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Factors Associated with Prenatal Smoking Among Black Women in Eastern North Carolina

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Objectives: The objective of this research was to explore prenatal smoking behaviors among Black women attending prenatal clinics. Despite the racial disparities in poor pregnancy outcomes, and the well-known association of smoking with harmful outcomes, little research has been conducted about prenatal smoking among Black women. *Methods*: Women were enrolled in the study and interviewed at the time of the first prenatal visit. The interview contained items to assess prenatal smoking and cessation, depressive symptoms, demographic factors, and beliefs about smoking. Reports of smoking cessation were verified using urinary cotinine. *Results*: The sample consisted of 811 Black women. Fourteen percent of the women were self-reported smokers, 12.6% reported cessation and 73% were nonsmokers. Twenty percent of the self-reported quitters had elevated cotinine; when these women were reclassified, 17% of the women were smokers. Factors associated with smoking in logistic regression analysis included elevated maternal depressive symptoms (OR = 1.7, 95% CI: 1.1–2.6), maternal age 20 years or older (OR = 1.94; 95% CI: 1.1, 3.3), less than a high school education (OR = 2.2; 95% CI: 1.2, 3.8), unmarried/not living with a partner (OR = 1.9; 95% CI: 1.0, 3.6), and allowing smoking in the home (OR = 5.5; 95% CI: 3.4, 8.6). *Conclusions*: The prevalence of maternal prenatal smoking was much higher among women in this sample than has been previously reported. The rate of nondisclosure of smoking among self-reported quitters was also high. Maternal behavioral (allowing smoking in the home) and psychosocial factors (depressive symptoms) were associated with prenatal smoking.

KEY WORDS: prenatal smoking; nondisclosure of smoking; depressive symptoms.

INTRODUCTION

Preterm birth is a major public health and clinical issue in the United States. The United States has a very high rate of infant mortality compared to other industrialized nations; the major reason for this is the very high rate of preterm birth. In 2002, the preterm birth rate was 12.2% of births, which was 28% higher than the rate in 1981 (1). Of particular concern is the long-standing two-fold risk for preterm birth outcomes among Black compared to White women. This racial disparity has existed for over 50 years, without reduction in the two-fold difference. The large racial disparity in preterm birth is primarily responsible for the significant racial disparity in infant mortality in the United States. Meaningful reductions in preterm birth and infant mortality, as well as racial disparities in these outcomes, will require acquiring additional knowledge about the etiology and prevention of preterm birth (2).

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One factor known to increase risk of both preterm birth and infant mortality is maternal prenatal smoking (3). Despite this, few studies have been conducted of smoking behaviors among pregnant Black women, the population group at greatest risk of preterm birth, low birth weight, and infant mortality. One reason for the lack of research is the lower prevalence of smoking among pregnant Black compared to White women. In 2000, 9.1% of pregnant Black women smoked cigarettes, compared to 13.2% of White women (4). However, these data are based upon self-reports from birth certificates, and the validity of reports of smoking among Black women is not well documented. An enhanced understanding of smoking behaviors and reporting of smoking among Black women could lead to interventions to reduce smoking in this group of women at highest risk for preterm birth and infant mortality.

In the study reported in this paper, we assessed various smoking behaviors among Black women, including self-reported smoking and cessation at entry to prenatal care, and nondisclosure of smoking among self-reported quitters. We also studied attitudes and beliefs about smoking, and psychosocial factors associated with smoking at entry to prenatal care. The overall objective of the research was to increase knowledge about prevalence of prenatal smoking and cessation among Black women, nondisclosure of smoking, and factors associated with smoking. Such factors might include attitudes and beliefs about the harmful effects of smoking, smoking by others in the home, and level of maternal depressive symptoms.

