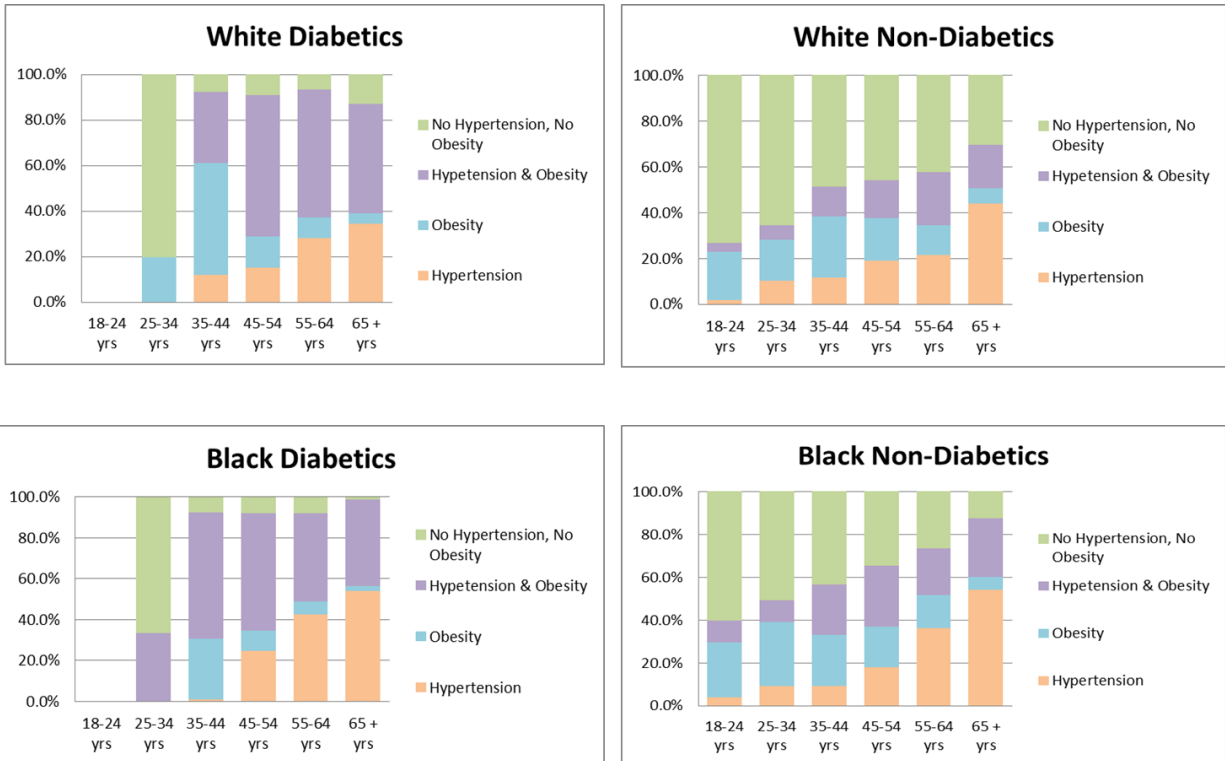


**TABLE 6 : Hypertension and Obesity Categories for Diabetic and Non-Diabetic Blacks and Whites**

	Category 1: Hypertension %	Category 2: Obesity %	Category 3: Hypertension & Obesity %	Category 4: No Hypertension, No Obesity %
<b>Whites, Diabetes</b>	29.1	10.5	49.0	11.4
<b>Blacks, Diabetes</b>	35.9	8.3	47.5	8.3
<b>Whites, No Diabetes</b>	19.5	17.0	14.1	49.4
<b>Blacks, No Diabetes</b>	18.7	21.5	19.3	40.5

Figure 11 breaks out diabetics and non-diabetics by race and age group making the differences between black and white diabetics more apparent.

**Figure 11: Race and Diabetic Status by Age Group**



For 25-34 year old white diabetics, 20.0% are in the obese only group and 80.0% are in the no hypertension, no obesity group. For 25-34 year old black diabetics, 33.5% are in the obesity and hypertension group and 66.5% are in the no hypertension, no obesity group.

