

## Quantitative Data Analysis of Multiple Factors Associated with Low Birth Weight in Bibb County, Georgia

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### ABSTRACT

#### Objective

This study aims to identify and evaluate significant risk factors associated with low birth weight in Bibb County, Georgia.

#### Methods

Data used in this study was obtained from the Georgia Department of Human Resources' Vital Records Offices. The sample consists of 2,346 white and black or African American women giving birth in Bibb County, Georgia in 2005. Logistic regression was used to analyze the risk factors associated with low birthweight in Bibb County, Georgia. The multiple factors analyzed as independent variables included maternal race, maternal education, maternal age group, socioeconomic status, marital status, maternal tobacco use during pregnancy, maternal alcohol use during pregnancy, trimester mother began prenatal care and number of prenatal care visits mother received. The dependent variable analyzed was whether the infant was born low birth weight.

#### Results

Logistic regression analysis showed that the most significant risk factor associated with low birth weight in 2005 was receiving less than six prenatal care visits (odds ratio [OR] = 3.6; 95% CI = 2.5, 5.3). Maternal education of 12th grade or less (OR = 1.7; 95% CI = 1.2, 2.3), maternal race of black or African American (OR = 2.0; 95% CI = 1.5, 2.6), and use of tobacco during pregnancy (OR = 1.7; 95% CI = 1.2, 2.4) were also significant factors for low birth weight.

#### Conclusions

Based on the observations of the present study, it is recommended that intervention programs and communication tools should focus on those significant risk factors associated with low birth weight and target at-risk pregnant women; hence, reducing the incidence of infants born low birth weight in Bibb County, Georgia.

## INTRODUCTION

Infant mortality<sup>1</sup> is often used as a determinant of the health and well-being of a population. In the United States, low birthweight<sup>2</sup> contributes significantly to the infant mortality rate, accounting for 113.7 per 1,000 of all infant deaths in 2005 (Kung, Hoyert, Xu, & Murphy, 2007). In the same year, 8.2% (339,514) of all births were low birthweight, which was the highest percentage reported since 1968 (Hamilton, Martin, & Ventura, 2006). Due to the increasing rate of low birthweight from 1980-2000, an increase of 11.4%, one of the Healthy People 2010 objectives aims to reduce the percentage of low birthweight to 5% (Office of Disease Prevention and Health Promotion, 2000).

Infants born low birthweight often experience negative health outcomes through infancy, childhood and adolescence. In addition to increased mortality, negative outcomes include developmental delays, congenital anomalies, respiratory problems, and long term adverse health outcomes, such as hypertension, diabetes, and coronary heart disease (Barker, Bull, Osmond, & Simmonds, 1990; Casey, Whiteside-Mansell, Barrett, Bradley, & Gargus, 2006; Eriksson, 2007; Jimenez-Chillaron et al, 2005; Reynolds & Phillips, 1998; Rich-Edwards et al., 1997). Modifiable risk factors for low birthweight include, but are not limited to, the following: adequate prenatal care, maternal behaviors such as smoking and drinking, nutrition, parity, and birth interval (Nobile, Gianluca, Altomare, & Pavia, 2007). Other identified risk factors include maternal race, maternal education, maternal age, socioeconomic status, and marital status (Nobile et al., 2007).

In the United States, African Americans have the highest percentage (14%) of infants born low birthweight among all races, which could largely contribute to the highest infant mortality rate (13.65 per 1,000) among African Americans (Hamilton et al., 2006). While the infant mortality rate for African Americans has continually decreased since 1980, the percentage of infants born low birthweight has continued to increase since 1980 to 13%, as compared to the national percentage of low birthweight (7.6%; Center for Disease Control and Prevention [CDC], 2002). The decline in infant mortality among African Americans can be largely attributed to medical and technological advances that allow infants to survive unfavorable conditions such as low birthweight and not necessarily to better education and prenatal care. The disparity between percentage of low birthweight among African Americans and the national percentage reinforces the need for better education and prenatal care services targeting this segment of the population.

