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Michele Kiely
CUNY School of Public Health

Ayman El-Mohandes
CUNY School of Public Health

Marie G. Gantz
RTI International

Dhuly Chowdhury
RTI International

Jutta S. Thornberry
RTI International

See next page for additional authors

Authors

Michele Kiely, Ayman El-Mohandes, Marie G. Gantz, Dhuly Chowdhury, Jutta S. Thornberry, and M. Nabil El-Khorazaty

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Michele Kiely[1], Ayman A.E. El-Mohandes[2], Marie G. Gantz[3], Dhuly Chowdhury[3], Jutta S. Thornberry[3], and M. Nabil El-Khorazaty*[3]

[1]*Eunice Kennedy Shriver* NICHD/NIH/HHS, Rockville, MD;

[2]College of Public Health, University of Nebraska Medical Center, Omaha, NE,

[3]RTI International, Rockville, MD;

*Deceased

Corresponding author: Michele Kiely, Division of Epidemiology, Statistics and Prevention Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, 6100 Executive Blvd, Rockville, MD 20852-7510, US, 301-594-1261, FAX: 301-402-2084, kielym@nih.gov

Short title: Understanding Adverse Pregnancy Outcome Risks

ABSTRACT

Objectives: This study investigates the relationship between diabetes, hypertension, preeclampsia, and Body Mass Index (BMI) -- the most common and interrelated medical conditions occurring during pregnancy; sociodemographic and behavioral risk factors; and adverse pregnancy outcomes in high-risk urban African American women in Washington, DC.

Methods: Data are from a randomized controlled trial conducted in 6 prenatal clinics. Women in their 1st or 2nd trimester were screened for behavioral risks (smoking, environmental tobacco smoke exposure, depression, and intimate partner violence) and demographic eligibility. 1,044 were eligible, interviewed and followed through their pregnancies. Classification and Regression Trees (CART) methodology was used to: 1) explore the relationship between medical and behavioral risks (reported at enrollment), sociodemographic factors and pregnancy outcomes, 2) identify the relative importance of various predictors of adverse pregnancy outcomes, and 3) characterize women at the highest risk of poor pregnancy outcomes.

Results: Overall, the strongest predictors of poor outcomes were prepregnancy BMI, preconceptional diabetes, employment status, intimate partner violence, and depression. In CART analysis, preeclampsia was the first splitter for low birthweight; preconceptional diabetes was the first splitter for preterm birth (PTB) and neonatal intensive care admission; BMI was the first splitter for very PTB, large for gestational age, Cesarean section and perinatal death; and employment was the first splitter for miscarriage.

Conclusions: Preconceptional factors play a very important role in pregnancy outcomes. For many of these women, the risks that they bring into the pregnancy were more likely to impact their pregnancy outcome than events during pregnancy.

INTRODUCTION

Diabetes, hypertension, preeclampsia and obesity are among the most common medical conditions causing pregnancy complications and adverse pregnancy outcomes [1-5]. Chronic hypertension is strongly associated with obesity and diabetes and is a strong predictor for preeclampsia. Diabetic mothers are more likely to be obese and are also at increased risk for preeclampsia. Preeclampsia is associated with increased maternal and perinatal morbidities and is a cause of preterm and late preterm births [5]. All four conditions are known risk factors for perinatal complications including low birthweight, preterm birth, Cesarean section and other associated morbidities and mortality [6-8]. In addition, outcomes have been shown to be worse when women have more than one of these diagnoses [9].

The prevalence of maternal diabetes, hypertension, preeclampsia and obesity has increased significantly over the past few decades [10,11]. Preconceptional and gestational diabetes increased by an average of 3% per year in the 1990s and the rise has increased to about 6% per year since 2000 [12]. The percentage of the US population diagnosed with diabetes more than doubled from 2.4% in 1976 to 6.3% in 2008 [11]. Trends from 1988-94 through 2005-06 indicate that among adults age $\geq$20 years, rates of obesity (body mass index (BMI) $\geq$ 30) increased from 23% to 34%, and rates of extreme obesity (BMI $\geq$ 40) increased from 3% to 6% [13]. These increases in diabetes and obesity occurred across race/ethnicity groups, genders and education levels [14]. During the period 1987-2004, rates of preeclampsia and gestational hypertension in the U.S. increased significantly, by 25% and 184%, respectively. The age-adjusted rate (per 1,000 deliveries) of preeclampsia rose from 23.6 to 29.4 and the rate of gestational hypertension rose from 10.7 to 30.6 [15].

Racial disparities in obstetric outcomes have been a documented problem for much of the last century [16], with a consistent two-fold increase in the infant mortality rate between African American infants and White infants [17]. In a recent review of obstetric outcomes and care, African Americans did consistently worse than other racial/ethnic minorities (American Indian/Alaska Natives, Asian/Pacific Islanders and Hispanics) [18]. While much of the disparity in infant mortality is attributable to the higher rates of low birth weight and preterm birth, the actual causes of these disparities remain unknown. Behavioral risk factors such as smoking, secondhand smoking, depression and domestic violence are known to contribute to the risk of adverse pregnancy outcomes [19-21]. When such behavioral risks are combined with complex and interrelated medical factors an interdisciplinary approach is necessary. This study investigates the relationship between preconceptional and gestational diabetes, chronic and gestational hypertension, preeclampsia, BMI (as a categorical variable), and behavioral and environmental risk factors (cigarette smoking, environmental tobacco smoke exposure (ETSE), depression, intimate partner violence (IPV), and alcohol and drug use during pregnancy) and adverse pregnancy outcomes in high-risk urban African American women. The use of Classification and Regression Trees (CART) is intended to show the relative contribution of these co-occurring risk factors to low birth weight, preterm birth, Cesarean section and other associated morbidities.

METHODOLOGY

The "NIH-DC Initiative to Reduce Infant Mortality in Minority Populations" is a congressionally mandated research project. The collaboration includes Children's National Medical Center, Georgetown University, George Washington University Medical Center,

Howard University, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, the National Center on Minority Health and Health Disparities and RTI International. As part of this collaboration, a randomized controlled trial (RCT) was conducted to evaluate the efficacy of an integrated behavioral intervention delivered during (prenatal care) PNC in reducing cigarette smoking, ETSE, depression and IPV during pregnancy and in improving pregnancy outcomes. This RCT, called DC-HOPE (Healthy Outcomes of Pregnancy Education), was reviewed and approved by the institutional review boards of all participating institutions. The secondary analysis described in this paper is based on data from DC-HOPE.

Participants

Women were screened and recruited at six community-based PNC sites serving mainly minority women in Washington, DC, between July, 2001 and October, 2003, and followed until July 2004. Women were demographically eligible if they self-identified as being a minority, were ≥18 years old, ≤28 weeks pregnant, a DC resident and English speaking. Women were consented for screening and baseline interview (if eligible), and were screened for demographic eligibility and for risk factors using an audio-computer assisted self interview. An average of 9 days after screening, a baseline interview took place where more detailed information on sociodemographics, reproductive history and behavioral risks was collected. Following this interview, women were randomized to the intervention or usual care group. At enrollment and upon delivery, medical records were abstracted. The main results of this RCT are previously published [22-24].

