Florida's Infant Mortality and Low Birth Weight Actual Rate Compared to Expected Rate by County 2015 Update

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Introduction

The public health community uses infant mortality and birth weight statistics extensively as maternal and child health indicators because they are relevant, readily available, and reliable due to a relatively high level of completeness.

The purpose of this analysis is to identify geographic areas in the state that exhibit statistically significant differences in low birth weight (LBW) and infant mortality (IM) rates than would be expected considering the unique demographics of each county.

IM and LBW rates in Florida vary across counties. This variation is due, in part, to the unique demographic characteristics of the county populations. In this analysis, adjustments are made to account for the differences in demographic characteristics. Three demographic characteristics are accounted to calculate the expected IM and LBW: maternal race, marital status, and educational attainment. These variables are used because of their known associations with risk of LBW and IM, and because adjusting provides a way to make valid comparisons among counties with different population sizes based on these characteristics.

Other demographic characteristics, such as young maternal age and smoking status, were not used to adjust IM and LBW estimates, to avoid eliminating differences that could possibly be attributed to public health interventions. For example, counties with lower than expected LBW percentages may have implemented successful smoking cessation programs. If adjustments had been made for smoking status, differences between actual and expected statistics would not be apparent. In another example, births to women under the age of 20 can be influenced by teen pregnancy prevention interventions, and by the same logic, adjustments are not made for maternal age.

IM and LBW rates can also vary due to random variation or chance. In this analysis, statistical methods are used to separate random from non-random variation. Therefore, rates reported as significantly higher or lower are most likely a result of non-random influences. Likewise, rates that are higher or lower than expected, but not statiscally significant, are most likely to be the result of random variation.

Methods

The data used in this analysis were extracted from the birth records for Florida residents who were born in calendar years 2014 and 2015. Infant mortality is defined as the death of a child less than one year of age. Infants born weighing less than 2,500 grams at delivery are considered LBW. This analysis uses three demographic variables to perform statistical adjustment on expected IM and LBW estimates: maternal race, marital status, and educational attainment. Each demographic variable has two defined values as follows: mother's race as non-Black or Black, marital status as married or not married, and mother's education as high school or above, or less than high school graduation. All possible combinations of the three demographic variables form nine mutually exclusive categories. The ninth category includes birth records for which any of the three demographic variables had a missing value. The nine categories are as follows:

Category	Maternal Race	Marital Status	Educational Attainment
1	Non-Black	Married	High School or More
2	Non-Black	Married	Less than High School
3	Non-Black	Not Married	High School or More
4	Non-Black	Not Married	Less than High School
5	Black	Married	High School or More
6	Black	Married	Less than High School
7	Black	Not Married	High School or More
8	Black	Not Married	Less than High School
9	Unknown	Unknown	Unknown

Calculating IM and LBW Expected Rates:
Using the classification scheme shown above, nine state-level category-specific IM expected rates were calculated from the 2014 vital records (the latest year available at the time of this analysis for complete linked birth and infant death data). The infant death linkage indicator is not recorded on the birth record until up to one year after a birth. Therefore, 2015 linked infant birth-death records were not complete at the time of this analysis and 2014 data were instead used to calculate expected IM estimates. This adjustment technique is referred to as "indirect adjustment." To obtain the 2015 expected number of infant deaths by county, each of the nine state-level category-specific IM rates for 2014 were multiplied by the total number of county-level births in 2015 and then summed. To compute the 2015 expected infant mortality rates for each county, the 2015 expected number of infant deaths was used as the numerator and the total number of births in 2015 was used as the denominator. Using the nine state-level category-specific rates to estimate county-specific expected IM counts and rates accounts for the unique sociodemographic composition of mothers in each county who gave birth to an infant and mothers whose infants had died by adjusting for the influence of maternal race, marital status and education.

These methods were applied in the same way to calculate expected LBW counts. However, 2015 state-level birth counts for each category were used to calculate expected county-level LBW percentages because birth weight is recorded at the time of delivery.

The Normal Approximation to the Binomial Distribution was used to test for statistically significant differences between actual and expected rates in most of the counties. In instances where the number of infant deaths or number of low birth weight infants was less than 30, the Poisson formula was used. The correlation between the actual to expected ratios for IM and LBW across the counties was also assessed.

In March 2004, the recording of maternal race on the birth record was changed to allow the selection of more than one race. For the purpose of this analysis, births where the only maternal race recorded was Black were classified as Black and all others were classified as non-Black.

