



Pre-Pregnancy Body Mass Index: Associations with Pregnancy Outcomes and Adverse Maternal Health Conditions Florida PRAMS, 2000

June 8, 2003

PRAMS Report # 13

Findings at a Glance

- The prevalence of premature births was significantly higher among underweight women (12.4%) than among normal weight women (7.9%).
- During 2000, 30.9% of obese women delivered by Cesarean section.
- The prevalence of diabetes during pregnancy (20.3%) was highest among obese women.
- The prevalence of hypertension during pregnancy (26.9%) was highest among obese women.
- The prevalence of urinary tract infections during pregnancy was highest among underweight women (25.2%).
- Non-Hispanic Black women had the highest prevalence of pre-pregnancy obesity (20.6%).

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Introduction

Pregnancy is a critical period when good health plays a vital role in the health of both a mother and her baby. A healthy pregnancy is without health complications from the time of conception to the delivery of a healthy baby. According to the American Dietetic Association, women should establish a lifestyle for optimal health that reduces the chance of adverse pregnancy outcomes, before becoming pregnant.⁽¹⁾ Healthy pre-pregnancy weight is an essential element of such a lifestyle. However, weight alone is not a sensitive measure of body size and proportionality. To illustrate this point: at the same weight, a tall woman might be underweight, while a short woman, overweight. Weight-for-height status offers a better measure of weight with regard to body size and proportionality. Maternal pre-pregnancy weight-for-height status is measured by Body Mass Index (BMI) which is weight in kilograms divided by height in meters squared, $BMI = \text{kg}/\text{m}^2$.

The purpose of this report is to describe pre-pregnancy BMI and its relationship to pregnancy outcomes and health conditions. This report also describes the socio-demographics of women who are at risk of pre-pregnancy underweight, overweight, or obesity, among Florida women in 2000.

The following pregnancy outcomes were analyzed for this report: 1) preterm births, 2) delivery by Cesarean Section, 3) low birth-weight births, and 4) length of infant's stay in hospital. The following health conditions were analyzed for this report: 1) diabetes, 2) hypertension, 3) urinary tract infection, and 4) premature rupture of membranes (PROM).

In keeping with the growing concern for healthy pregnancy outcomes, our goal in analyzing these outcome variables was to document any associations between pre-pregnancy BMI and pregnancy outcomes and health factors among women in Florida. This report will contribute to the understanding about the relationships between pre-pregnancy BMI, birth outcomes, and health conditions.

Analysis for this report is based on data from the 2000 Florida Pregnancy Risk Assessment Monitoring System (PRAMS). PRAMS is a joint surveillance project between the Florida Department of Health and the U. S. Centers for Disease Control and Prevention, designed to monitor the physical, economic, and social health of Florida mothers and newborns. PRAMS is a mail survey with telephone follow-up of non-responders using a random sample of recent mothers of live-born infants completed when the infant is approximately three to six months old. In 2000, 2,065 surveys were completed with a response rate of 75.7%. The demographic distribution of survey respondents is given in Table 1. The results presented are weighted to reflect the total population of Florida new mothers and infants in 2000. SAS-callable SUDAAN was used to analyze the data.

Definitions

Body Mass Index (BMI) - $\text{Weight (kg)}/\text{height (m)}^2$ or $BMI = [\text{weight (lb)}/\text{height (in)}^2] \times 703$.

Low Birth Weight - A live infant weighing 2500 grams or less at birth.

Normal Weight - BMI of 19.8 to less than 25.

Obese - BMI of 30.0 or higher.

Overweight - BMI of 25.0 to less than 30.0.

Preterm Birth - The birth of a live infant with gestational age of 37 weeks or less.

Underweight - BMI of less than 19.8.

The Florida PRAMS survey assesses health problems during pregnancy by asking the following question:

Did you have any of these problems during your pregnancy?

- High blood pressure (including preeclampsia or toxemia) or retained water
- High blood sugar (diabetes)
- Urinary tract infection
- Water broke more than 3 weeks before your baby was due (premature rupture of membranes (PROM))

Table 1: Survey respondents' demographics by race/ethnicity (unweighted numbers and weighted percentages), Florida PRAMS 2000*