A total of 2,913 women were screened and 1,398 met eligibility criteria. Of these, 85% (n=1,191) consented to participate in a baseline telephone interview before randomization; 1,070 (89.9%) were reached and participated. Of these women, 1,044 were African American and still

pregnant at the time of the baseline interview. Of those 1,044, women for whom birth outcomes were available (n=918) are included in these analyses. Birthweight or gestational age at birth was recorded for 867 live births.

Measures

Data on sociodemographic and behavioral risk factors were based on self reporting by pregnant women in a baseline telephone interview. Data on preeclampsia, preconceptional and gestational diabetes, chronic and gestational hypertension, prepregnancy BMI, pregnancy outcome, mode of delivery, and infant's gestational age, birthweight, neonatal intensive care unit (NICU) admission and perinatal death were abstracted from medical records. In a small number of cases, pregnancy outcome was obtained through phone calls to the participant, and gestational age was calculated based on the reported delivery date.

Definitions of risk factors, such as BMI and large for gestational age (LGA), vary by racial and ethnic groups; thus, race and ethnicity should be accounted for in developing indices and in analysis [25,26]. In the current analysis, race-specific criteria for developing those measures were adopted. Recommended BMI categories systematically overestimate the proportion of overweight and obese African Americans. In addition, the standard overweight and obesity cut-points overestimate the body fat percentages among African Americans [26]. Thus the race-specific BMI categories suggested by Jackson and colleagues' were used in this analysis [26]. Normal weight was defined as BMI less than 26.4, overweight was defined as BMI between 26.4 and 31.9, while obese was defined as BMI $\geq$31.9. For the definition of LGA, the results for African American infants published by Zhang and Bowes [25] were utilized to identify those in the upper 10th percentile.

Data on intimate partner violence were collected using the Revised Conflict Tactics

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Scale, the time frame being over the past year. Depression was assessed using the Hopkins Symptom Checklist, measuring symptoms over the last month. Alcohol use was measured as frequency of consumption of beer, wine, wine coolers or liquor (individually), ranging from once or twice during pregnancy to daily consumption. A detailed smoking history was collected, including smoking in the past week and prior smoking, as well as measures of each participant's desire to and belief in, her ability to quit. ETSE was measured by self-reported estimates of tobacco smoke exposure on a typical day in the past week at home, in a car, at friends' home(s) and the workplace. Validated instruments were used to assess risk [24].

Five main outcomes were addressed: rates of low (<2,500 grams) and very low birthweight (<1,500 grams) (LBW, VLBW), preterm (<37 weeks) and very preterm birth (<33 weeks) (PTB, VPTB) and LGA (the upper 10th percentile). In addition, four other adverse events are discussed: Cesarean delivery, miscarriage (<20 weeks gestation), infant admittance to the NICU and perinatal deaths (deaths 20+ weeks gestation or <28 days of life).

Analysis Plan

Bivariate analyses compared the 1,044 African American women enrolled in DC-HOPE to the subset of 918 with data on pregnancy outcomes. Chi-square tests were used to compare categorical variables between the two groups of women, and *t* tests were used for continuous variables. SAS version 9.1 was used for these analyses (SAS Institute Inc., Cary, NC).

In addition, CART methodology was applied (CART version 6.0, Salford Systems, San Diego, CA). CART is a binary tree method used to predict a dependent variable, whether categorical (classification) or continuous (regression), as a function of a set of independent variables [27-30]. The methodology seeks hidden and complex structures or patterns in data by

constructing a series of binary splits, called recursive partitioning, each based on one independent variable selected to minimize the within groups variance of the dependent variable.

The series of binary splits result in a tree which visually represents the relationships between the predictors and outcome. These trees can be very large, with many branches, and they are often "pruned" by the user so that a truncated version of the tree results. CART also produces a ranking of the predictors in order of their importance for predicting the outcome. These rankings also depend on the pruning of the tree.

The most promising advantage of CART is that various interaction effects among predictors can be examined [28]. The visual display of the tree makes it easy to see the hierarchical interaction of independent variables. CART trees can reveal the importance of predictors which may otherwise be masked by other variables included in the tree. This advantage of CART analysis is very important for our study as the medical conditions (hypertension, diabetes, preeclampsia and obesity) included as predictors in the models are interrelated. Details on CART methodology as used in epidemiological studies have been previously described [30].

This paper gives a comprehensive picture of the relationship between medical, behavioral and sociodemographic factors on one hand, and various pregnancy outcome measures on the other. CART methodology is applied to: 1) explore the relationship between 17 predictors (preconceptional and gestational diabetes, preeclampsia, BMI, chronic and gestational hypertension, cigarette smoking, ETSE, depression, IPV, alcohol use and illicit drug use, education, employment, relationship status, Medicaid and the Women, Infants and Children program (WIC)), and adverse pregnancy outcomes (LBW, VLBW, PTB, VPTB, LGA, Cesarean-section, miscarriage, NICU admission and perinatal death), 2) identify the best

discriminating variables, thus indicating the relative importance of various predictors in relation to the adverse pregnancy outcome, and 3) characterize subgroups of high-risk women at the highest risk of adverse pregnancy outcomes.

RESULTS

Bivariate comparisons of the 1,044 eligible African American women to the subset of 918 with known pregnancy outcomes are presented in Table 1. The results indicate no significant differences in risk factors between the total study sample and the women included in these analyses. It is striking to observe the high percentages of women who were overweight or obese (26.5% and 27.4%, respectively among the total sample, and 26.9% for each category among women included in these analyses), who used alcohol (21.4% for the total sample and 22% for women included in these analyses), and who used illicit drug (11.8% for the total sample and 12.3% for women included in these analyses) in this high-risk, pregnant population.

Pregnancy resulted in miscarriage in 2.4% of cases and perinatal death in 1.9%. Of live births, 12.8% were LBW, 1.7 % were VLBW, 13.4% were PTB, 2.5% were VPTB and 9.4% were LGA.   Cesarean delivery was reported in 29.1% of live births and the infant's admittance to NICU was reported in 13.2%.

Overall Results

Table 2 shows the relative importance from CART analysis of the 17 predictors, after accounting for masking, with respect to the 9 adverse pregnancy outcomes. The overall rankings for the predictor variables (based on averaging the rankings over all outcomes) indicate that the strongest predictors of poor pregnancy outcomes in these data are BMI, preconceptional diabetes, employment status, intimate partner violence and depression. For almost all of the poor pregnancy outcomes (LBW, VLBW, VPTB, LGA, Cesarean section, miscarriage, NICU

admission, and perinatal deaths), BMI plays a major role. Preconceptional diabetes was an important predictor of LGA, Cesarean section, NICU admission, perinatal death and PTB. Gestational hypertension was an important predictor of VLBW and perinatal death. Preeclampsia was predictive of LBW. Among the psychosocial behavioral factors, IPV was an important predictor of VLBW, PTB and VPTB. Sociodemographic and behavioral factors were particularly important for predicting miscarriage. While BMI and preconceptional diabetes were the primary and secondary predictors in the overall ranking, the next 5 predictors were sociodemographic and behavioral factors (in rank order: employment, IPV, depression, alcohol use in pregnancy and education). Educational attainment was the strongest predictor of PTB and IPV was the second strongest. Employment status was the second strongest predictor of VPTB, the third strongest for miscarriage and the fourth for LBW and VLBW.