Results
The results of this analysis are shown in the following tables and maps for IM and LBW. In the tables, actual statistics are compared to expected statistics. The expected statistics are adjusted for the demographic characteristics in each county, as described above. Counties with statistically significant higher than expected actual statistics are indicated in the tables with an "H" and those with an "L" indicate statistically significant lower than expected actual statistics. The maps display the results of the statistical tests for significance. Counties where the actual statistics are significantly higher or lower are shaded, as indicated by the legend on the maps.

There is a statistically significant correlation between the actual to expected LBW ratios and the actual to expected infant death ratios (Kendall's rank correlation coefficient = 0.32; p value of 0.000).

Also included in this report are summary tables for the years 2011 through 2015 that show the Hs and Ls for the counties for each of the past five years.

Summary
For 2015 IM rates: Actual vs. Expected

- Broward (5.42 vs. 6.95), Dade (4.84 vs. 6.17), and Palm Beach (4.91 vs. 6.45) counties had statistically significant lower than expected IM rates (Table 1). The counties with lower IM rates than expected are located in the southern region of the state (Map, page 10). Broward and Dade presented lower IM rates than expected for all five years studied while Palm Beach presented lower IM rates than expected during the last four years (Table 3).

- Bradford (17.01 vs. 5.96), Hillsborough (7.97 vs. 6.20), Lake (8.48 vs. 5.97), Polk (8.55 vs. 6.28), and Volusia (8.30 vs. 6.07) counties had statistically significant higher than expected IM rates (Table 1). As can be observed on the map, all counties except Bradford are located in the center of the state. Only Hillsborough County presented higher IM rates than expected in each of the last five years (Table 3).

For 2015 low birth weight percentages: Actual vs. Expected

- Collier (6.30% vs. 8.00%), Indian River (7.87% vs. 9.39%), Jefferson (4.03% vs. 9.94%), Lee (7.53% vs. 8.28), Leon (8.70% vs. 9.72%), Manatee (6.83 vs. 8.30%), Martin (5.31% vs. 7.96%), Monroe (5.98% vs. 7.92%), Palm Beach (8.47% vs. 8.84%), Pinellas (7.58% vs. 8.51%), Polk (7.91% vs. 8.63%), and Saint Lucie (7.84% vs. 9.10%) counties had significantly lower percentages of LBW (Table 2) infants than expected. These counties are located in the north, center, and south regions of the state (Map, page 10). None of the counties presented lower than expected percentages of low birth weight for at least four consecutive years (Table 4).

- Alachua (9.88% vs. 8.95%), Bradford (13.27 vs. 8.58%), Citrus (11.01% vs. 7.76%), Dixie (12.68% vs. 8.15%), Duval (10.01% vs. 9.40%), Escambia (10.92% vs. 9.21%), Gilchrist (12.89% vs. 7.82%), Hillsborough (9.03% vs. 8.59%), Lake (9.30% vs. 8.25%), Levy (11.00% vs. 8.39%), Nassau (9.46% vs. 7.62%), Volusia (9.23% vs. 8.48%), and Wakulla (10.95% vs.7.92%) counties had significantly higher percentages of low birth weight infants than expected (Table 3). These counties are located in the north and center regions of the state. Escambia is the only county with four years (albeit not consecutive) of higher percentage of LBW infants than expected (Table 4).

Discussion
This analysis should be considered a preliminary step in the continuing endeavor to reduce IM and low birth weight in Florida. The results of this analysis can be used to focus further studies and public health efforts on areas of the state where the risks of poor infant health outcomes are significantly higher and also analyze factors that contribute to the lower risks seen in some areas.

One limitation of this analysis is the high variability of rates in smaller counties compared to those in larger counties. Consequently, larger differences in rates for small counties may not be statistically significant while the same or smaller differences may be statistically significant in larger counties. Actual rates that are statistically significant higher than the expected rates are most likely not a result of random fluctuations and may indicate a public health problem requiring further investigation and intervention; however, higher rates that are not statistically significant may warrant further investigation as well. Smaller counties with higher than expected rates for a period of several years may also be cause for concern.

Since adjustments were used to account for the differing demographic composition in each county, further analysis could focus on other factors not included in this report, such as smoking rates and mother's age at birth. Unique factors in each county contribute to IM and LBW. Local area analysis of factors associated with these outcomes should be undertaken to better understand the reasons for statistically significant lower or higher than expected rates with separate analyses performed for each area of concern. Finally, it should be noted that in this analysis, rates for each county are compared to the statewide rates, after adjustment for maternal race, marital status, and education attainment. The issue of whether or not the statewide rates should be used as a baseline in these comparisons is not addressed in this analysis.