At 35-44 years old, both black and white diabetics have the same proportion of their populations in the no hypertension and no obesity group (7.2%, 7.3%). The remaining 93% is split differently for the two groups:

- Black diabetics have 1.3% in the hypertension only group, 29.6% in the obesity only group and 61.8% in the hypertension and obesity group, and
- White diabetics have 12.7% in the hypertension only, 49.2% in the obesity only group and 31.3% in the hypertension and obesity group.

From age 45 through 65+, both black and white diabetics show a decrease in the proportion of the obesity only group, but an increase in both the hypertension only and the hypertension and obesity groups. By 65+ years, white diabetics have 12.7% in the no hypertension-no obesity group compared to 1.1% for black diabetics.

**Table 7: Diabetics by Age Group and Hypertension-Obesity Category**

Years	% Hypertension		% Obesity		% Hypertension & Obesity		% No Hypertension, No Obesity	
	White	Black	White	Black	White	Black	White	Black
18-24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-34	0.0	0.0	20.0	0.0	0.0	33.5	80.0	66.5
35-44	12.3	1.3	49.2	29.6	31.3	61.8	7.2	7.3
45-54	15.4	24.9	13.6	9.7	62.4	57.4	8.6	8.0
55-64	28.5	42.7	9.1	6.5	56.3	42.8	6.1	8.1
65 +	34.6	54.1	4.7	2.6	48.0	42.1	12.7	1.1

The possibility of an interaction between race and the four hypertension and obesity groups was explored with logistic regression analysis. For the 2015 Louisiana BRFSS data, the overall p value for the interaction between race and all hypertension and obesity categories combined was 0.4592, indicating no statistical support for the presence of an interaction in the 2015 data. The 2011 and 2013 Louisiana BRFSS data also has the hypertension, obesity and diabetes data. Logistic regression analysis was performed on these data with the following results (full models available in Appendix A):

**Table 8: Comparison of Diabetes POR by Hypertension/Obesity Categories and Year**

Hypertension/Obesity	2011 Sample N=9,686		2013 Sample N=4,684		2015 Sample N=3,984		2011, 2013, 2015 Combined Data Sample N=18,354	
	Prevalence Odds Ratio	p	Prevalence Odds Ratio	p	Prevalence Odds Ratio	p	Prevalence Odds Ratio	p
Category 1 vs 4	4.813	< 0.0001	5.762	< 0.0001	3.202	<.0001	4.369	< 0.0001
Category 2 vs 4	3.849	< 0.0001	4.792	< 0.0001	2.602	0.0009	3.580	< 0.0001
Category 3 vs 4	11.846	< 0.0001	15.724	< 0.0001	8.064	<.0001	11.249	< 0.0001

Interaction (between Race and the Hypertension/Obesity Categories) p values:

Table 9: p Values for Interaction Between Race and the Hypertension/Obesity Categories		
Year	Sample Size	p Value
2011	9,686	0.0053
2013	4,684	0.0184
2015	3,984	0.4592
Combined Data	18,354	0.0003

Looking across the four analyses:

POR for Hypertension Only ranges from 3.2 to 5.7

POR for Obesity Only ranges from 2.6 to 4.8

POR for Hypertension and Obesity ranges from 8.1 to 15.7.

The prevalence odds ratios for each category vary from year to year, but their relative positions remain the same:

POR Hypertension and Obesity > POR Hypertension Only > POR Obesity Only.

The interaction between race and the Hypertension/Obesity categories is significant for 2011, 2013 and for the combined data indicating that separate analyses for blacks and whites is appropriate. The combined data will be used for the separate analysis because it has the highest sample size and the lowest p value for the interaction term.