Maternal Demographic	Overall		non-Hispanic White		non-Hispanic Black		Hispanic	
	n	%	n	%	n	%	n	%
Overall	2065	100.0	844	51.8	803	23.1	368	22.6
Age Distribution								
19 Years and Under	660	12.6	246	10.3	286	20.5	119	10.4
20 to 24 Years	440	26.5	152	23.5	208	31.5	78	29.8
25 to 34 Years	734	46.8	325	48.6	235	35.7	141	51.8
35 Years and Over	231	14.1	121	17.5	74	12.3	30	8.0
Education								
Less Than 12 Years	596	20.1	198	13.4	260	27.2	134	29.0
12 Years	727	32.7	280	31.1	315	38.4	121	33.2
13 Years or More	733	47.2	364	55.4	221	34.4	113	37.8
Annual Household Income								
\$15,600 and Under	809	34.1	239	20.3	399	57.7	159	45.7
\$15,601 to \$39,600	622	37.6	292	41.8	200	28.5	110	34.8
\$39,601 and Over	391	28.3	239	37.9	83	13.8	54	19.6

*Due to small sample size and non-homogeneous characteristics, the race/ethnicity category of "Other" is excluded from this table and from data analysis conducted for this report.

Part 1: The Relationship Between Pre-Pregnancy BMI and Pregnancy Outcomes

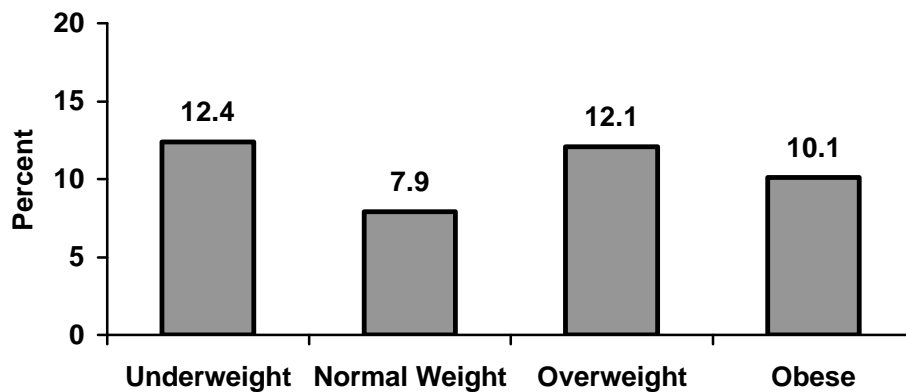
By examining preterm births, C-section deliveries, low birth-weight births and the length of infant's stay in the hospital, we can develop a greater understanding about the relationship between pre-pregnancy BMI and these pregnancy outcomes. Furthermore, this report will enable health care professionals to identify women who are at greater risk of adverse pregnancy outcomes.

Preterm Births

Most pregnancies last around 40 weeks. Babies born before 37 weeks of pregnancy are called premature or preterm and are at greater risk of suffering from serious health problems than babies born full term. Premature babies weigh less, their organs are not fully developed, they are more likely to face complications than babies born full term, and they usually require time in a neonatal intensive care unit. Premature babies also have a higher risk of death and permanent afflictions, such as mental retardation, cerebral palsy, lung and gastrointestinal problems, and vision and hearing loss.⁽²⁾

The overall prevalence of preterm births among new mothers in Florida during 2000 was 9.9%. The prevalence of preterm births among underweight women was substantially higher than among normal-weight women. Although the prevalence of preterm births among overweight women was apparently similarly greater than among normal-weight women, this difference was not found to be statistically significant (see Figure 1 & Table 2).

Figure 1: Prevalence of preterm births by pre-pregnancy BMI, Florida PRAMS 2000



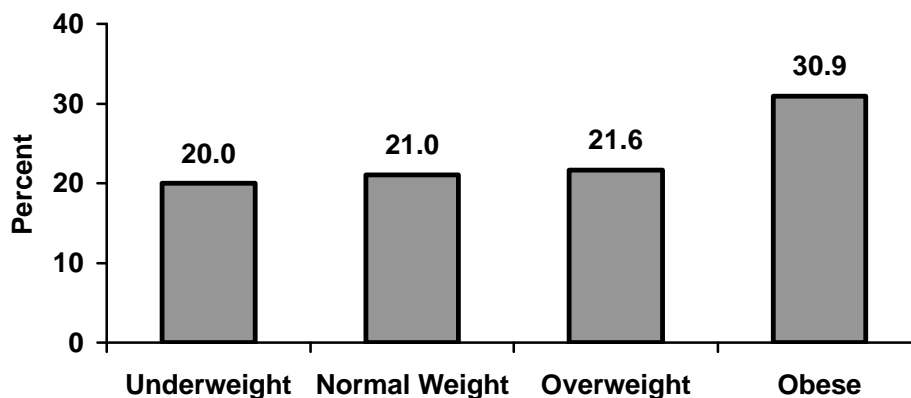
Delivery by Cesarean Section (C-Section)

A Cesarean Section delivery is usually performed when a vaginal birth is not possible or is not safe for the mother or child. Recovery from a Cesarean delivery takes longer than it would from a natural vaginal birth.