CART analysis revealed specific subgroups of pregnant women at risk for these adverse pregnancy outcomes. Truncated CART trees for the outcomes are presented in the charts. Selected results from these trees are described below.

LBW Results

Women with preeclampsia were more likely to have LBW babies (OR=3.13, 95% CI: 1.52-6.11). (Chart 1) Women without preeclampsia who smoked cigarettes at baseline were more likely to have LBW infants (OR=1.77, 95% CI: 1.03-2.98). Moreover, within the group of women without preeclampsia who were not smokers and were of normal weight, those who were depressed at baseline were significantly more likely to have a LBW infant (OR=1.90, 95% CI: 1.00-3.64).

VLBW Results

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BMI was the most important predictor of VLBW; however, none of the splits in the truncated CART tree reached a level of significance of p <0.05 (results not shown).

PTB Results

Pregnant women with preconceptional diabetes were significantly more likely to have a PTB (OR= 4.44, 95% CI: 1.90-9.93). (Chart 2) Moreover, women without preconceptional diabetes who were overweight or obese and receiving Medicaid were significantly more likely to have a PTB (OR=6.38, 95% CI: 1.01-264.79) than those not receiving Medicaid. In addition, among women without preconceptional diabetes who were overweight or obese and receiving Medicaid, women with a high school education or less were more likely to have a PTB than those who had at least some college education (OR=7.82, 95% CI: 1.23-325.12).

VPTB Results

Obese women were significantly less likely to have a VPTB (OR=0, 95% CI: 0-0.69). Among normal weight women, those who were depressed were significantly more likely to have VPTB (OR=2.91, 95% CI: 1.01-9.46). (Chart 3) In addition, for this same group, among the women who were depressed, those who were not employed were more likely to have a VPTB (OR=7.52, 95% CI: 1.07-325.06).

LGA Results

Obese women were significantly more likely to have a LGA infant (OR=2.26, 95% CI: 1.28-3.87) than those who were normal or overweight. (Chart 4)

Cesarean Section Results

Obese women were significantly more likely to have Cesarean section (OR=1.91, 95% CI: 1.29-2.81) than those who were normal or overweight. (Chart 5) Among non-obese women who did not have pregnancy-related hypertension, who had at most a high school education, and

who were not employed, women who did not consume alcohol during their pregnancy were more likely to have a Cesarean section (OR=2.03, 95% CI: 1.03-4.25) than women who did consume alcohol.

Miscarriage Results

Women who were employed were significantly more likely to have miscarriage (OR= 3.19, 95% CI: 1.23-8.88). (Chart 6)

NICU Admission Results

Women with preconceptional diabetes were significantly more likely to have infants admitted to NICU (OR=5.40, 95% CI: 2.25-12.56). (Chart 7) Moreover, among women without preconceptional diabetes, normal weight women were significantly more likely to have infants admitted to NICU (OR=2.00, 95% CI: 1.19-3.50) than overweight or obese women. For overweight or obese women without preconceptional diabetes, women with preeclampsia were significantly more likely to have babies admitted to NICU (OR=6.76, 95% CI: 1.62-24.21). Among women without preconceptional diabetes, normal weight women who were depressed at baseline were significantly more likely to have infants admitted to NICU (OR=1.77, 95% CI: 1.05-2.98) than those who were not depressed.

Perinatal Deaths Results

Infants born to overweight or obese women were more likely to experience perinatal deaths (OR=7.79, 95% CI: 1.20-328.21) than infants born to normal weight women (Chart 8)

DISCUSSION

This study evaluates the importance of various predictors of poor pregnancy outcomes in a population of high-risk, urban, African American mothers. Racial and ethnic disparities with respect to rates of preconceptional and gestational diabetes, being overweight or obese, having

chronic or pregnancy induced hypertension or preeclampsia, and the relationships between these risk factors and adverse pregnancy outcomes, are well documented [18,31-33]. When these complications co-occur, women are at heightened risk for poor pregnancy outcomes [9]. Behavioral risk factors such as alcohol or illicit drug use, depression and intimate partner violence, and environmental exposures including secondhand smoke may independently affect pregnancy adversely or further exacerbate the effects of medical complications. The women in this study brought many challenges to their pregnancies including behavioral risks and environmental exposures. Those risks, explored in our models, may also be surrogates for a set of circumstances that may be too complex to measure.

In order to truly understand the risks that contribute to poor pregnancy outcomes, it is important to understand and consider biological, psychosocial and behavioral risks concomitantly. The artificial separation of these risks as representing different domains may lead researchers to focus on biological risks, possibly because they believe them to be more amenable to change. The results of this analysis demonstrate an intensity of expression of psychosocial risks that bring them on par with well defined biological risks. It is worthy of note that for some of these adverse pregnancy outcomes the importance of the psychosocial risks outweighs that of the biological risks. When focusing on the biological risks, preconceptional diabetes ranked second while gestational diabetes ranked seventeenth; chronic hypertension ranked seventh while gestational hypertension ranked thirteenth. These two preconceptional risk factors may be driven by the overrepresentation of obesity in this population. The level of obesity seen in the women in this study is striking even considering the current epidemic of obesity among African Americans [34].

The gap between African American and White infant mortality and other adverse pregnancy outcomes is well documented [16,18]. Racial disparities in birth outcomes persist despite early access to prenatal care [16]. Our findings reinforce those of Lu et al. [34] that there is a need to increase access to interconception and preconception care. Although the women in DC-HOPE were recruited because of their risk profile, many had difficult lives above and beyond their eligibility to participate in our study. In order to improve birth outcomes among disadvantaged women such as those recruited to this study, there is a need to address the social and economic inequalities in which they live over the course of their lives [35].

The importance of risks occurring prior to pregnancy is evident throughout this analysis. The top six ranking risks (in order of importance) were BMI, preconceptional diabetes, IPV, depression, employment status and alcohol use. These predictors could be co-dependent; for example poverty, poor nutritional habits, obesity and diabetes can influence and be influenced by depression. It is possible to hypothesize many such permutations of the relationships among these variables that are potentially causally interrelated. It may be a fair assumption that many of these risks, if not averted, could be favorably modified by interventions delivered during the interconceptional period. Many of the pregnant women participating in this study began their pregnancies already predisposed to unfavorable pregnancy outcomes.