**TABLE 10 : Diabetes POR Estimates  
Combined Data for Whites (Sample N=13,377)**

Predictor	Prevalence Odds Ratio (POR)	95% Confidence Limits		p
Female v Male	0.815	0.697	0.954	0.0107
Age (continuous)	1.044	1.039	1.050	< 0.0001
Less than \$25,000 vs higher	1.460	1.229	1.736	< 0.0001
Category 1 vs Category 4	3.577	2.770	4.619	< 0.0001
Category 2 vs Category 4	4.352	3.153	6.007	< 0.0001
Category 3 vs Category 4	10.799	8.483	13.749	< 0.0001

**TABLE 11 : Diabetes POR Estimates  
Combined Data for Blacks (Sample N=4,977)**

Predictor	Prevalence Odds Ratio (POR)	95% Confidence Limits		p
Female v Male	0.948	0.744	1.207	0.0107
Age (continuous)	1.042	1.034	1.050	< 0.0001
Not High School Grad vs Higher	1.397	1.056	1.848	< 0.0001
Category 1 vs Category 4	6.181	3.749	10.192	< 0.0001
Category 2 vs Category 4	2.611	1.452	4.694	< 0.0001
Category 3 vs Category 4	12.383	7.580	20.230	< 0.0001

All predictors are significant at the 95.5% level ( $p < 0.05$ ) in both models. The effects for gender, age and SES (education for Blacks, income for Whites) are similar for both populations. The largest effects for both Blacks and Whites are the hypertension/obesity categories. The confidence intervals for Categories 1 and 2 overlap for both Blacks and Whites, an indication that Categories 1 and 2 are not statistically distinct from each other. The confidence interval for Category 3 for Whites does not overlap with those for Categories 1 and 2, indicating a statistical difference. For Blacks, the confidence interval for Category 3 does overlap with the CI for Category 1 but not for Category 2 which might be attributable to the relatively smaller sample size. The Diabetes POR for Category 3 for both Black and Whites is the greatest effect at 12.4 and 10.8, respectively. The odds of reporting Diabetes for Blacks with Hypertension alone is 1.7 times higher than for Whites with Hypertension alone. Whites with Obesity alone have 1.7 times higher odds of reporting Diabetes than Blacks with Obesity alone.

## Discussion

This analysis used data from the 2011, 2013 and 2015 Louisiana BRFSS surveys centering on responses for gender, race, age, socio-economic status, diabetes, hypertension and obesity. The data is subject to the biases associated with self-reported survey data and include, but are not limited to, recall bias and over and under reporting. Self-report of diabetes and socio-demographic characteristics is considered highly accurate. Self-reported heights and weights are likely to underestimate average BMI and self-report of hypertension has moderate sensitivity.<sup>1</sup>

The most important weakness of this analysis is that there is no indicator for family history of diabetes.

Analysis shows that the largest effects can be attributed to hypertension and obesity. Creating four mutually exclusive categories, hypertension alone, obesity alone, both hypertension and obesity and no hypertension or obesity, allowed

characterization of the likelihood of a respondent to report having doctor-diagnosed diabetes based upon these indicators. The 2015 data was restricted to blacks and whites due to small sample size for other races and all diabetics with an age of diagnosis equal to 18 years or younger were eliminated from analysis to exclude probable Type 1 diabetics from analysis. Using the no hypertension and no obesity group as the comparison standard, obesity alone significantly increased the odds of reporting diabetes to 2.6, hypertension alone increased the odds to 3.2 and having reported both hypertension and obesity raised the odds to 8.1.

Numerous studies have documented that African Americans consistently demonstrate a higher prevalence of hypertension than whites not only in middle age and older but also as children. Blacks develop hypertension at an earlier age than whites.<sup>2</sup> The presence of a significant interaction between race and the hypertension/obesity categories was not established using the 2015 data, possibly due to small sample size. The 2011, 2013 and 2015 BRFSS data were combined, restricted to blacks and whites and all respondents with age at diagnosis less than or equal to 18 were eliminated from analysis. A significant interaction ( $p=0.0003$ ) was found, and analysis was performed separately for blacks and whites.