Mother's Resident County	2015 Births[3]	2015 Expected[1] Infant Deaths	2015 Actual Infant Deaths	2015 Expected Infant Mortality Rate Per 1000 Births	2015 Actual Infant Mortality Rate Per 1000 Births	H=Actual Rate Signif.Higher [2] L=Actual Rate Signif.Lower [2] Than Expected
ALACHUA	2,885	18	20	6.10	6.93	
BAKER	336	2	4	5.45	11.90	
BAY	2,396	15	13	6.12	5.43	
BRADFORD	294	2	5	5.96	17.01	H
BREVARD	5,246	30	33	5.72	6.29	
BROWARD	22,307	155	121	6.95	5.42	L
CALHOUN	150	1	1	5.72	6.67	
CHARLOTTE	1,030	6	7	5.48	6.80	
CITRUS	1,017	6	10	5.90	9.83	
CLAY	2,225	13	11	5.84	4.94	
COLLIER	3,256	19	22	5.84	6.76	
COLUMBIA	827	5	8	6.11	9.67	
DADE	32,432	200	157	6.17	4.84	L
DESOTO	376	2	5	6.25	13.30	
DIXIE	142	1	1	5.63	7.04	
DUVAL	13,041	90	103	6.90	7.90	
ESCAMBIA	3,902	26	30	6.66	7.69	
FLAGLER	797	4	5	5.58	6.27	
FRANKLIN	106	1	0	6.18	0.00	
GADSDEN	557	5	5	8.77	8.98	
GILCHRIST	194	1	2	5.42	10.31	
GLADES	79	0	0	6.09	0.00	
GULF	119	1	2	6.23	16.81	
HAMILTON	167	1	2	7.29	11.98	
HARDEE	390	2	2	5.93	5.13	
HENDRY	631	4	2	6.16	3.17	
HERNANDO	1,600	9	11	5.43	6.88	
HIGHLANDS	917	6	3	6.09	3.27	
HILLSBOROUGH	17,570	109	140	6.20	7.97	H
HOLMES	219	1	2	5.11	9.13	
INDIAN RIVER	1,246	10	9	8.03	7.22	
JACKSON	496	3	4	6.63	8.06	
JEFFERSON	124	1	0	7.80	0.00	
LAFAYETTE	59	0	0	5.36	0.00	
LAKE	3,184	19	27	5.97	8.48	H
LEE	6,776	40	41	5.90	6.05	
LEON	3,047	22	22	7.22	7.22	
LEVY	391	2	4	5.51	10.23	
LIBERTY	75	0	0	5.23	0.00	
MADISON	210	2	0	7.22	0.00	
MANATEE	3,469	21	20	5.94	5.77	
MARION	3,584	22	25	6.00	6.98	
MARTIN	1,262	7	6	5.52	4.75	
MONROE	752	4	3	5.31	3.99	
NASSAU	803	4	4	4.92	4.98	
OKALOOSA	2,829	15	15	5.13	5.30	
OKEECHOBEE	523	3	3	5.77	5.74	
ORANGE	16,718	106	107	6.34	6.40	
OSCEOLA	4,183	23	21	5.42	5.02	
PALM BEACH	14,873	96	73	6.45	4.91	L
PASCO	5,105	28	23	5.48	4.51	
PINELLAS	8,744	54	56	6.18	6.40	
POLK	7,483	47	64	6.28	8.55	H
PUTNAM	815	6	8	7.36	9.82	
SAINT JOHNS	2,158	11	10	5.10	4.63	
SAINT LUCIE	3,099	21	18	6.78	5.81	
SANTA ROSA	1,943	9	7	4.71	3.60	
SARASOTA	2,907	16	17	5.38	5.85	
SEMINOLE	4,554	25	22	5.42	4.83	
SUMTER	500	3	6	6.00	12.00	
SUWANNEE	434	3	3	5.99	6.91	
TAYLOR	249	2	3	6.51	12.05	
UNION	147	1	0	5.67	0.00	
VOLUSIA	4,939	30	41	6.07	8.30	H
WAKULLA	338	2	3	5.31	8.88	
WALTON	806	4	6	4.98	7.44	
WASHINGTON	228	1	1	5.97	4.39	
TOTAL[4]	224,261	1,394	1,399	6.22	6.24	