The relationship between maternal depressive symptoms and prenatal smoking was of particular interest because overall, smoking is more prevalent among those who are depressed than among those who are not depressed (5) and depression has been shown to exert an influence on other health behaviors among women (e.g., alcohol use) (6). Prior work has also demonstrated that pregnant women with elevated levels of depressive symptoms are more likely to engage in potentially harmful behaviors during the prenatal period than those with lower levels of depressive symptoms (6). Elevated levels of depressive symptoms are relatively common among pregnant women in the United States. About one in five women will suffer an episode of major depressive disorder in her lifetime, and the usual age of onset is during the reproductive years (ages 20–40 years of age) (7, 8). Prior research has shown that as many as 50% of women will experience elevated levels of depressive symptoms during pregnancy (6, 9). Despite the high prevalence of elevated levels of depressive symptoms among pregnant women, there are few prior studies about the relationship between maternal prenatal depressive symptoms and smoking behaviors from the United States. Prior studies in Norway (10) and Scotland (11) have demonstrated associations between maternal depressive symptoms and prenatal smoking. These studies were conducted among White European women; in the study reported in this paper, we sought to ascertain if these findings would be confirmed for Black women in the Southeastern United States. The main study hypothesis was that women with elevated depressive symptoms would be more likely to be smokers than those with lower levels of depressive symptoms.

METHODS

The sample for the study was recruited from the prenatal clinics of the Departments of Obstetrics and Gynecology and Family Medicine, at the Pitt County Memorial Hospital and Brody School of Medicine, located in Greenville, North Carolina. These clinics serve a population of women that is primarily low income. All patients seeking care in these clinics who were ages 16 or older were approached at the time of the first prenatal visit and asked to participate in the study by a trained research assistant. Written informed consent was obtained from each participant, and a trained interviewer conducted face-to-face interviews with all women who gave consent (greater than 95% of all those approached). Recruitment and enrollment occurred from March 2001–November 2002. The Institutional Review Board of East Carolina University approved the research. The analyses reported in this paper focus upon women who reported their race as Black (70% of the study sample).

The study interview included a number of items to assess smoking-related behaviors, as well as beliefs about smoking. The items related to smoking were taken from a questionnaire developed by the Robert Wood Johnson Foundation's Smoke-Free Families Program, Phase I, to reduce prenatal smoking. When this program was initiated, an extensive literature review was conducted and a working group of experts on research about prenatal smoking was convened by the Foundation in order to identify the most useful measures for smoking behaviors (12). The results of

the literature review and input of the working group were used to develop items to assess smoking during pregnancy (12). The resulting questionnaire was used by Robert Wood Johnson Smoke-Free Families Phase II projects, including the one described in this paper.

A question in the interview was used to assess smoking behaviors. This item asked, "Which statement best describes you now?" It had six response options, which allowed women to categorize themselves as current smokers who smoked the same, more, or less than before they learned of the pregnancy; as having quit smoking since learning of the pregnancy or prior to learning of the pregnancy; or as nonsmokers (13). Offering women several response options related to smoking, instead of a yes/no question, appears to facilitate more valid reporting of prenatal smoking (13).

Biochemical confirmation was used to assess validity of reports of smoking cessation. Urinary cotinine was used for this assessment. Cotinine is a stable metabolite of nicotine, and cotinine testing is a well-accepted standard for validating reports of smoking cessation (14, 15). Urinary cotinine assessments were performed for all women who reported quitting smoking within the past 12 months. For these assessments, urine was obtained at the same time that the questionnaire was administered. It was frozen in tubes that were shipped weekly to a commercial laboratory, J-2 Laboratories of Phoenix, Arizona. Assessment of urinary cotinine was performed using an enzyme multiplied immunoassay technique (EMIT) using an FDA approved reagent system purchased from Diagnostic Reagents, Inc., (DRI) on an automated chemistry analyzer (Olympus AU 640). The lowest concentration that can be differentiated using this technique is 50 ng/mL. The laboratory was blind to the smoking status of the women. A cut point of 80 ng/mL of cotinine was used to identify levels sufficient to indicate current smoking (13). Women who reported themselves to be quitters, but who had cotinine levels above 80 ng/mL were reclassified as smokers.

Women were also asked if they had smoked in the past 7 days and past 30 days. The interview included items to assess beliefs and attitudes about smoking, including beliefs about the harmful effects of smoking upon their own health or that of their unborn baby, the number of smokers living in their household, and if smoking was allowed inside their home. These questions were also taken from the Smoke-Free Families questionnaire.