Reasons a woman might have an unplanned C-section include the following labor-related incidence: 1) The cervix stops dilating, or the baby stops progressing down the birth canal; 2) The baby's heart rate becomes irregular and may be unable to withstand continued labor; 3) The umbilical cord prolapses, or slips through the cervix, becomes compressed, and decreases oxygen supply to the baby.⁽³⁾ Although Cesarean sections are safe procedures, certain health risks are higher after Cesarean section than after vaginal delivery. These risks can include: 1) Adverse reactions to the anesthesia; 2) Surgery related risks such as bleeding, infection, injury to the woman's urinary tract, or injury to the baby.⁽³⁾

Overall, 22.8% of new mothers in Florida delivered their new baby by Cesarean section in 2000. The prevalence of birth by C-Section was the highest among obese mothers (See Figure 2 & Table 2).

Figure 2: Prevalence of delivery by Cesarean by pre-pregnancy BMI, Florida PRAMS 2000



Low Birth-Weight Births

Low birth-weight babies are more likely than babies of normal weight to develop health problems. Further, a low birth-weight premature baby is at greater risk of developing respiratory problems.^(4,5)

During 2000, 7.3% of births in Florida were low birth-weight. Among underweight new mothers, the prevalence of low birth-weight births (9.8%) was significantly higher than among their normal-weight counterparts (6.8%) (see Table 2). Studies have shown an association between low birth-weight births and maternal cigarette smoking during pregnancy.⁽⁶⁾ To rule out smoking during pregnancy as a possible confounder, we analyzed BMI by low birth-weight outcomes among women who smoked cigarettes during pregnancy. We found that pre-pregnancy BMI maintained a significant, independent association to low birth-weight outcomes among underweight women.

Length of Infant’s Stay in Hospital

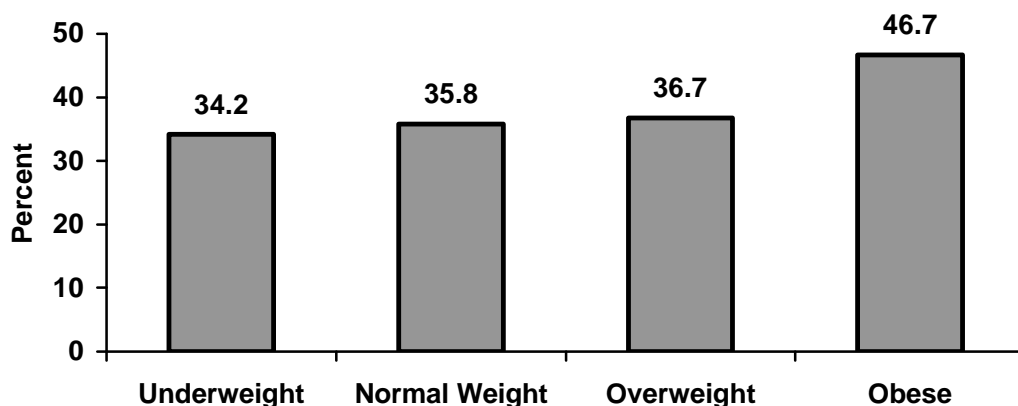
The length of an infant’s stay in the hospital can be indicative of the newborn’s need for extended care. In Florida, most new mothers and their newborns stay in the hospital for two days. In analyzing adverse birth outcomes, we looked for a correlation between mother’s pre-pregnancy BMI and the length of infant’s stay in the hospital.

Over one third (38.9%) of Florida newborns remained in the hospital for more than two nights in 2000. The prevalence of newborns who spent more than two nights in the hospital was significantly higher among those born to obese mothers than among those born to either underweight or normal-weight mothers (see Figure 3 & Table 2).

Table 2: Prevalence of birth outcomes by pre-pregnancy BMI, Florida PRAMS 2000

Birth Outcomes	Overall	BMI			
		< 19.8	19.8 - <25	25 - <30	>=30
Preterm Birth	9.9	12.4	7.9	12.1	10.1
Delivery by C-Section	22.8	20.0	21.0	21.6	30.9
Low-Birth-Weight Birth	7.3	9.8	6.8	7.5	7.6
Length of Stay in Hospital > Two Days	38.9	34.2	35.8	36.7	46.7

Figure 3: Prevalence of infant's stay in hospital greater than two days by pre-pregnancy BMI, Florida PRAMS 2000



Part 2: The Relationship Between Pre-Pregnancy BMI and Adverse Maternal Health Conditions

Existing research and information pertinent to maternal and child health can be enhanced by an examination of relationships between pre-pregnancy BMI and adverse health conditions, such as diabetes, hypertension, urinary tract infection, and premature rupture of membranes (PROM). In particular, this report will enable health care workers to identify women who are at risk of adverse health conditions during their pregnancy.