[1] The expected number of infant deaths is calculated with adjusting for the maternal race, marital status and education characteristics of the births in each county

[2] The significance level used is .05

TABLE 1. FLORIDA ACTUAL INFANT MORTALITY RATES PER 1000 BIRTHS 2015 COMPARED TO EXPECTED[1] RATES PER 1000 BIRTHS

TABLE 2. FLORIDA ACTUAL LOW BIRTH WEIGHT PERCENTAGES COMPARED TO EXPECTED² PERCENTAGES 2015						
Mother's Resident County	2015 Births⁴	2015 Expected² LBW Births	2015 Actual LBW Births	2015 Expected LBW Percent	2015 Actual LBW Percent	H=Actual Rate Signif.Higher ³ L=Actual Rate Signif.Lower ³ Than Expected
ALACHUA	2,885	258	285	8.95%	9.88%	H
BAKER	336	28	32	8.24%	9.52%	
BAY	2,396	202	213	8.44%	8.89%	
BRADFORD	294	25	39	8.58%	13.27%	H
BREVARD	5,246	428	429	8.17%	8.18%	
BROWARD	22,307	2,090	2,074	9.37%	9.30%	
CALHOUN	150	13	15	8.45%	10.00%	
CHARLOTTE	1,030	81	93	7.86%	9.03%	
CITRUS	1,017	79	112	7.76%	11.01%	H
CLAY	2,225	178	195	8.02%	8.76%	
COLLIER	3,256	261	205	8.00%	6.30%	L
COLUMBIA	827	73	85	8.82%	10.28%	
DADE	32,432	2,789	2,733	8.60%	8.43%	
DESOTO	376	31	32	8.22%	8.51%	
DIXIE	142	12	18	8.15%	12.68%	H
DUVAL	13,041	1,226	1,306	9.40%	10.01%	H
ESCAMBIA	3,902	359	426	9.21%	10.92%	H
FLAGLER	797	64	58	8.00%	7.28%	
FRANKLIN	106	8	8	8.01%	7.55%	
GADSDEN	557	62	75	11.09%	13.46%	
GILCHRIST	194	15	25	7.82%	12.89%	H
GLADES	79	6	6	8.01%	7.59%	
GULF	119	10	6	8.34%	5.04%	
HAMILTON	167	15	20	9.18%	11.98%	
HARDEE	390	31	25	7.93%	6.41%	
HENDRY	631	53	46	8.34%	7.29%	
HERNANDO	1,600	126	129	7.85%	8.06%	
HIGHLANDS	917	78	69	8.51%	7.52%	
HILLSBOROUGH	17,570	1,510	1,586	8.59%	9.03%	H
HOLMES	219	17	21	7.56%	9.59%	
INDIAN RIVER	1,246	117	98	9.39%	7.87%	L
JACKSON	496	44	43	8.94%	8.67%	
JEFFERSON	124	12	5	9.94%	4.03%	L
LAFAYETTE	59	4	6	7.50%	10.17%	
LAKE	3,184	263	296	8.25%	9.30%	H
LEE	6,776	561	510	8.28%	7.53%	L
LEON	3,047	296	265	9.72%	8.70%	L
LEVY	391	33	43	8.39%	11.00%	H
LIBERTY	75	6	7	8.43%	9.33%	
MADISON	210	22	29	10.29%	13.81%	
MANATEE	3,469	288	237	8.30%	6.83%	L
MARION	3,584	308	331	8.58%	9.24%	
MARTIN	1,262	100	67	7.96%	5.31%	L
MONROE	752	60	45	7.92%	5.98%	L
NASSAU	803	61	76	7.62%	9.46%	H
OKALOOSA	2,829	219	207	7.73%	7.32%	
OKEECHOBEE	523	42	38	8.08%	7.27%	
ORANGE	16,718	1,473	1,508	8.81%	9.02%	
OSCEOLA	4,183	333	350	7.95%	8.37%	
PALM BEACH	14,873	1,315	1,259	8.84%	8.47%	L
PASCO	5,105	396	420	7.76%	8.23%	
PINELLAS	8,744	744	663	8.51%	7.58%	L
POLK	7,483	646	592	8.63%	7.91%	L
PUTNAM	815	74	83	9.09%	10.18%	
SAINT JOHNS	2,158	162	145	7.49%	6.72%	
SAINT LUCIE	3,099	282	243	9.10%	7.84%	L
SANTA ROSA	1,943	143	152	7.34%	7.82%	
SARASOTA	2,907	232	220	7.98%	7.57%	
SEMINOLE	4,554	366	364	8.05%	7.99%	
SUMTER	500	43	50	8.67%	10.00%	
SUWANNEE	434	36	34	8.36%	7.83%	
TAYLOR	249	22	28	8.74%	11.24%	
UNION	147	12	16	7.97%	10.88%	
VOLUSIA	4,939	419	456	8.48%	9.23%	H
WAKULLA	338	27	37	7.92%	10.95%	H
WALTON	806	60	62	7.48%	7.69%	
WASHINGTON	228	19	13	8.25%	5.70%	
TOTAL⁴	224,261	19,368	19,364	8.64%	8.63%	