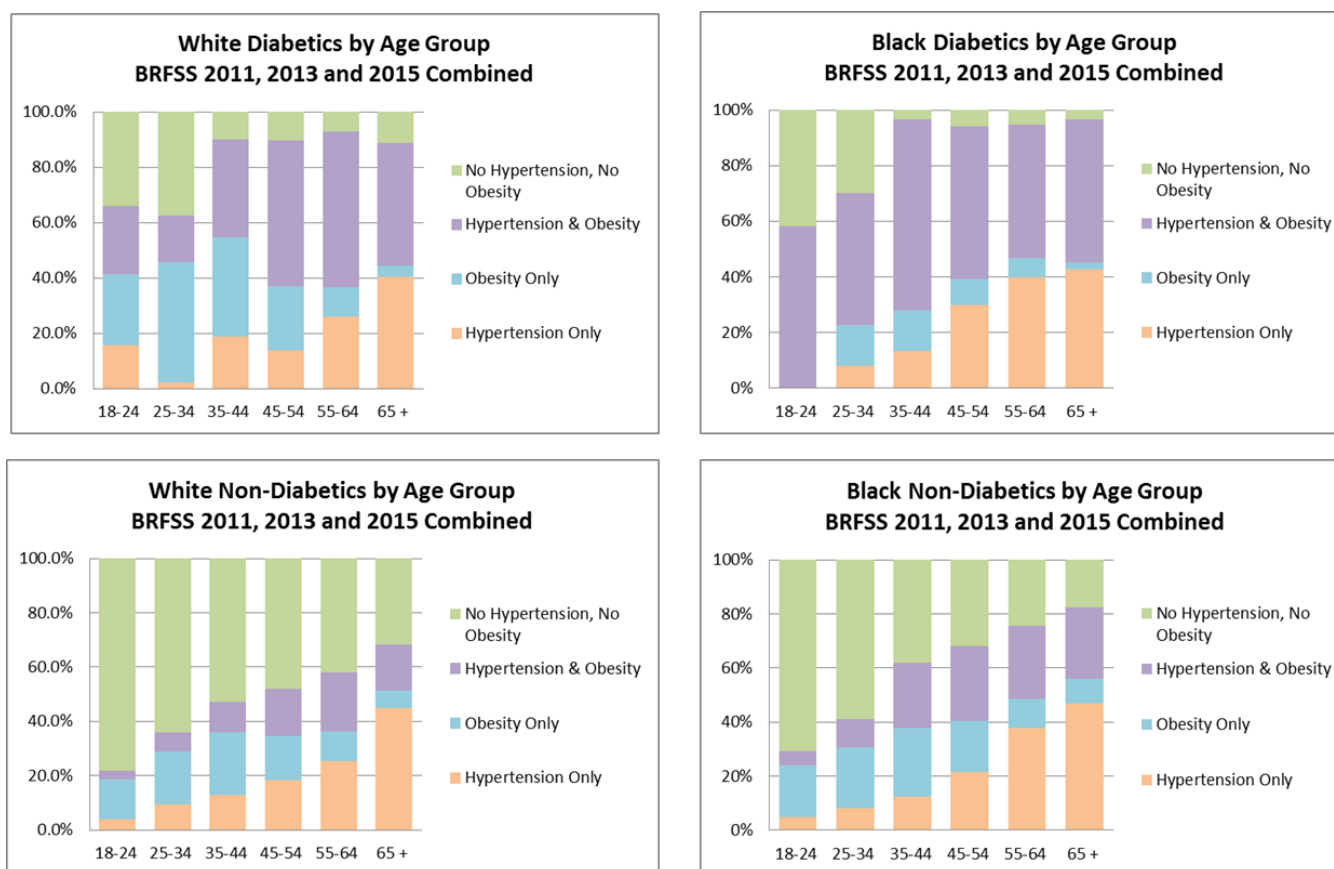
**Table 12: POR for BRFSS 2011, 2013 and 2015 Combined Data**

Predictor	Prevalence Odds Ratio (POR) for BRFSS 2011, 2013 and 2015 Combined Data		
	Overall	Whites	Blacks
Category 1 vs Category 4	4.369	3.577	6.181
Category 2 vs Category 4	3.580	4.352	2.611
Category 3 vs Category 4	11.249	10.799	12.383

The results suggest that hypertension is the main driver for Blacks while obesity alone has a larger effect for whites. Except for the obesity only group, African Americans demonstrated a higher response to the hypertension/obesity categories. Having both hypertension and obesity increased the odds of reporting diabetes more than the combined effects of hypertension only and obesity only for both Blacks and Whites.