Bibb County is located in Central Georgia. According to the US Census Bureau, the population of Bibb County was an estimated 154,903 in 2006 with 50.4% of blacks or African Americans, and 47.2% of whites (US Census Bureau, 2008). The median household income in Bibb County was \$35,540, and 20% of the population was living below poverty level (US Census Bureau, 2008). In Bibb County, Georgia the percentage of infants born low birthweight has increased since 1994 (Online Analytical Statistical Information System [OASIS], 2007). Among all races and mothers of all ages, Bibb County witnessed a 36.4% increase in infants born low birthweight (10.7% in 1994 to 14.6% in 2005; OASIS, 2007). More specifically, among the black population, an increase of 29.3% of infants born low birthweight occurred between 1994 and 2005 (14.0% in 1994 and 18.1% in 2005; OASIS, 2007). This is the largest percent increase among all races in Bibb County, Georgia during the same years.

This study aims to identify significant risk factors affecting low birthweight in Bibb County, Georgia in 2005. Data analyzed for this study was obtained from a dataset provided by Georgia Department of Human Resources' Vital Records Offices. Independent variables include the following: maternal race, maternal education, maternal age group, demographic profile major cluster (socioeconomic status [SES]), marital status, maternal tobacco use during pregnancy,

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<sup>1</sup> Number of infants born alive who died within the first year of life per 1,000 live births

<sup>2</sup> Low birthweight is defined as babies born weighing < 2,500g

maternal alcohol use during pregnancy, trimester mother began prenatal care and number of prenatal care visits mother received. Georgia Department of Human Resources uses multiple variables to derive a demographic major cluster, which represents the four socioeconomic status groups: high, middle, low middle, and low (OASIS, 2007). In this paper, demographic major cluster will be referred to as socioeconomic status (SES). The dependent variable is whether the infant was born low birthweight.

## METHODS

### *Sampling Procedures*

The sample used for this study was extracted from a larger dataset collected by the Georgia Department of Human Resources' Vital Records Offices. There are 159 counties in Georgia and each county has a Vital Records office that is responsible for collecting "vital events which are defined as birth, death, fetal deaths (stillbirth), induced termination of pregnancy, marriage and divorce certificates and reports" (Georgia Department of Human Resources, 2007). Vital records are completed in the county where the events occurred; therefore, for the sake of this study, birth certificates are completed in the county in which the birth occurred. Hospital staff complete most birth records; however, in situations where a birth occurred outside of a hospital, the vital records registrar follows strict guidelines to register the birth.

### *Subjects*

The original dataset included births in Georgia from January 1, 1994 through December 31, 2005 and contained 1,518,579 birthing events. Since this study focuses on birthing events for white and black or African American women in Bibb County, Georgia in 2005, the original dataset was reduced to include only those birth events that met this criterion. Subjects with empty fields for selected variables were removed from the dataset. After cleaning the dataset, the number of birthing events was reduced to 2,346.

### *Data Analysis*

Data was analyzed using SPSS 16.0 for Windows. Logistic regression was performed to analyze the risk factors associated with low birthweight in Bibb County, Georgia. For logistic regression analysis, specific variables from the data set were grouped for simplified comparison. Grouped variables include the following: last grade mother completed, month mother began prenatal care, number of prenatal visits mother received, SES and weight in grams. For analysis, last grade mother completed was grouped into two categories:  $\leq 12^{\text{th}}$  grade and  $> 12^{\text{th}}$  grade. Month mother began prenatal care was also grouped into two categories: women receiving prenatal care in the third trimester or no prenatal care and women receiving prenatal care in the first and second trimesters. Number of prenatal care visits was grouped into two categories: women receiving less than six prenatal care visits and women receiving six or more prenatal care visits.

## RESULTS

### *Demographic Characteristics of the Sample Population*

Demographic characteristics of the sample population are summarized in Table 1. The sample consisted of 2,346 subjects, 60.3% ( $n=1,414$ ) of whom were unmarried. Approximately 63% ( $n=1,487$ ) of the subjects were black. Maternal age varied greatly ranging from 14 to 46 years; however, the 20-29 year age group represented the majority of the sample population

**Table 1:** Demographic Characteristics of White and Black or African American Females Giving Birth in Bibb County, Georgia in 2005

Characteristic	Frequency (n)	Percent (%)
<b>Maternal Race</b>		
White	859	36.6
Black or African American	1487	63.4
<b>Maternal Education</b>		
<= 8th Grade	49	2.1
Some High School	586	25.0
12th Grade	970	41.3
Some College	308	13.1
Four Years of College	377	16.1
> Four Years of College	56	2.4
<b>Maternal Age Group</b>		
10 - 19	369	15.7
20 - 29	1354	57.7
30 - 39	578	24.6
40 - 49	45	1.9
<b>Socioeconomic Status</b>		
High	459	19.6
Middle	267	11.4
Low Middle	402	17.1
Low	1218	51.9
<b>Marital Status</b>		
Married	932	39.7
Unmarried	1414	60.3

N = 2346

(57.7%, n=1,354). Maternal education also varied, with the majority of subjects categorized as completing the 12<sup>th</sup> grade (41.3%, n=970). More than one-half of subjects (51.9%, n=1218) were of low socioeconomic status.