¹ *LBW = Low Birth Weight, defined as birth weight below 2500 grams.*

² *The expected number of low birth weight births is calculated with adjusting for the maternal race, marital status and education characteristics of the births in each county*

³ *The significance level used is .05*

⁴ *Total excludes 12 births with county unknown*

TABLE 3. INFANT MORTALITY RATES ACTUAL VERSUS EXPECTED STATISTICAL SIGNIFICANCE[1] SUMMARY BY COUNTY 2011-2015							
Mother's Resident County	**2011**	**2012**	**2013**	**2014**	**2015**	**Total L**	**Total H**
ALACHUA			H	H			2
BAKER	H		H				2
BAY	H			H			2
BRADFORD			H		H		2
BREVARD							
BROWARD	L	L	L	L	L	5	
CALHOUN							
CHARLOTTE			L			1	
CITRUS							
CLAY							
COLLIER							
COLUMBIA		H					1
DADE	L	L	L	L	L	5	
DESOTO							
DIXIE							
DUVAL		H	H	H			3
ESCAMBIA							
FLAGLER							
FRANKLIN							
GADSDEN							
GILCHRIST							
GLADES							
GULF							
HAMILTON							
HARDEE							
HENDRY							
HERNANDO							
HIGHLANDS		H					1
HILLSBOROUGH	H	H	H	H	H		5
HOLMES		H					1
INDIAN RIVER	H						1
JACKSON							
JEFFERSON			H				1
LAFAYETTE							
LAKE				H	H		2
LEE							
LEON							
LEVY							
LIBERTY	H						1
MADISON							
MANATEE	H						1
MARION				H			1
MARTIN							
MONROE							
NASSAU							
OKALOOSA			H				1
OKEECHOBEE							
ORANGE			H	L		1	1
OSCEOLA							
PALM BEACH		L	L	L	L	4	
PASCO			H				1
PINELLAS							
POLK		H			H		2
PUTNAM				H			1
SAINT JOHNS		L				1	
SAINT LUCIE							
SANTA ROSA							
SARASOTA	L					1	
SEMINOLE							
SUMTER				H			1
SUWANNEE							
TAYLOR							
UNION							
VOLUSIA		L			H	1	1
WAKULLA							
WALTON		H					1
WASHINGTON							

[1] H indicates the actual infant death rate was statistically significantly higher than the expected infant death rate for the county
L indicates the actual infant death rate was statistically significantly lower than the expected infant death rate for the county
after adjusting for the race, marital status and education characteristics of the births in each county.
The significance level used is .05

TABLE 4. LOW BIRTH WEIGHT (< 2500 grams) PERCENTAGE ACTUAL VERSUS EXPECTED STATISTICAL SIGNIFICANCE [1] SUMMARY BY COUNTY 2011-2015