Diabetes

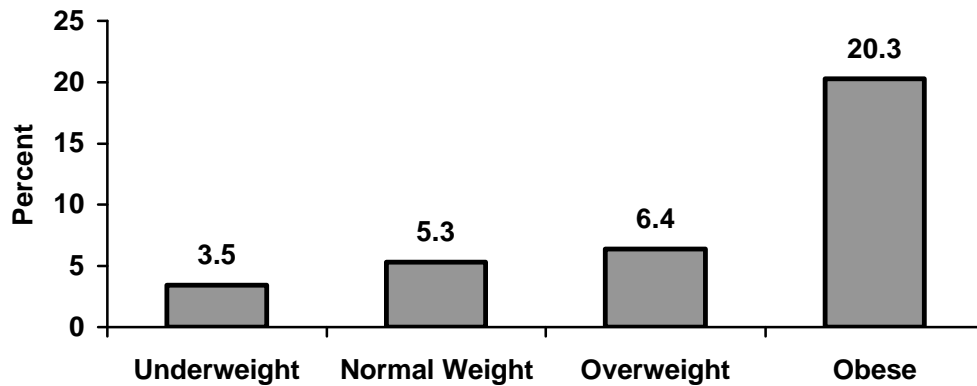
Despite advances in medical technology, babies born to women with diabetes, especially women with poor diabetes control, are still at risk of having birth defects. High blood sugar levels and ketones (substances that in large amounts are poisonous to the body) pass through the placenta to the baby. These increase the chance of birth defects. Hence, good blood sugar control before pregnancy is very important.⁽⁷⁾

Gestational diabetes is a type of diabetes that starts during pregnancy. Complications of gestational diabetes include the following:

- A greater than normal risk for developing high blood pressure during pregnancy.
- A greater than normal risk of excessive fetal weight gain, which can cause difficulty for the baby's shoulders to pass through the vagina during birth (shoulder dystocia). This can lead to injury to the nerves in the baby's neck or other injuries during delivery.
- Increased risk of C-section delivery.
- Increased risk of low blood glucose levels (hypoglycemia), low blood calcium levels, high bilirubin blood levels (jaundice), or breathing difficulties in the newborn infant.⁽⁶⁾

Overall, 7.8% of new mothers in Florida had diabetes during pregnancy in 2000. We found no significant difference in the prevalence of diabetes among pregnant women by race/ethnicity (see Table 3). The prevalence of diabetes during pregnancy was highest among obese mothers (see Figure 4 & Table 4).

Figure 4: Prevalence of diabetes during pregnancy by pre-pregnancy BMI, Florida PRAMS 2000



Hypertension (High Blood Pressure)

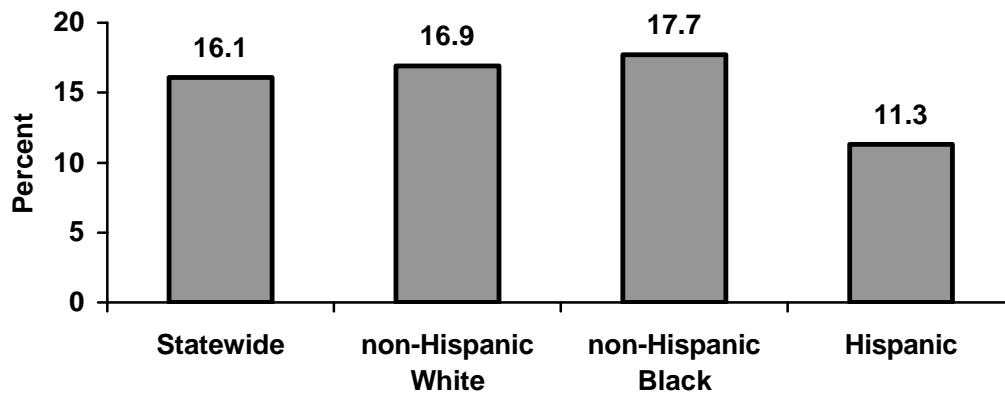
High blood pressure during pregnancy can cause serious complications. It can cause a decrease in the blood and oxygen supply available to a mother and her baby. It can lead to maternal kidney problems, breathing problems, seizures, strokes, and even death. The unborn infant may have difficulty with growing, getting enough oxygen, and other complications.⁽⁸⁾