### *Behaviors, Prenatal Care and Birth Outcomes of the Sample Population*

Table 2 describes behaviors, prenatal care and birth outcomes of the sample population. Approximately 9% (n = 207) of the sample reported using tobacco at some point during their pregnancy. Ten subjects (0.4%) reported alcohol use during their pregnancy. Twenty-five females (1.1%) received late or no prenatal care during the course of pregnancy. A large percentage of subjects (95.4%, n = 2,238) received prenatal care during the first trimester of pregnancy. Approximately 53% (n=1232) of the subjects received 11-15 prenatal care visits while 5.3 % (n = 125) of subjects received less than six prenatal care visits. Weeks of gestation varied, with 20.8% (n = 487) of births delivered with less than 37 weeks gestation. Infant weight at birth also varied greatly with 14.8% of births (n = 347) weighting <2,500 grams.

### *Risk Factors Associated with Low Birthweight*

It was found that maternal age, marital status, alcohol use during pregnancy, SES, and trimester mother began prenatal care did not significantly affect infant birth weight ( $P > 0.05$ ). The final logistic regression model includes maternal education, maternal race, tobacco use during pregnancy, and number of prenatal care visits mother received.

Table 3 shows significant variables associated with birthweight of the sample population. The most significant risk factor for low birthweight in 2005 was receiving less than six prenatal care visits (OR = 3.6; 95% CI = 2.5, 5.3). Maternal education of 12<sup>th</sup> grade or less (OR = 1.7; 95% CI = 1.2, 2.3), a maternal race of black or African American (OR = 2.0; 95% CI = 1.5, 2.6), and the use of tobacco during pregnancy (OR = 1.7; 95%CI = 1.2, 2.4) were also found to significantly affect infant birthweight.

## DISCUSSION

In this study, significant risk factors for delivering a low birthweight infant in Bibb County, Georgia in 2005 were found to be the following: an education of 12<sup>th</sup> grade or less, a maternal race of black or African American, using tobacco during pregnancy, and receiving less than six prenatal care visits. Clear differences exist among women of different subgroups. Women giving birth with an education of 12<sup>th</sup> grade less were 70% more likely to deliver a low birthweight infant than women giving birth with an education higher than 12<sup>th</sup> grade. Black women were two times more likely to deliver a low birthweight infant than their white counterpart. Women who used tobacco during pregnancy were 70% more likely to deliver a low birthweight infant than women who did not use tobacco during pregnancy. Women who received less than six prenatal care visits were 3.6 times more likely to deliver a low birthweight infant than women who received six or more prenatal care visits during pregnancy (Table 3). This is the first study that evaluates significant risk factors associated with low birthweight in the geographical area of Bibb County, Georgia. The observations from this study were consistent with previous findings by other researchers (Hessol, Fuented-Afflick, & Bacchetti, 1998; Jackson, Batiste, & Rendall-Mkosi, 2007; Nigg & Breslau, 2007; Nobile et al., 2007; Suzuki, Minai, and Yamagata, 2007; Villalbi, Salvador, Cano-Serral, Rodriguez-Sanz, & Borrell, 2007; Ward, Lewis, & Coleman, 2007). Suzuki et al. (2007) found that a maternal education less than high school was a significant risk factor for delivering a low birthweight infant ( $p=0.0422$ ). Hessol et al. (1998) determined that black parents were more likely to deliver a low birthweight infant than white parents (OR = 1.60, 95% CI = 1.50, 1.71). Nobile et al. (2007) found that mothers who smoked during pregnancy ( $p=0.002$ ) and who had fewer prenatal care visits ( $p=0.001$ ) were more likely to deliver a low birthweight infant.