Mother's Resident County	2011	2012	2013	2014	2015	Total L	Total H
ALACHUA					H		1
BAKER	H		H				2
BAY	H						1
BRADFORD		H	H		H		3
BREVARD	L		L			2	
BROWARD							
CALHOUN							
CHARLOTTE							
CITRUS					H		1
CLAY							
COLLIER		L		L	L	3	
COLUMBIA	L					1	
DADE							
DESOTO		L				1	
DIXIE				L	H	1	1
DUVAL		H			H		2
ESCAMBIA	H	H		H	H		4
FLAGLER							
FRANKLIN							
GADSDEN				H			1
GILCHRIST					H		1
GLADES							
GULF							
HAMILTON							
HARDEE							
HENDRY	H	L		L		2	1
HERNANDO			H				1
HIGHLANDS			L			1	
HILLSBOROUGH	H		H		H		3
HOLMES							
INDIAN RIVER			L	L	L	3	
JACKSON							
JEFFERSON					L	1	
LAFAYETTE							
LAKE					H		1
LEE			H		L	1	1
LEON					L	1	
LEVY		L			H	1	1
LIBERTY							
MADISON			H				1
MANATEE			L	L	L	3	
MARION	L					1	
MARTIN				L	L	2	
MONROE		L		L	L	3	
NASSAU					H		1
OKALOOSA							
OKEECHOBEE							
ORANGE							
OSCEOLA				H			1
PALM BEACH			L	L	L	3	
PASCO				H			1
PINELLAS					L	1	
POLK	L				L	2	
PUTNAM				H			1
SAINT JOHNS	L	L				2	
SAINT LUCIE	L	H		L	L	3	1
SANTA ROSA				H			1
SARASOTA		L	L	L		3	
SEMINOLE	H			L		1	1
SUMTER				H			1
SUWANNEE			H				1
TAYLOR							
UNION							
VOLUSIA					H		1
WAKULLA					H		1
WALTON							
WASHINGTON							

[1] H indicates the actual low birth weight % was statistically significantly higher than the expected low birth weight % for the county
L indicates the actual low birth weight % was statistically significantly lower than the expected low birth weight % for the county after adjusting for the race, marital status and education characteristics of the births in each county.
The significance level used is .05

Actual County Infant Mortality Rates per 1,000 Live Births Compared with Expected Infant Mortality Rates per 1,000 Live Births: Florida 2015

- Significantly High (alpha < 0.05)
- Significantly Low (alpha < 0.05)
- Not Significant
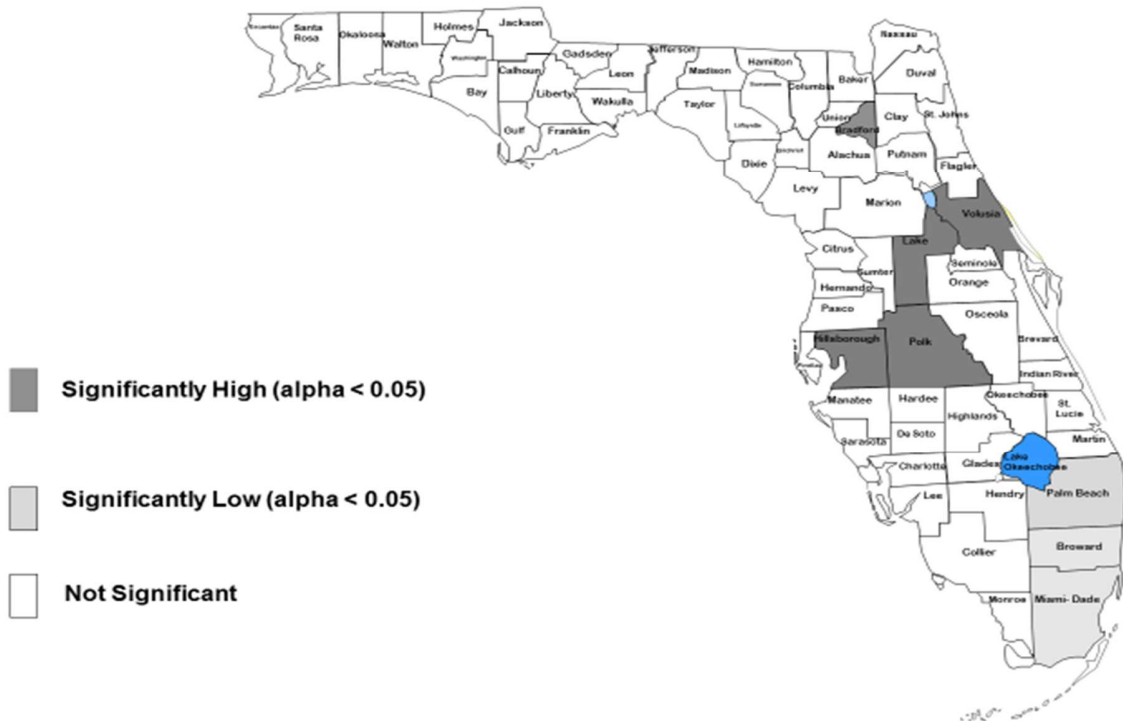
Actual County Low Birth Weight Percentage Compared with Expected Low Birth Weight Percentage: Florida 2015

- Significantly High (alpha < 0.05)
- Significantly Low (alpha < 0.05)
- Not Significant