The study interview contained items to assess demographic information (e.g., maternal age, marital status, and education) and depressive symptoms. The Center for Epidemiologic Studies' Depression Scale (or CES-D) was used to assess maternal depressive symptoms (16). The twenty-item CES-D was developed by the National Institute of Mental Health to assess the epidemiology of depression in community-based samples (16). Respondents report the presence, in the past 7 days, of symptoms characteristic of depression, such as sadness, hopelessness, fatigue, crying, low self-esteem, and changes in sleep or appetite. Scores on the CES-D range from zero to 60, with a score of 16 or greater used to indicate "high" levels of depressive symptoms. Certain common symptoms of pregnancy are also salient symptoms of depression, such as appetite changes and fatigue (17). This could artificially inflate CES-D scores of pregnant women. To address this problem, we raised the cut-point score used to indicate "elevated" levels of depressive symptoms. This more conservative approach was used to identify only those women in the upper 25% of CES-D scores as in the "high" group. Our rationale was that few women would achieve scores in this group based mainly upon symptoms of pregnancy, and that those in this highest group would be very likely to meet the criteria for depressive illness (17). This approach has been used in prior research with samples of pregnant women (17).

The CES-D has been widely used in epidemiologic research, and has been shown to be a valid and reliable measure of depressive symptoms in various diverse samples (18–20). For example, prior research has shown that about 40–50% of adults with elevated scores on the CES-D would be diagnosed as clinically depressed (18). Further, CES-D scores correlate well with assessments by clinicians, and CES-D scores decrease with treatment of depression (16, 18–20).

Descriptive analyses were used to identify the smoking, demographic and other characteristics of the sample of women. Bivariate analyses were used to evaluate associations between depressive symptoms, beliefs and attitudes about smoking and demographic factors with smoking. The odds ratio and 95% confidence interval were calculated for each bivariate association. In addition, variables associated with smoking at $p = .10$ or less were simultaneously entered into a multiple logistic regression model. Smokers in the model included all self-reported smokers plus those who described themselves as quitters but had elevated urinary cotinine values ("nondisclosers"). Nonsmokers were all

those who reported themselves to be nonsmokers and all self-reported quitters with negative cotinine tests. This model was used to assess the independent associations of each variable with smoking, controlling for the effects of the other variables. The beta coefficients from the logistic regression models were used to estimate the adjusted odds ratios and 95% confidence intervals for independent variables.

RESULTS

A total of 811 Black women comprised the analysis sample. As shown in Table I, of these women, approximately 41% had completed a high school education, about 32% had not completed high school and an additional 28% reported having more than a high school education. About 34% of the women were married or living with a partner, while 66% reported being not married/not living with a partner. Approximately 72% of the women were Medicaid recipients, and 20% reported having private health insurance. About 90% of the women enrolled for prenatal care before the end of the second trimester. Approximately 76% of the patients were enrolled in clinics of the Department of Obstetrics and Gynecology, and the remainder were enrolled at the Family Practice Center.

Approximately 14% ($N = 116$) of the women enrolled in the study described themselves as current smokers at the time of the first prenatal visit. Among the smokers, almost all reported reducing their smoking since learning of the pregnancy (87.9% of smokers reported reducing smoking). Overall, 12.6% ($N = 102$) of the women reported that they had quit smoking. (Approximately 8% ($N = 64$) of the women reported that they had quit smoking since they learned they were pregnant, and 4.7% ($N = 38$) reported that they quit smoking prior to learning of the pregnancy.) An additional 73% ($N = 592$) of the women described themselves as nonsmokers (Table II).

Smoking within the past 7 days or past 30 days were also assessed. Overall, 15.2% of the women in the sample reported smoking within the past 7 days and 17.6% reported smoking within the past 30 days.

Urinary cotinine analysis indicated that 21 of the 102 women (21%) who reported that they had quit smoking had cotinine levels above 80 ng/mL, so these 21 women who did not disclose continued smoking were reclassified as smokers for the remaining analyses. This had the effect of increasing the percent of smokers from 14% to 17%, and reducing the percent of quitters from 12.6% to 10%. There was a significant difference in nondisclosure of smoking, according to urinary cotinine testing, among self-reported quitters between those women who reported quitting prior to learning of the pregnancy (10.5% nondisclosure) and those who reported quitting after learning of the pregnancy (26.6% nondisclosure) ($p < .001$).