Out of every 100 pregnant women, five to ten will develop high blood pressure during their pregnancies.⁽⁸⁾ Risk factors for developing high blood pressure include:

- First pregnancy under age 17 or over age 35.
- Family history of high blood pressure.
- Pregnant with twins or triplets.
- Poor diet during pregnancy.
- Overweight.
- Smoking tobacco.
- Adverse blood vessel conditions, kidney disease, or diabetes.⁽⁸⁾

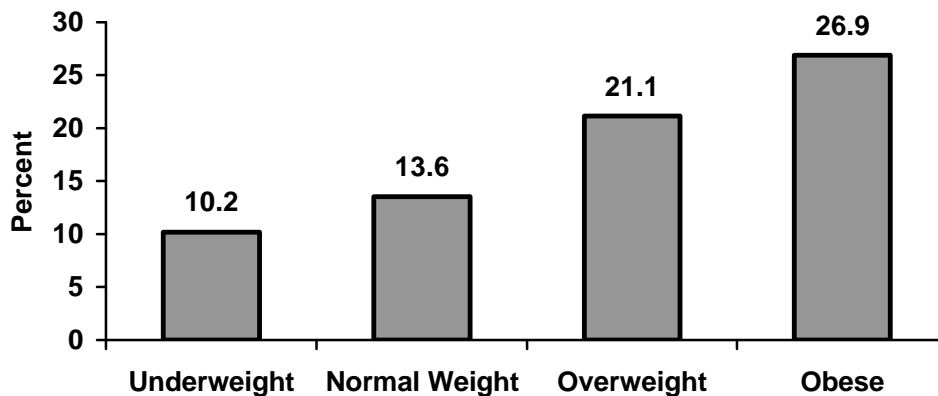
The overall prevalence of hypertension during pregnancy among new mothers in Florida was 16.1%. New mothers who were of non-Hispanic Black race/ethnicity had a higher prevalence of hypertension during pregnancy than their Hispanic counterparts (see Figure 5 & Table 3).

Figure 5: Prevalence of hypertension during pregnancy by race/ethnicity, Florida PRAMS 2000



Hypertension during pregnancy among overweight women was higher than among both underweight women and normal-weight women. The prevalence of hypertension during pregnancy was highest among obese women (see Figure 6 & Table 4).

Figure 6: Prevalence of hypertension during pregnancy by pre-pregnancy BMI, Florida PRAMS 2000

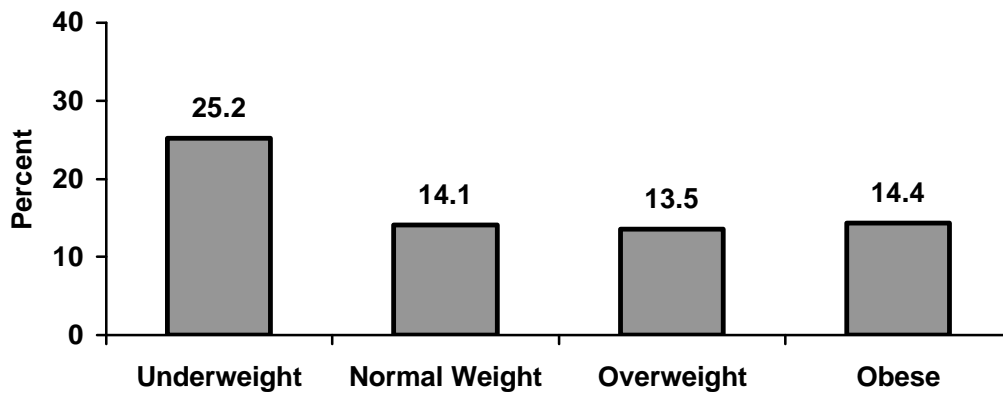


Urinary Tract Infection

A study of perinatal registry data found that women who had a urinary tract infection during pregnancy were significantly more likely than those who did not to have a premature delivery and to deliver low birth-weight infants. The presence of a urinary tract infection during pregnancy also was associated with premature labor and hypertension.⁽⁹⁾

Overall, 16.3% of new mothers suffered from urinary tract infections during pregnancy. We found no significant differences in the prevalence of urinary tract infections among pregnant women by race/ethnicity (see Table 3). The prevalence of urinary tract infections during pregnancy was highest among women who were underweight before pregnancy (see Figure 7 & Table 4).