As a methodology, CART has advantages over customary analytic methods. In particular, it provides an integrated picture of risk factors and defines subpopulations that are at increased or lowered risk of the outcome of interest. In this instance, authors were struck by the strength of the finding of the importance of preconceptional factors. Given the strength of this finding, the challenge is how to encourage similar populations to address their health issues prior

to pregnancy. This is particularly true for populations that are neither planning their pregnancies nor practicing contraception.

The main strengths of our study include that the data were collected prospectively, as part of a randomized controlled trial. The limitations of the study include its restriction to high-risk African American women and the lack of its generalizability to a broader population. This sample of African American women screened into a behavioral intervention trial because they were at increased risk. The confidence intervals for some of the measures are extremely wide, reflecting the difficulty of estimating the precise impact of certain risk factors on the outcomes we saw in our population. We cannot be sure whether similar results would be found in a more representative, but still homogeneous, racial sample.

The findings of this study speak to the challenge of understanding that, to improve pregnancy outcomes, care cannot begin with onset of pregnancy. Since the early 1990s, guidelines have recommended preconception care, including a focus on consumer knowledge, clinical practice and public health programs [36]. As noted by Lu and colleagues [34] the unsuccessful efforts to reduce the gap in health disparities have focused on improving access to prenatal care. Recent findings from RCTs testing the efficacy of interventions focused on preconceptional health have shown measurable effects, mainly in the areas of nutrition and physical activity [37]. Preconceptional counseling has also been shown to change behaviors during pregnancy, including reduction in alcohol use and early adherence to recommended vitamin intake [38]. A more effective concept recommends the avoidance of fragmentation of child-bearing risk where poor reproductive outcomes are examined from the perspective of a single isolated risk. A single risk approach defies the naturally co-occurring multi-risk variables, especially within vulnerable populations [39]. We hope that this article will add to the growing

evidence intended to inform policy on the importance of focusing on the interconceptional and preconceptional period to offer specialized services to women in the reproductive age group and most significantly to those who may be manifesting early stages of chronic illness or risky health behaviors.

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Table 1.

Sociodemographic Characteristics and Prevalence of Various Risk Factors for

All DC-HOPE Participants and for Those with Known Pregnancy Outcomes

Characteristics	All women (n=1044)	Women with known pregnancy outcomes (n=918)	P-value *
Maternal age, mean ± SD, years	24.57 ± 5.41	24.59 ± 5.39	0.91
Education level	316 (30.27%)	274 (29.85%)	0.98
< High school, n (%)	486 (46.55%)	431 (46.95%)	
HS graduate/GED, n (%)	242 (23.18%)	213 (23.20%)	
At least some college, n (%)			
Employment status	381 (36.5%)	334 (36.4%)	0.96
Worked full or part-time, n (%)			
Relationship status from baseline interview			0.78
Single/ separated /widowed/ divorced, n (%)	797 (76.3%)	696 (75.8%)	
Married or living with partner, n (%)	247 (23.7%)	222 (24.2%)	
Preconceptional diabetes* (yes), n (%)	37 (4.2%)	35 (3.9%)	0.82
Gestational diabetes* (yes), n (%)	57 (6.4%)	57 (6.4%)	0.82
Chronic hypertension* (yes), n (%)	60 (6.7%)	58 (6.5%)	0.86
Pregnancy-related hypertension* (yes), n (%)	34 (3.8%)	34 (3.8%)	1.00
Preeclampsia (yes), n (%)	53 (6.2%)	53 (6.2%)	1.00
BMI Category			0.97
Normal weight, n (%)	284(46.1%)	248 (46.3%)	
Overweight, n (%)	163 (26.5%)	144 (26.9%)	
Obese, n (%)	168 (27.4%)	144 (26.9%)	
Cigarette smoking (yes), n (%)	198 (19.0%)	170 (18.5%)	0.80
Environmental tobacco smoke exposure (yes), n (%)	742 (72.4%)	652 (72.4%)	0.98
Depression (yes), n (%)	463 (44.4%)	404 (44.0%)	0.88
Intimate Partner Violence (yes), n (%)	336 (32.2%)	301 (32.8%)	0.78
Medicaid, n (%)	810 (78.0%)	717 (78.5%)	0.79
WIC, n (%)	455 (43.6%)	395 (43.0%)	0.80
Alcohol use during pregnancy, n (%)	223 (21.4%)	202 (22.0%)	0.73
Illicit drug use during pregnancy, n (%)	123 (11.8%)	113 (12.3%)	0.72

*Physician diagnosed

Table 2. Rankings of Predictor Importance for 17 Variable Influencing Adverse Pregnancy Outcomes (CART Results)

Predictor	LBW	VLBW	PTB	VPTB	LGA	Cesarean section	Mis-carriage	NICU	Perinatal Deaths	Overall Ranking
Preconceptional Diabetes	9	8	3	9	**1**	2	12	2	2	2
Gestational Diabetes	12	10	15	8	15	17	16	8	16	17
Chronic Hypertension	13	11	9	5	9	13	17	3	4	8[§]
Gestational Hypertension	15	3	14	16	17	5	15	9	3	14
Preeclampsia	**1**	6	17	17	8	11	14	4	6	8[§]
BMI	2	**1**	6	**1**	2	1	**1**	**1**	**1**	1
Cigarette Smoking	3	17	13	15	5	6	8	14	10	12[§§]
ETSE	17	5	8	12	16	15	11	13	15	16
Depression	6	7	11	4	7	10	7	5	13	5
IPV	5	2	2	3	13	9	13	10	12	4
Education	11	9	**1**	13	10	8	2	12	11	7
Employment	4	4	12	2	11	12	3	15	5	3
Marital Status	16	14	10	6	14	4	4	6	17	12[§§]
Medicaid	7	16	4	14	3	14	5	16	9	10
WIC	14	12	5	11	6	16	6	17	14	15
Alcohol Use in Pregnancy	10	15	7	7	4	3	10	11	8	6
Drug Use in Pregnancy	8	13	16	10	12	7	9	7	7	11

§The average ranking for Chronic Hypertension and Preeclampsia were identical.
§§The average ranking for Cigarette Smoking and Marital Status were identical.