Other measures of nondisclosure of smoking among self-reported quitters ($N = 102$) similarly revealed continued smoking among quitters. Seven women (6. 9% of quitters) reported smoking within

Table I. Selected Characteristics of the Sample, Greenville, North Carolina, 2001–2002

Characteristic	No	Percentage
Demographic		
Age		
<20 years	178	21.9
≥20 years	633	78.1
Education		
<High school graduate	258	31.8
High school graduate	330	40.7
>High school graduate	223	27.5
Health insurance		
Medicaid	582	71.8
Private	163	20.1
None	66	8.1
Marital status		
Married, living w/partner	167	20.6
Not married, living w/partner	110	13.6
Widowed, divorced, separated, not living w/partner	50	6.2
Not married, not living w/partner	484	59.7
Trimester of enrollment in prenatal care		
First	418	51.9
Second	303	37.6
Third	84	10.4
Psychosocial		
Depressive symptoms		
High (≥23)	223	27.5
Low (≤22)	588	72.5
Knowledge, attitudes, beliefs		
Smoking will harm baby		
A lot	726	91.3
Not at all, not much, some	69	8.7
Smoking will harm self		
A lot	713	89.3
Not at all, not much, some	85	10.7
Number of smokers in home (excluding self)		
None	555	69.5
1 or more	243	30.5
Smoking allowed in home		
No	488	60.3
Yes	321	39.7

Table II Smoking Status of Prenatal Patients, Greenville, North Carolina, 2001–2002

Smoking status	No	Percentage
Smokers		
Smoke regularly, about same as before found out pregnant	13	1.6
Smoke regularly, more than before found out pregnant	1	0.1
Smoke some, cut down on cigarettes since found out pregnant	102	12.6
Quitters		
Stopped smoking after found out pregnant	64	7.9
Stopped smoking before found out pregnant	38	4.7
Nonsmokers		
Never smoked or smoked less than 100 cigarettes ever	592	73.1

the past 7 days, and 24 women (23.5% of quitters) reported smoking within the past 30 days. There were significant differences in these measures of continued smoking according to when women reported they had quit. None of the 38 women who reported quitting before learning of the pregnancy reported smoking within the past 7 days, compared to 11% of the 64 women who reported quitting after learning of the pregnancy. Similarly, 5.3% of the 38 women who reported quitting prior to learning of the pregnancy reported smoking within the past 30 days, compared to 34.4% of the 64 women who indicated that they quit after learning of the pregnancy.

Most of the women in the sample (91.3%) reported believing that smoking was harmful to the health of their baby "a lot," and 89.3% of the women reported believing that smoking was harmful to their own health "a lot." Slightly over two-thirds of the women lived in homes with no other smokers (69.5%), and 60.3% lived in homes in which no one was allowed to smoke.

Scores on the CES-D questionnaire to measure depressive symptoms ranged from 0 to 55, with a median of 15 and a mean of 17.37. The cut-point score used to identify the top 25% of scores on the CES-D was 23 or greater. Scores on the CES-D are consistent with prior research in which the questionnaire was administered to low income pregnant women (6, 9, 17).

Maternal depressive symptoms were significantly associated with self-reported smoking behaviors in bivariate analysis. Women with higher levels of CES-D scores had a higher prevalence of smoking at the time of the first prenatal visit (26%) compared to those with lower scores on the CES-D (13.6%) (unadjusted OR = 2.23 95% CI: 1.53, 3.27).

Other variables associated with increased prevalence of smoking in bivariate analysis, as shown in Table III, included maternal marital status (unmarried women) and education (women with a high school education or less). Belief that smoking could harm the health of their baby or themselves "a lot" was associated with a decreased prevalence of smoking. In addition, women who lived with at least one smoker in the home (excluding themselves) and women who lived in households in which smoking was allowed in the home also had an increased prevalence of smoking.

Logistic regression analysis was used to calculate adjusted odds ratios for the each variable associated with smoking. Variables entered into the model included: CES-D category, maternal age, education and marital status, maternal beliefs about the effects of smoking upon their baby and themselves, living with other smokers in the household and allowing smoking in the home. Age was entered into the model, despite the lack of a significant association with smoking in this sample, because it is known to be associated with smoking and is thus a potential confounder. As shown in Table IV, the adjusted odds ratio representing the association between maternal depressive symptoms and smoking was 1.71 (95% CI: 1.12, 2.62). Other variables associated with smoking in this model were: older maternal age (OR = 1.94; 95% CI: 1.14, 3.30), low maternal education (OR = 2.18; 95% CI: 1.24, 3.82), single marital status (OR = 1.90; 95% CI: 1.00, 3.62), and allowing smoking in the home (OR = 5.45; 95% CI: 3.44, 8.61).