Figure 7: Prevalence of urinary tract infections during pregnancy by pre-pregnancy BMI, Florida PRAMS 2000



Premature Rupture of Membranes (PROM)

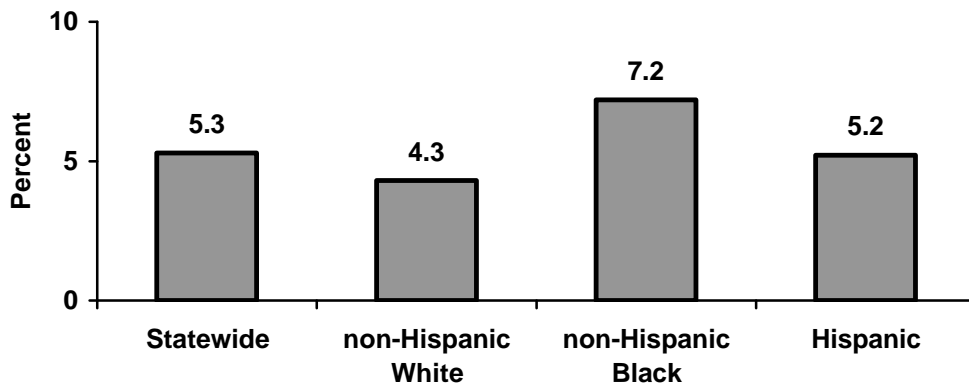
PROM occurs when the amniotic membranes surrounding the unborn baby break, causing the fluids to leak out. When this occurs near the end of the pregnancy (after 37 weeks, or full term) it is known as term PROM. However, it is still considered as premature since labor contractions have not started.

Infection is the main risk to the continuing pregnancy once PROM is confirmed. The amniotic membranes and fluids represent a formidable barrier to infection. When PROM occurs, bacteria may enter the lower genital tract into the womb. This can cause infection around the baby.

The other main risk to the baby is that of premature delivery. Prematurely born babies potentially face breathing difficulties as their lungs are not adequately developed. Premature newborns' bodily systems are immature. Furthermore, depending on the age at which they are born, premature infants can face many weeks in a neonatal intensive care unit.⁽¹⁰⁾

The prevalence of PROM more than 3 weeks before their baby's due date was 5.3% among Florida new mothers during 2000. The prevalence of PROM was significantly higher among non-Hispanic Black women than among their non-Hispanic White counterparts (see Figure 8 & Table 3).

Figure 8: Prevalence premature rupture of membranes (PROM) by race/ethnicity, Florida PRAMS 2000



The prevalence of PROM was higher among obese mothers than among underweight mothers (see Figure 9 & Table 4).

Figure 9: Prevalence of premature rupture of membranes (PROM) by pre-pregnancy BMI, Florida PRAMS 2000

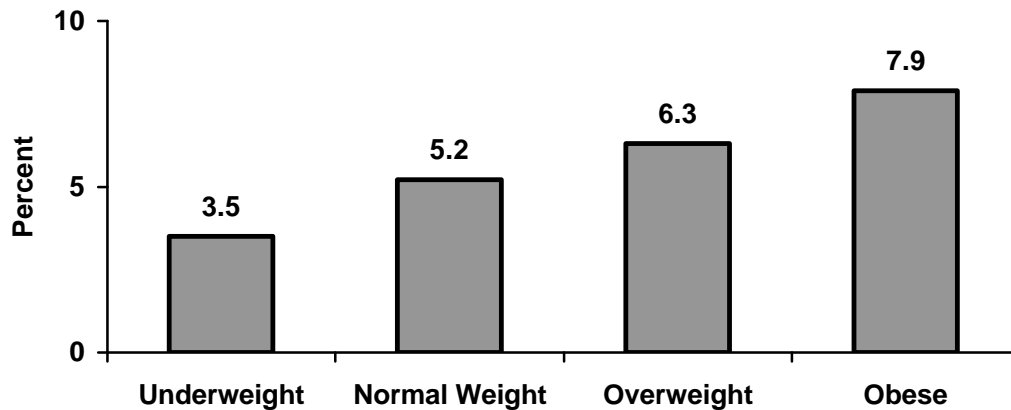


Table 3: Prevalence of maternal health factors by race/ethnicity, Florida PRAMS 2000

Maternal Factors	Overall	non-Hispanic White	non-Hispanic Black	Hispanic
Diabetes during Pregnancy	7.8	7.7	8.1	7.4
Hypertension during Pregnancy	16.1	16.9	19.7	11.3
Urinary Tract Infections during Pregnancy	16.3	15.8	17.2	14.6
Premature Rupture of Membranes (PROM)	5.3	4.4	7.2	5.2

Table 4: Prevalence of maternal health factors by pre-pregnancy BMI, Florida PRAMS 2000

Maternal Factors	Overall	BMI			
		< 19.8	19.8 - <25	25 - <30	>=30
Diabetes during Pregnancy	7.8	3.5	5.3	6.4	20.3
Hypertension during Pregnancy	16.1	10.2	13.6	21.1	27.0
Urinary Tract Infections during Pregnancy	16.3	25.2	14.1	13.5	14.4
Premature Rupture of Membranes (PROM)	5.3	3.5	5.2	6.3	7.9

Part 3: Maternal Demographics: Who is at Risk of Pre-Pregnancy Underweight, Overweight, or Obesity?