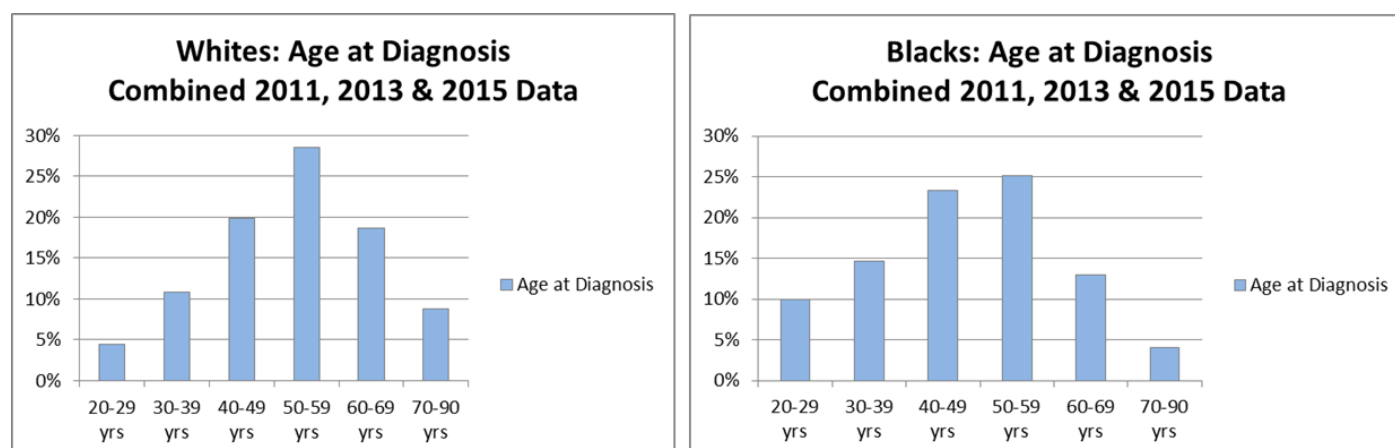
It was also possible to see more detail in the age breakouts using the increased sample size of the combined data.