**Table 2:** Behaviors, Prenatal Care and Birth Outcomes of Sample Population.

Characteristic	Frequency (n)	Percent (%)
<b>Behaviors</b>		
Tobacco Use During Pregnancy		
Yes	207	8.8
No	2139	91.1
Alcohol Use During Pregnancy		
Yes	10	0.4
No	2336	99.6
<b>Prenatal Care</b>		
Trimester Mother Began Prenatal Care		
No Prenatal Care	20	0.9
First Trimester	2238	95.4
Second Trimester	83	3.5
Third Trimester	5	0.2
Number of Prenatal Care Visits Mother Received		
No Visits	20	0.9
1-5	105	4.5
6-10	790	33.7
11-15	1232	52.5
16-20	182	7.8
21-25	13	0.6
26-30	3	0.1
> 30	1	0.0
<b>Birth Outcomes</b>		
Weeks of Gestation		
< 37 weeks	487	20.8
>= 37 weeks	1859	79.2
Infant Weight in Grams		
< 2500 grams	347	14.8
>= 2500 grams	1999	85.2

N = 2346

**Table 3:** Significant Variables Associated with Low Birthweight of the Sample Population.

Variable	Risk Factor	OR	95% CI
Maternal Education	<= 12th grade education	1.7	1.2, 2.3
Maternal Race	Black or African American	2.0	1.5, 2.6
Tobacco Use During Pregnancy	Use of tobacco	1.7	1.2, 2.4
Number of Prenatal Care Visits	Less than 6 prenatal care visits	3.6	2.5, 5.3

Note: OR=Odds Ratio; CI=Confidence Interval.

Note: Final logistic regression model includes the following variables: maternal education, maternal race, tobacco use during pregnancy and number of prenatal care visits.

Variables such as maternal age, trimester mother began prenatal care, alcohol consumption during pregnancy and SES are known risk factors for low birthweight (Jackson et al., 2007; Nobile et al., 2007; Villalbi et al., 2007); however, they were not found to significantly affect birthweight in this study. The reason for not finding trimester mother began prenatal care to significantly affect birthweight was possibly due to the small number of subjects who began prenatal care in the third trimester and the small number of subjects who received no prenatal care during pregnancy. The number of subjects who consumed alcohol during pregnancy was also likely too small to detect any significant difference between the two groups.

The findings of this study are subject to several limitations. First, because only white and black or African American women were included in the sample population, the full scope of how selected factors affect birthweight of other races in Bibb County, Georgia is unknown. Second, the small sample size of some subgroups made it difficult to detect any significant differences between the subgroups. Third, because subjects containing unknown fields for selected variables were deleted from the dataset, not all black and white women giving birth in Bibb County, Georgia in 2005 were included in the analysis.

This study provides information on significant risk factors for delivering a low birthweight infant in Bibb County, Georgia, based on the analysis of the most recent available individual data. The findings presented in this study will provide more scientific evidence that healthcare workers and public health professionals could use for intervention programs to decrease the incidence of infants born low birthweight in Bibb County, Georgia. By identifying significant risk factors associated with low birthweight, intervention programs and communication tools could focus on these risk factors and target at-risk women; hence, reducing the percentage of infants born low birthweight in Bibb County, Georgia.

Further studies on low birthweight in Bibb County, Georgia should include a trend analysis of significant risk factors from available OASIS data for years 1994 through 2006. Similar to the present study, the results of a trend analysis would identify significant risk factors over a twelve year time period for Bibb County. Analyzing more years of low birthweight data and trends of risk factors associated with low birthweight will give public health professionals and healthcare workers more insight into the increasing burden of low birthweight in Bibb County, Georgia. Studying risk factors over time would allow professionals to monitor risk factors on the decline and risk factors that are increasing. Future research should also include all races in Bibb County, Georgia in order to understand the full scope of the problem. Attributable risk of the significant risk factors should also be assessed in future studies.

## CONCLUSION

The percentage of low birthweight in Bibb County, Georgia has continually increased since 1994. Significant risk factors associated with the continued increase and burden of low birthweight that are found in this study are a maternal education of 12<sup>th</sup> grade or less, a maternal race of black or African American, using tobacco during pregnancy, and receiving less than six prenatal care visits. With the percentage of low birthweight in Bibb County, Georgia being higher than the national average and continually increasing, there is an immediate need to address these four significant risk factors in order to reduce low birthweight. In order to achieve the Healthy People 2010 goal at the local level and to provide a healthier start at life by being born normal weight, health professionals and the community must engage in intervention efforts. Health care workers, public health professionals, local health departments, and the North Central Health District office must improve current methods and implement new methods that will target receiving low birthweight in the Bibb County community.

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