The overall prevalence of pre-pregnancy underweight among Florida women during 2000 was 17.4%. Nearly half (47.5%) of Florida women who gave birth to a live-born infant during 2000 were of normal pre-pregnancy BMI, while 21.0% were overweight before pregnancy, and 14.1% were obese prior to becoming pregnant (see Table 5).

Race/Ethnicity

Over half (51.8%) of Florida new mothers in 2000 were non-Hispanic White, less than one-fourth (23.1%) were non-Hispanic Black, and 22.6% were Hispanic.

When analyzing pre-pregnancy BMI by race/ethnicity, the prevalence of pre-pregnancy underweight was significantly higher among non-Hispanic White women (18.8%), than among non-Hispanic Black women (12.3%). Non-Hispanic Black women had lower a prevalence of normal pre-pregnancy BMI (41.0%) than both non-Hispanic White (49.1%) and Hispanic women (52.0%). The prevalence of pre-pregnancy overweight was higher among non-Hispanic Black women (26.2%) than among non-Hispanic White women (19.7%). The prevalence of pre-pregnancy obesity was highest among non-Hispanic Black women (20.6%). In contrast, 12.4% of non-Hispanic White women were obese before becoming pregnant, and 11.8% of Hispanic women were obese before becoming pregnant (see Table 5).

Age

Overall, 12.6% of women in Florida who gave birth to a live-born infant were 19 years old and under. Over one-fourth (26.5%) were between 20 years old and 24 years old. Just under half of Florida new mothers in 2000 were between 25 years and 34 years old, while 14.1% were 35 years old and over. Florida women aged 19 and under had the highest prevalence (27.5%) of pre-pregnancy underweight during 2000 among all age groups. The prevalence of pre-pregnancy underweight was higher among women between the ages of 20 years and 24 years (18.0%) than among both those ages 25 to 34 (16.8%) and those ages 35 and over (8.8%). The prevalence of pre-pregnancy obesity was higher among women who were at least 25 years of age than among those ages 19 and under. Women who were at least 35 years of age had a higher prevalence of pre-pregnancy obesity than women who were 24 years old and under (see Figures 9 & 10, & Table 5).

Figure 9: Prevalence of pre-pregnancy underweight by age, Florida PRAMS 2000

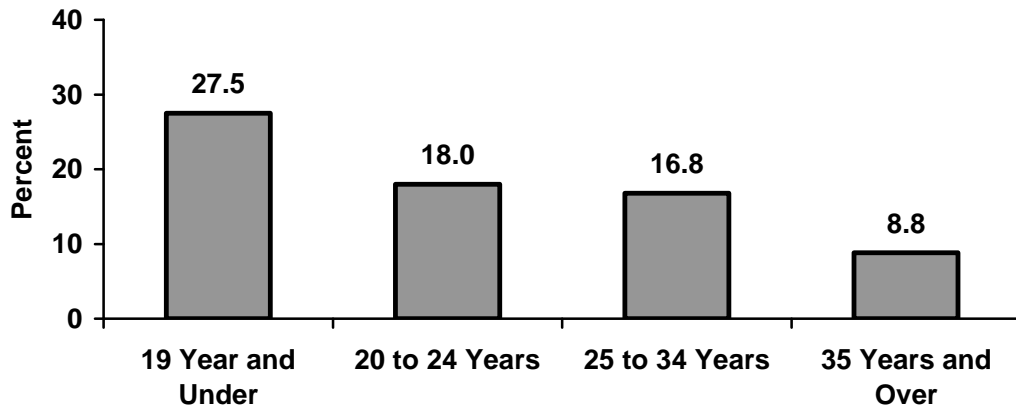
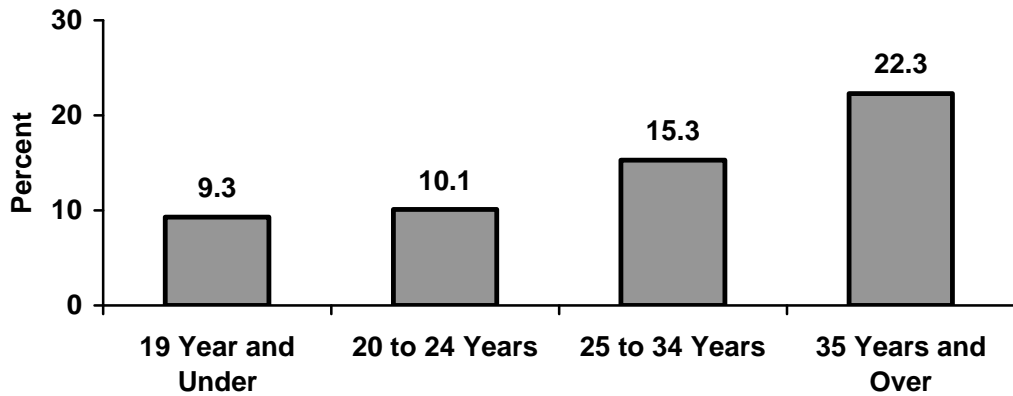