**Figure 13: Age Breakout by Diabetic Status and Race**



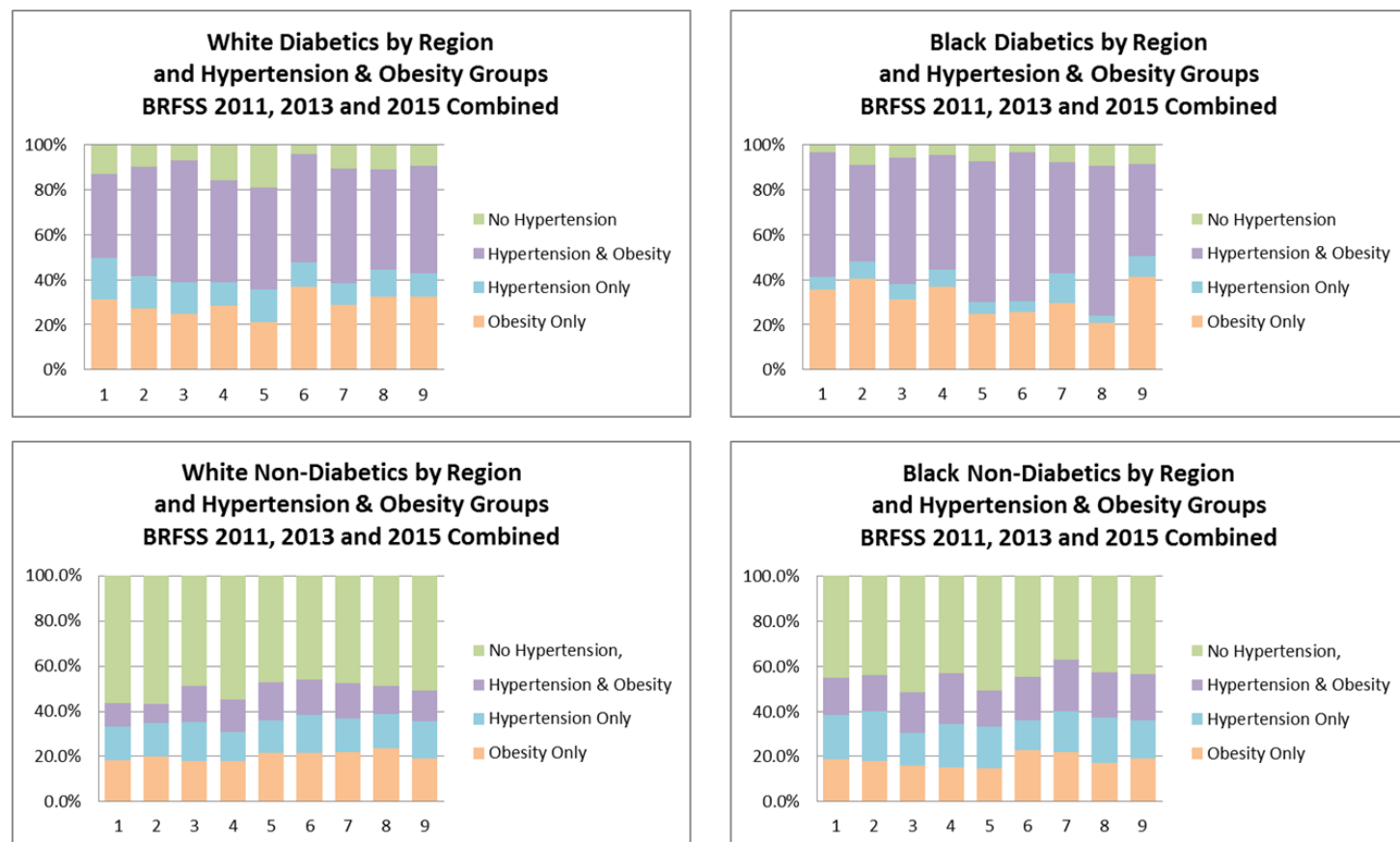
The difference between Black and White diabetics is more pronounced in the early decades of the age breakout. Blacks have 58% of 18 to 24 year olds in the obesity plus hypertension group compared to 15.8% for whites. For the same age group, Whites have 25.8% in the obesity only category compared to an undetectably small amount for Blacks. Age at diagnosis of diabetes is slightly skewed to the younger decades for Blacks as compared to Whites.

**Figure 14: Age at Time of Diabetes Diagnosis**



Logistic regression analysis was run to assess differences in prevalence of diabetes or risk factors across Louisiana's nine administrative regions. Analysis was run for the total populations, blacks only, whites only, diabetics only and non-diabetics only. No significant results were found. There was insufficient data to perform analysis by region, race and age group or to obtain POR by region.

**Figure 15: Regions by Diabetic Status and Race**



NOTE: Ideally, the socio-economic predictor should describe the respondent at the time of diabetes diagnosis. BRFSS data does not include this indicator so the respondent's current education or income status was used. Educational status is a better reflection of childhood and adolescent SES than current income, particularly since many women have not been in the paid workforce as adults. In addition, the Poverty Income Ratio (annual family income divided by the federal poverty line) was also calculated using current income, number of children and adults in the household and the 2015 poverty line.<sup>3</sup> Independent logistic regression analysis was run for each of these SES modifiers in the general model that included continuous age, sex, race (for total population runs), SES and the obesity/hypertension groups. The model with the smallest SES p value was chosen. Income was usually significant for the total population and for Whites while educational status was significant for Blacks. The PIR never achieved significance.