Chart 1: LBW by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women
N = 833
% LBW = 12.8%

OR = 3.13 (95% CI, 1.52-6.11)

Preeclampsia
N = 51
% LBW = 29.4%

No Preeclampsia
N = 782
% LBW = 11.8%

OR = 1.77 (95% CI, 1.03-2.98)

Smokers
N = 145
% LBW = 17.2%

Non-Smokers
N = 637
% LBW = 10.5%

BMI < 26.4
N = 416
% LBW = 11.8%

BMI ≥ 26.4
N = 221
% LBW = 8.1%

OR = 1.9 (95% CI, 1.00-3.64)

Depressed
N = 171
% LBW = 15.8 %

Not Depressed
N = 245
% LBW = 9.0%
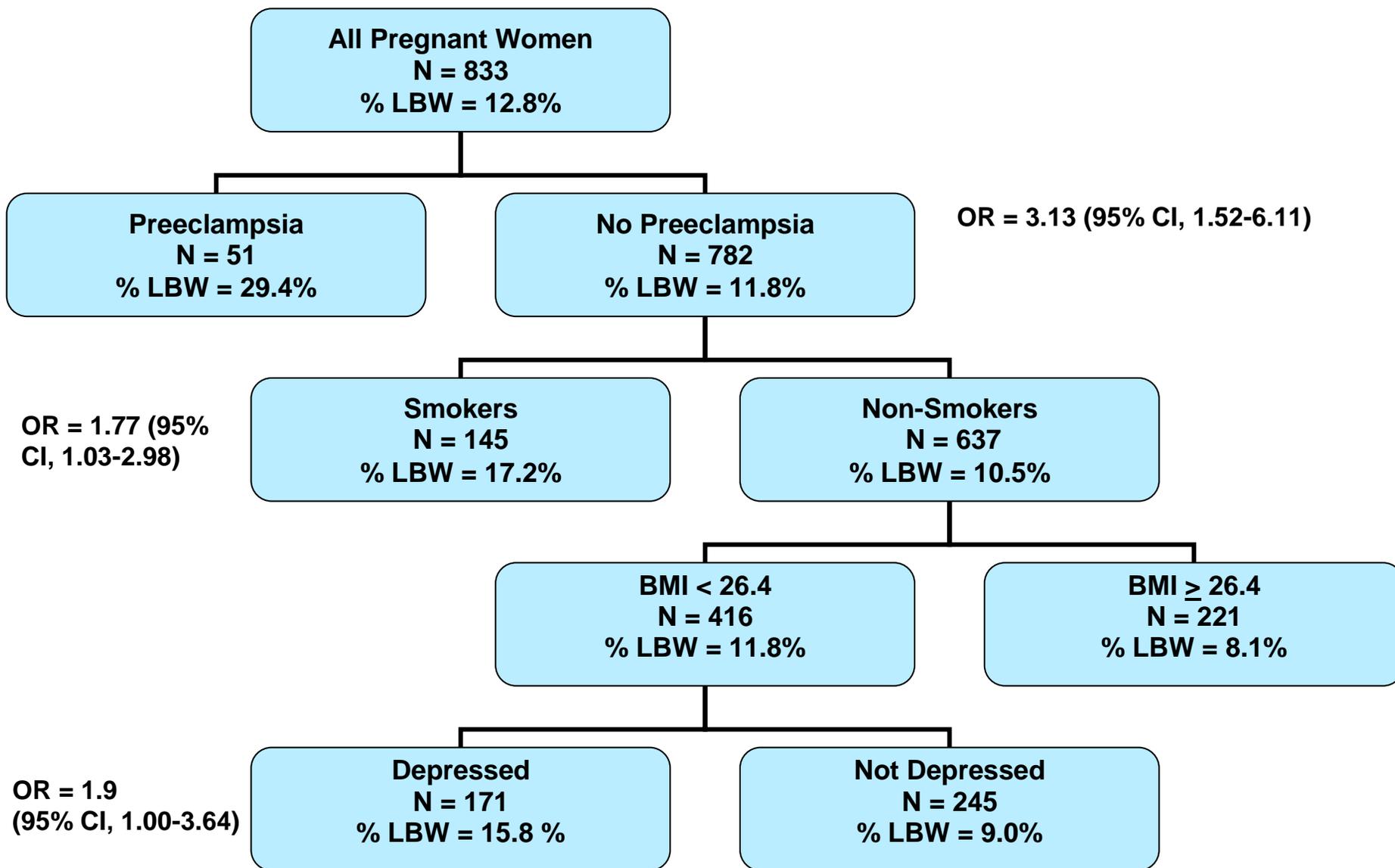
Chart 2: PTB by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women
N = 866
% PTB = 13.4%

Preconceptional Diabetes
N = 31
% PTB = 38.7%

No Preconceptional Diabetes
N = 835
% PTB = 12.5%

OR = 4.44 (95% CI, 1.90-9.93)

BMI < 26.4
N = 515
% PTB = 13.4%

BMI ≥ 26.4
N = 320
% PTB = 10.9%

IPV
N = 172
% PTB = 17.4%

No IPV
N = 343
% PTB = 11.4%

Medicaid
N = 274
% PTB = 12.4%

OR = 6.38
(95% CI, 1.01-264.79)

No Medicaid
N = 46
% PTB = 2.2%

OR = 7.82 (95% CI, 1.23-325.12)

Education ≤ High School
N = 227
% PTB = 14.5%

Education > High School
N = 47
% PTB = 2.1%

26
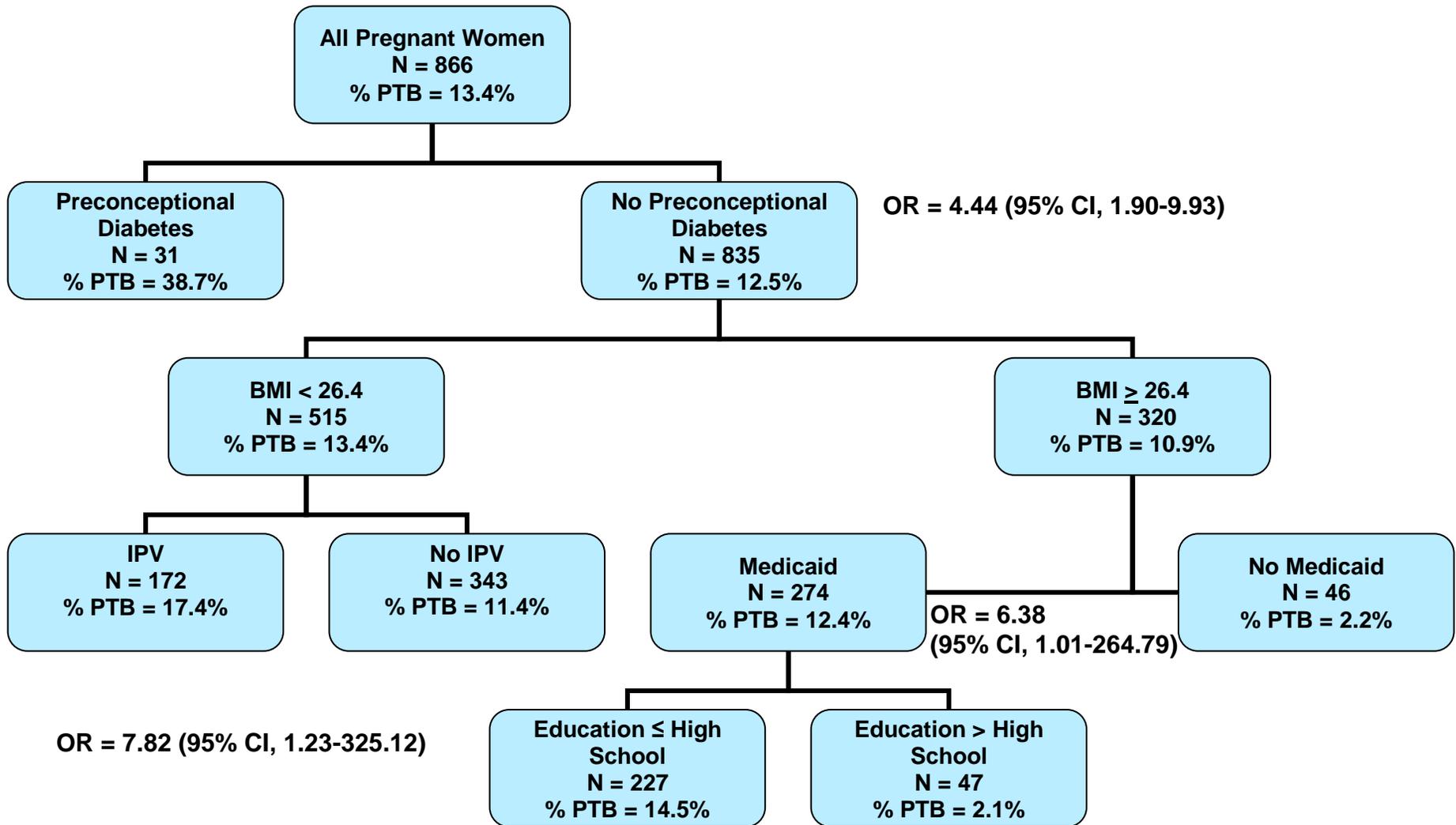
Chart 3: VPTB by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant
Women
N = 866