Figure 10: Prevalence of pre-pregnancy obesity by age, Florida PRAMS 2000



Education Level

Overall, one in five (20.1%) new mothers in Florida during 2000 had less than 12 years of formal education. Approximately one in three (32.7%) had exactly 12 years of formal education, and almost half (47.2%) of them had at least 13 years of formal education. When analyzing pre-pregnancy BMI by levels of education, we found no significant differences in BMI categories (see Table 5).

Annual Household Income

Approximately over one in three (34.1%) of Florida new mothers had household incomes of \$15,600 and under. Similarly, 37.6% of new mothers in Florida had household incomes of between \$15,601 and \$39,600. Finally, 28.3% had household incomes of \$39,601 and over. When analyzing pre-pregnancy BMI by annual household income, we found no significant differences in BMI categories (see Table 5).

Marital Status

During 2000, 62.3% of new mothers in Florida were married, while 37.7% were not married. The prevalence of pre-pregnancy underweight was significantly higher among women who were not married (21.1%) than among their married counterparts (15.2%) (see Table 5).

Table 5: Maternal demographics by pre-pregnancy BMI percentages, Florida PRAMS 2000

Maternal Demographics	Overall	BMI			
		< 19.8	19.8 - <25	25 - <30	>=30
Overall	100.0	17.4	47.5	21.0	14.1
Maternal Race/Ethnicity					
non-Hispanic White	51.8	18.8	49.1	19.7	12.4
non-Hispanic Black	23.1	12.3	41.0	26.2	20.6
Hispanic	22.6	16.6	52.0	19.6	11.8
Other*	2.5	41.0	36.7	12.4	10.0
Maternal Age					
19 Years and Under	12.6	27.5	45.6	17.6	9.3
20 to 24 Years	26.5	18.0	50.0	21.9	10.1
25 to 34 Years	46.8	16.8	47.4	20.5	15.3
35 Years and Over	14.1	8.8	44.8	24.1	22.3
Maternal Education					
Less than 12 Years	20.1	20.2	43.8	19.9	16.2
12 Years	32.7	17.2	47.5	20.9	14.4
13 Years or More	47.2	16.6	48.9	21.5	13.0
Annual Household Income					
\$15,600 and Under	34.1	16.4	45.6	20.4	17.5
\$15,601 to \$39,600	37.6	17.2	45.1	22.7	14.9
\$39,601 and Over	28.3	17.6	50.5	21.3	10.5
Marital Status					
Married	62.3	15.2	49.9	21.8	13.1
Not Married	37.7	21.1	43.4	19.6	15.9
WIC Participation					
Yes	40.9	16.3	42.8	21.7	19.2
No	59.1	18.3	50.4	20.5	10.9

*Due to small sample size and non-homogeneous characteristics, the race/ethnicity category of "Other" is excluded from data analysis conducted for this report.

Summary

Among new mothers in Florida during 2000, the prevalence of pre-pregnancy underweight was highest among non-Hispanic White women aged 19 years and under. On the other hand, the prevalence of pre-pregnancy obesity was higher among non-Hispanic Black women and women aged 35 and older than among women of other racial groups or women aged 34 and under.

Findings in this report show that higher levels of poor birth outcomes and health conditions are present among women who are either underweight or obese prior to pregnancy. Underweight mothers had higher levels of preterm delivery, low birth-weight infants, and urinary tract infections.

This study also found that mothers who were obese had a higher prevalence of C-sections, diabetes, hypertension, PROM, and infants who had longer hospital stays. These findings correspond to other research that shows an association between obesity and increased incidence of diabetes and hypertension. Both diabetes and hypertension are also associated with poor birth outcomes.⁽¹¹⁾

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