## REFERENCES

1. [www.cdc.gov/diabetes/statistics/comp/methods.htm](http://www.cdc.gov/diabetes/statistics/comp/methods.htm)
2. Lackland D. T., Racial Differences in Hypertension: Implication for High Blood Pressure Management, Am J Med Sci. 2014 August; 348(2): 135-138.
3. Robbins, J M, V Vacarino, H Zhang, S V Kasl, Socioeconomic Status and Type 2 Diabetes in African American and Non-Hispanic White Women and Men: Evidence From the Third National Health and Nutrition Examination Survey, Am J of Public Health, Jan 2001, Vol. 91, (1).

## APPENDIX A

The possibility of an interaction between race and the four hypertension and obesity groups was explored with logistic regression analysis. For the 2015 Louisiana BRFSS data, the overall p value for the interaction between race and all hypertension and obesity categories combined was 0.4592. Individual interaction p values for the three categories were 0.6834 (hypertension only), 0.5790 (obesity only) and 0.6879 (hypertension and obesity), indicating no statistical support for the presence of an interaction in the 2015 data. The 2011 and 2013 Louisiana BRFSS data also has the hypertension, obesity and diabetes data. Logistic regression analysis was performed on these data with the following results:

**TABLE 13:**  
**Diabetes Prevalence Odds Ratio Estimates for BRFSS 2011 (Sample N=9,686)**

Predictor	Prevalence Odds Ratio	95% Confidence Limits		p
Female v Male	0.743	0.616	0.898	0.0021
Black v White	1.695	1.375	2.090	< 0.0001
Age (continuous)	1.035	1.028	1.042	< 0.0001
Less than \$35,000 vs higher	1.178	0.965	1.438	0.1069
Category 1 vs Category 4	4.813	3.465	6.684	< 0.0001
Category 2 vs Category 4	3.849	2.570	5.763	< 0.0001
Category 3 vs Category 4	11.846	8.629	16.261	< 0.0001

For the 2011 Louisiana BRFSS data, the overall p value for the interaction between race and all hypertension and obesity categories combined was 0.0053. Individual interaction p values for the three categories were 0.0143 (hypertension only), 0.9101 (obesity only) and 0.0675 (hypertension and obesity), indicating statistical support for the presence of an interaction for race and hypertension only and marginal significance for interaction for race and hypertension and obesity.

**TABLE 14:**  
**Diabetes Prevalence Odds Ratio Estimates for BRFSS 2013 (Sample N=4,684)**

Predictor	Prevalence Odds Ratio	95% Confidence Limits		p
Female v Male	1.117	0.866	1.442	0.3932
Black v White	1.366	1.042	1.789	0.0238
Age (continuous)	1.043	1.035	1.052	< 0.0001
Some High School v HS Degree/College	1.858	1.330	2.594	0.0003
Category 1 vs Category 4	5.762	3.943	8.418	< 0.0001
Category 2 vs Category 4	4.792	2.903	7.911	< 0.0001
Category 3 vs Category 4	15.724	10.967	22.544	< 0.0001

For the 2013 Louisiana BRFSS data, the overall p value for the interaction between race and all hypertension and obesity categories combined was 0.0184. Individual p values for the three categories were 0.5254 (hypertension only),

0.0272 (obesity only) and 0.6351 (hypertension and obesity), indicating statistical support for the presence of an interaction for race and obesity only.

**TABLE 15:**  
**Diabetes Prevalence Odds Ratio Estimates for BRFSS 2011, 2013 and 2015 Combined Data**  
**(Sample N=18,354)**

<b>Predictor</b>	<b>Prevalence Odds Ratio</b>	<b>95% Confidence Limits</b>		<b>p</b>
<b>Female v Male</b>	0.852	0.746	0.975	0.0195
<b>Black v White</b>	1.636	1.409	1.900	< 0.0001
<b>Age (continuous)</b>	1.043	1.039	1.048	< 0.0001
<b>Less than \$25,000 vs higher</b>	1.319	1.149	1.514	< 0.0001
<b>Category 1 vs Category 4</b>	4.369	3.467	5.505	< 0.0001
<b>Category 2 vs Category 4</b>	3.580	2.679	4.783	< 0.0001
<b>Category 3 vs Category 4</b>	11.249	8.984	14.084	< 0.0001

For the combined 2011, 2013 and 2015 Louisiana BRFSS data, the overall p value for the interaction between race and all hypertension and obesity categories combined was 0.0003. Individual p values for the three categories were 0.0661 (hypertension only), 0.1310 (obesity only) and 0.6801 (hypertension and obesity), indicating marginal statistical support for the presence of an interaction for race and hypertension only and no support for an interaction between race and obesity or race and hypertension and obesity.