OR = 0.0 (95% CI, 0.0 – 0.69)

BMI > 31.9
N = 149
% VPTB = 0.0%

BMI < 31.9
N = 717
% VPTB = 3.1%

BMI < 26.4
N = 560
% VPTB = 3.4%

BMI > 26.4
N = 157
% VPTB = 1.9%

Depressed
N = 244
% VPTB = 5.3%

Not Depressed
N = 316
% VPTB = 1.9%

OR = 2.91 (95% CI, 1.01- 9.46)

Not Employed
N = 154
% VPTB = 7.8%

Employed
N = 90
% VPTB = 1.1%

OR = 7.52 (95% CI, 1.07-325.06)
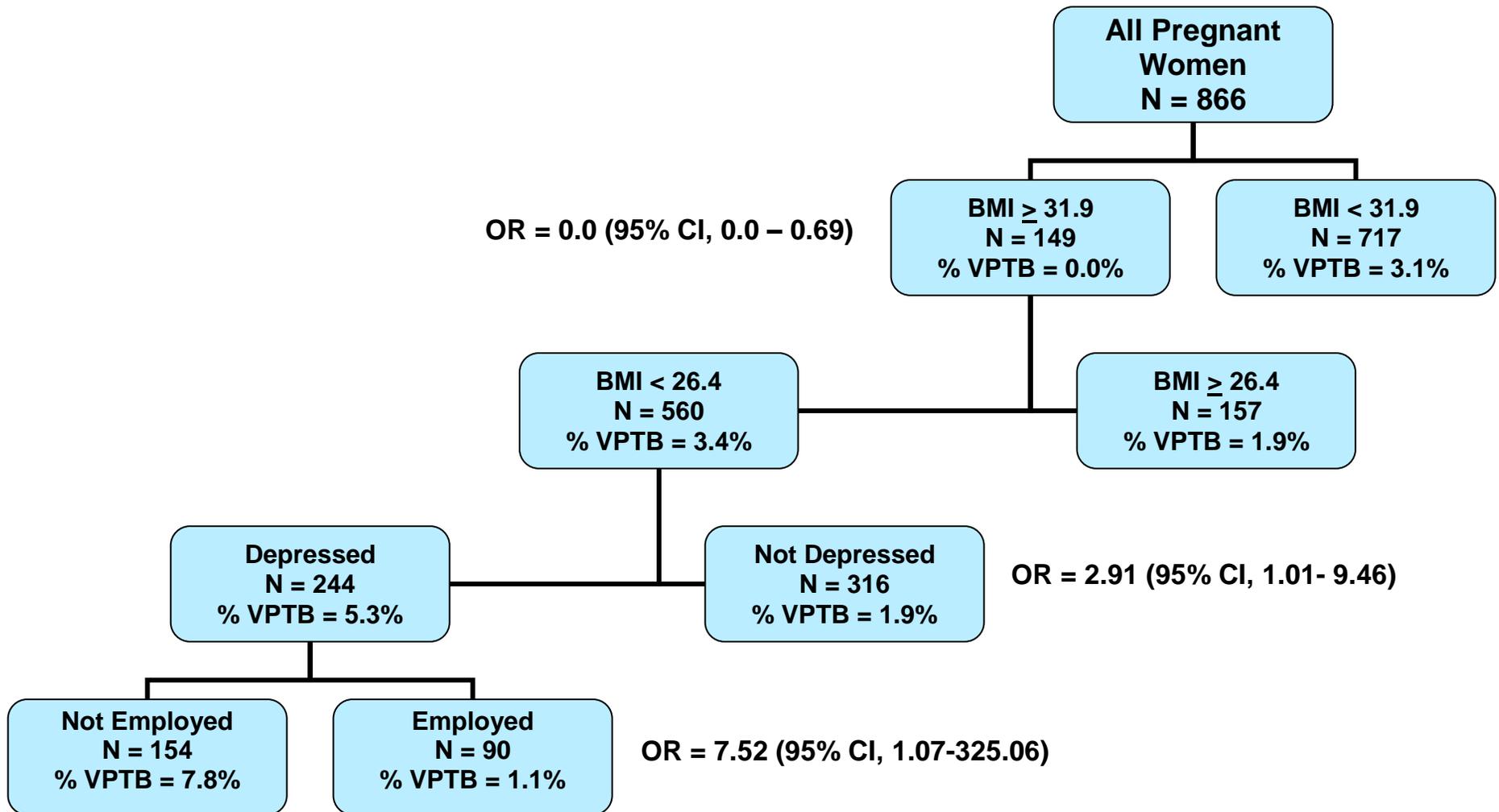
Chart 4: LGA by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women
N = 832
% LGA = 9.4%

BMI ≥ 31.9
N = 148
% LGA = 16.2%

BMI < 31.9
N = 684
% LGA = 7.9%

OR = 2.26 (95% CI, 1.28-3.87)

Smoker
N = 121
% LGA = 4.1%

Non-Smoker
N= 563
% LGA = 8.7%

Preconceptional Diabetes
N = 4
% LGA = 50%

No Preconceptional Diabetes
N = 559
% LGA = 8.4%
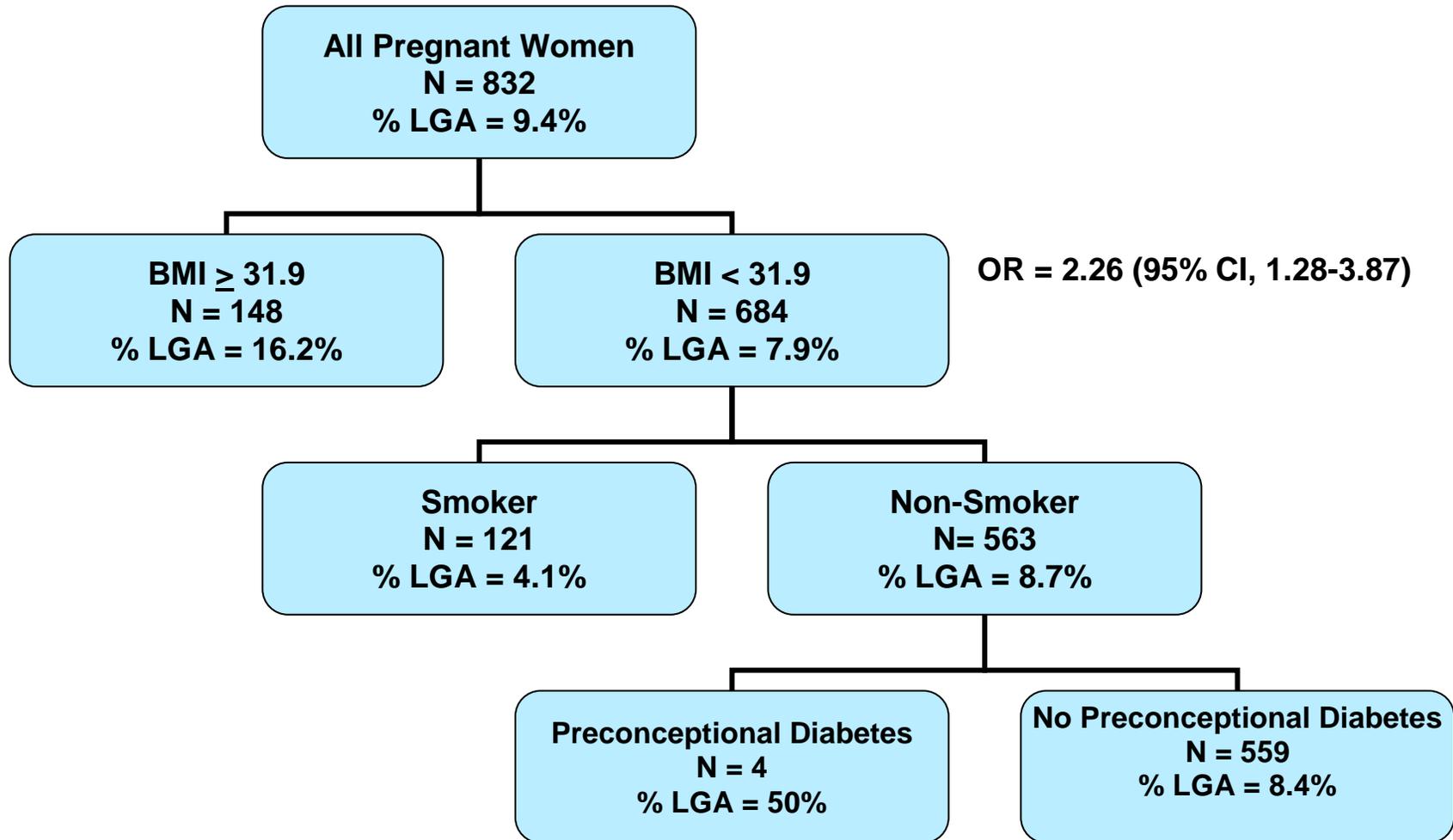
Chart 5: Cesarean Section by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women
N = 837
% C-section = 29.0%

BMI ≥ 31.9
N = 147
% C-section = 40.8%

OR = 1.91 (95% CI, 1.29-2.81)

BMI < 31.9
N = 690
% C-section = 26.5%

No Pregnancy-Related
Hypertension
N = 666
% C-section = 25.8%

Pregnancy-Related Hypertension
N = 24
% C-section = 45.8%

Education ≤ High School
N = 510
% C-section = 24.1%

Education > High School
N = 156
% C-section = 31.4%

Not Employed
N = 338
% C-section = 26.0%

Employed
N = 172
% C-section = 20.3%

No Alcohol Use
N = 260
% C-section = 28.8

Alcohol Use
N = 78
% C-section = 16.7%

OR = 2.03, (95% CI, 1.03-4.25)

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Chart 6: Miscarriage by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women
N = 909
% Miscarriage = 2.4%

Employed
N = 328
% Miscarriage = 4.3%

OR = 3.19 (95% CI, 1.23 – 8.88)

Not Employed
N = 581
% Miscarriage = 1.4%

BMI < 31.9
N = 282
% Miscarriage = 5.0%

BMI $\geq$ 31.9
N = 46
% Miscarriage = 0%

Education > High School
N = 110
% Miscarriage = 3.6%

Education $\leq$ High School
N = 471
% Miscarriage = 0.8%
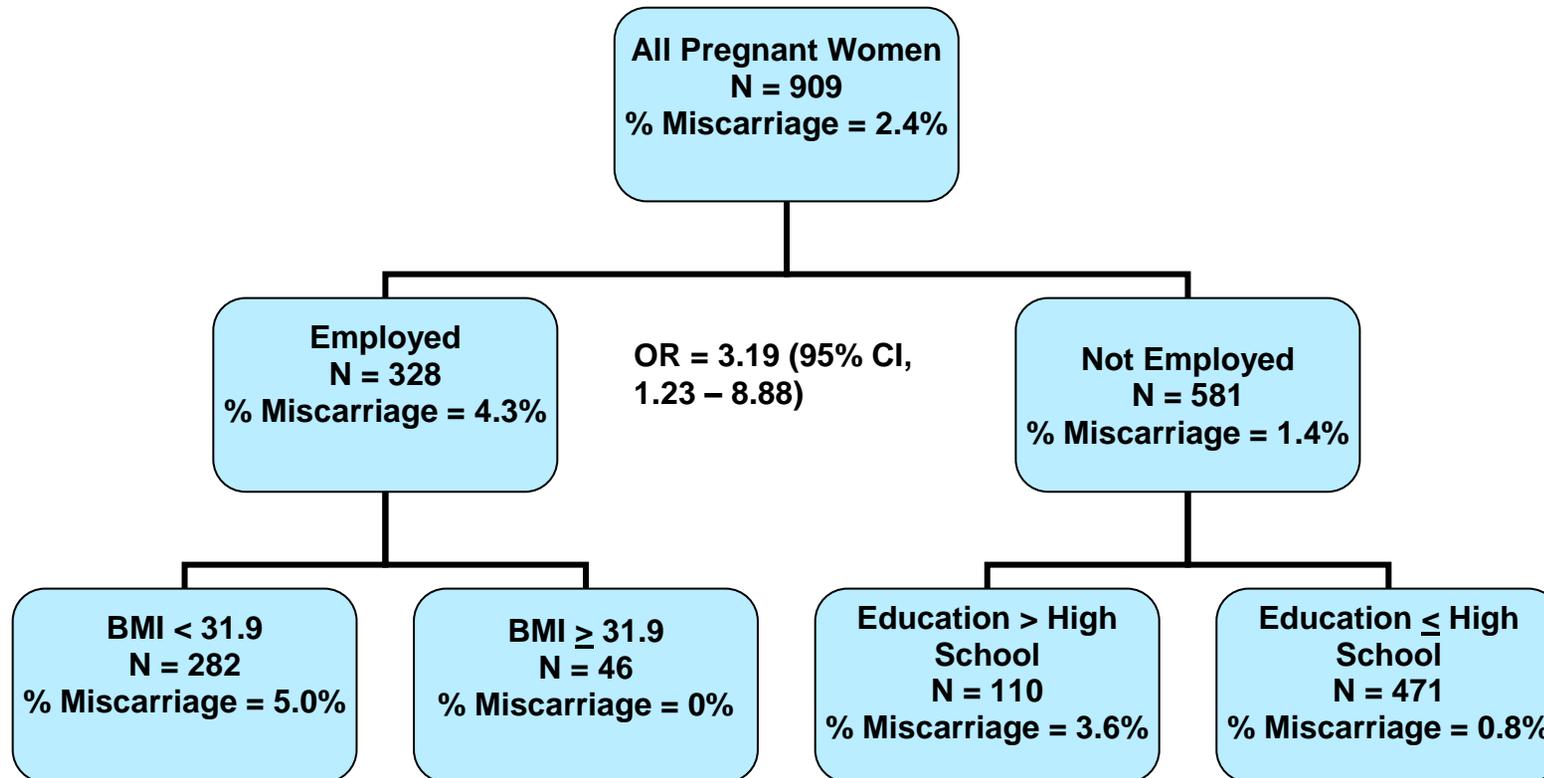
Chart 7: Infant admittance to NICU by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women
N = 824
% NICU = 13.2%