## APPENDIX B

### Pre-Diabetes

Pre-diabetics have elevated blood sugar that is not high enough to be diagnosed as diabetes. Statewide, 7.5% of respondents report a diagnosis of pre-diabetes.

<b>Table 16: Pre-Diabetes</b>			
		<b>Percent</b>	<b>95% Confidence Interval</b>
<b>GENDER</b>	Male	39.7	33.1-46.3
	Female	60.3	53.7-66.9
<b>RACE</b>	White	61.8	55.0-68.7
	Black	34.0	27.2-40.7
<b>AGE</b>	18-24	NA*	NA
	25-34	11.4	5.9-16.8
	35-44	14.4	9.6-19.2
	45-54	18.5	13.3-23.7
	55-64	26.2	20.9-31.6
	65+	22.2	17.7-26.7
<b>EDUCATION</b>	Did not Graduate HS	17.2	11.4-23.0
	Graduated HS	42.2	35.5-48.9
	Attended College	25.3	19.9-30.7
	Graduated College	15.3	11.5-19.1
<b>INCOME</b>	Less than \$15,000	16.4	10.7-22.1
	\$15,000-\$24,999	18.9	13.2-24.7
	\$25,000-\$34,999	15.0	9.6-20.4
	\$35,000-\$44,999	10.0	6.3-13.8
	\$50,000 or more	39.7	32.2-47.2

\*Sample size insufficient to generate valid estimate

Pre-diabetics are more likely to be female, white, over the age of 45 and to have no college vs those with some college or a college degree. Half earn \$35,000 per year or greater. Chi square analysis shows significant differences for gender and age ( $p=0.0139$  and  $p=0.0024$ , respectively), but no significant difference for race or income. Education level was marginally significant (0.0739).

Using the same 4 groups to describe hypertension and obesity, pre-diabetes generally follows the breakout for diabetes.

**Table 17: Pre-Diabetes by Hypertension/Obesity Category**

TOTAL POPULATION	% Pre-Diabetes	95% Confidence Interval
Category 1: Hypertensive Only	7.2	5.4-9.0
Category 2: Obese Only	6.6	4.3-8.9
Category 3: Hypertensive and Obese	16.2	13.0-19.4
Category 4: No Hypertension, No Obesity	3.8	2.6-5.1

The pre-diabetes population is small, so education and age were dichotomized for logistic regression analysis, and race was restricted to black vs white. Those who reported having diabetes were eliminated from regression analysis. Significant effects are for gender, age and categories 1 and 3 when compared to category 4. Category 2 is marginally significant. Higher odds of reporting pre-diabetes were, in descending order, from Category 3 (5.8), Category1 (1.8) and Category 2 (1.6).

<b>Table 18: Pre-Diabetes Prevalence Odds Ratio Estimates</b>				
<b>Predictor</b>	<b>Prevalence Odds Ratio</b>	<b>95% Confidence Limits</b>		<b>p value</b>
<b>Females vs Males</b>	1.502	1.083	2.085	0.0148
<b>Black vs White</b>	1.181	0.844	1.652	0.3308
<b>Over 44 years vs 44 and younger</b>	1.786	1.205	2.648	0.0039
<b>No college vs at least some college</b>	1.193	0.875	1.626	0.2636
<b>Category1 vs 4</b>	1.780	1.114	2.846	0.0160
<b>Category 2 vs 4</b>	1.582	0.929	2.692	0.0910
<b>Category 3 vs 4</b>	5.837	3.752	9.081	< 0.0001