OR = 5.40
(95% CI,
2.25-12.56)

Preconceptional
Diabetes
N = 28
% NICU = 42.9%

No Preconceptional
Diabetes
N = 796
% NICU = 12.2%

OR = 2.0
(95% CI, 1.19-3.50)

BMI < 26.4
N = 526
% NICU = 14.4%

BMI ≥ 26.4
N = 270
% NICU = 7.8%

Depressed
N = 227
% NICU = 18.5%

Not Depressed
N = 299
% NICU = 11.4%

Preeclampsia
N = 16
% NICU = 31.3%

No Preeclampsia
N = 254
% NICU = 6.3%

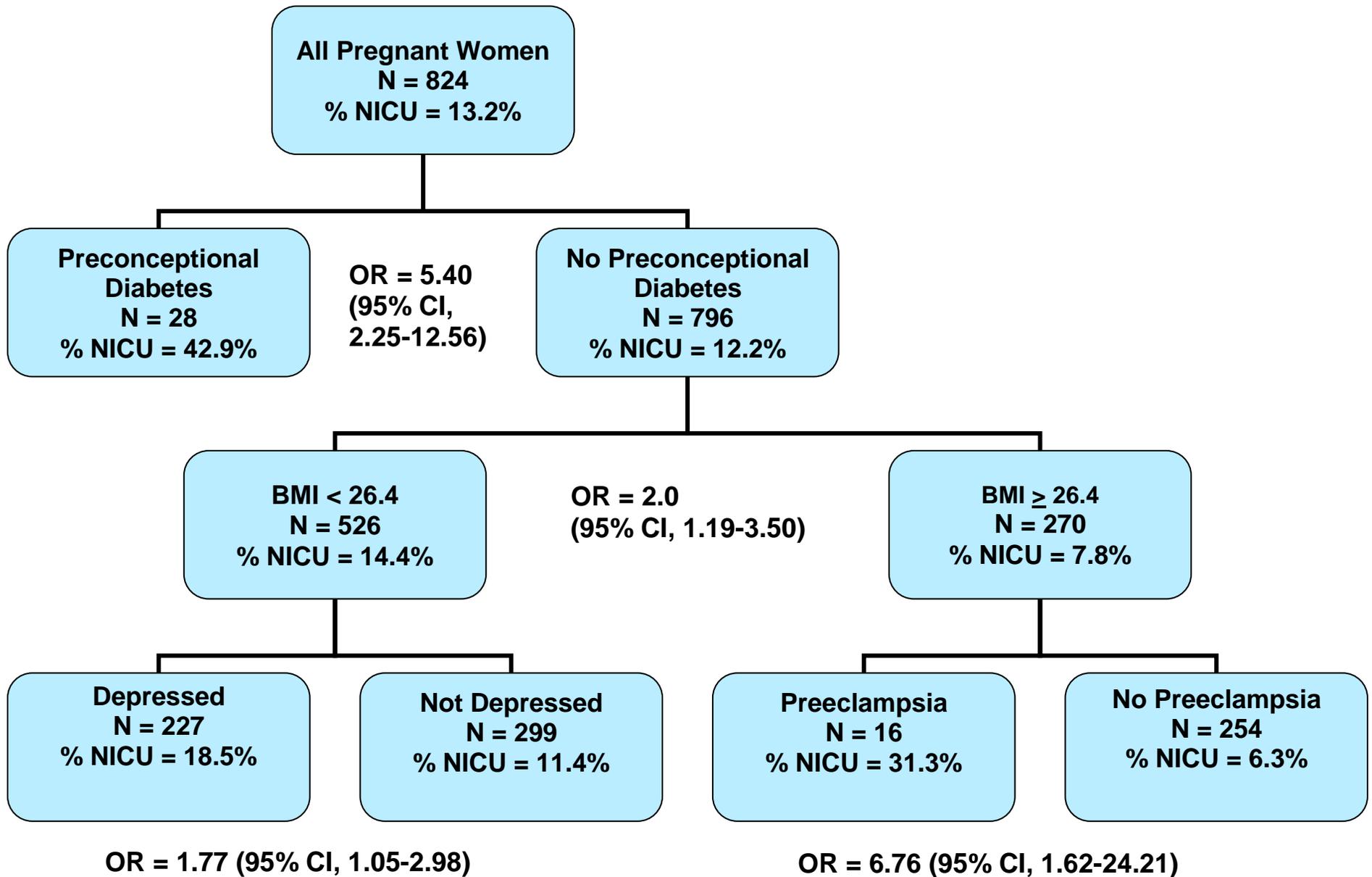OR = 1.77 (95% CI, 1.05-2.98)

OR = 6.76 (95% CI, 1.62-24.21)

Chart 8: Perinatal Deaths by Sociodemographic, Behavioral, and Medical Characteristics

All Pregnant Women

N = 887

% Perinatal Death = 1.9%

BMI ≥ 26.4

N = 601

% Perinatal Death = 2.7%

BMI < 26.4

N = 286

% Perinatal Death = 0.3%

OR = 7.79 (95% CI, 1.20-328.01)