DISCUSSION

The results from this study provide evidence that maternal smoking is much higher among this sample of Black pregnant women than has been shown in national data. Approximately 14% of women reported themselves to be smokers. Additionally, when self-reported quitters with elevated urinary cotinine values were reclassified as smokers (nondisclosers), the percentage of women who were smokers rose to 17.0%. National data, based mainly upon birth certificates, indicate that about 9% of Black women smoked during pregnancy in 2000 (4). Thus, the prevalence of prenatal smoking among the women in our sample was almost double

Table III. Variables Associated with Smoking Status (Smokers vs. Nonsmokers)

Variable	Smoke (%)	Unadjusted odds ratio	95% C.I
Psychosocial			
Depressive symptoms			
Low	13.6	1	
High	26.0	2.23	1.53, 3.27
Demographic			
Age			
<20 years	13.5	1	
≥20 years	18.0	1.41	0.88, 2.27
Education			
>12 years	8.5	1	
≤12 years	20.2	2.72	1.63, 4.54
Marital status			
Married, living w/partner	8.4	1	
Not married or living w/partner	19.3	2.61	1.46, 4.67
Knowledge, attitudes, beliefs			
Smoking will harm baby			
A lot	15.8	1	
All else	29.0	2.17	1.24, 3.78
Smoking will harm self			
A lot	15.8	1	
All else	27.1	1.97	1.17, 3.31
No. of smokers in home (excluding self)			
None	15.3	1	
1 or more	21.8	1.54	1.05, 2.26
Smoking allowed in home			
No	7.4	1	
Yes	31.8	5.85	3.87, 8.84

that reported based on birth certificate data. The prevalence of smoking among this group of pregnant women in Eastern North Carolina is far above the Year 2000 goal for the United States of 10% or fewer women smoking during pregnancy (21). This finding suggests that relying on national data from birth certificates to estimate smoking prevalence among pregnant women may result in underestimates of smoking. This problem is especially serious for Black women, since this population group is at elevated risk of preterm birth, low birthweight, and infant mortality, which are all associated with prenatal smoking. Accurate data about prenatal smoking is a necessity for planning programs to reduce poor pregnancy outcomes among Black women.

Our study also demonstrates the significance of the problem of nondisclosure of smoking among pregnant women. We validated self-reports of quitting with cotinine testing, and found that 21% of self-reported quitters were in reality still smoking. This suggests that biochemical validation of self-reports of smoking cessation and nonsmoking status are very important for accurate assessment of smoking status among pregnant women. Our study found higher rates of nondisclosure of smoking than in some prior research (14, 15). The reason for this is likely that our study was focused upon smoking, which seems to encourage under-reporting of smoking. Studies of pregnant women focused on other issues (e.g., nutrition, infection) appear to facilitate more accurate reporting of smoking behaviors.

Table IV. Multiple Logistic Regression Model for Smoking Status (Smokers vs. Nonsmokers)

Variables	Odds ratio	95% C.I
Depressive symptoms (low = 0, high = 1)	1.71	1.12, 2.62
Age (<20 years = 0, ≥20 years = 1)	1.94	1.14, 3.30
Education (>12 years = 0, ≤12 years = 1)	2.18	1.24, 3.82
Marital status (married = 0, not married = 1)	1.90	1.00, 3.62
Smoking harm baby (a lot = 0, else = 1)	1.40	0.65, 3.00
Smoking harm self (a lot = 0, else = 1)	1.40	0.67, 2.91
No. smokers in home (none = 0, 1 or more = 1)	0.99	0.63, 1.57
Smoking allowed in home (no = 0, yes = 1)	5.45	3.44, 8.61

Data from our study suggest that timing of prenatal smoking cessation may be associated with nondisclosure of smoking. Among self-reported quitters, those women who reported quitting prior to learning of the pregnancy appear to be more likely to have negative urinary cotinine testing, and less likely to report recent smoking (within the past 7 or 30 days), than women who reported quitting since learning of the pregnancy.

We found a relatively strong association between maternal depressive symptoms and smoking during pregnancy. The adjusted odds ratio for smoking, comparing women with elevated depressive symptoms (upper 25%) to those with lower levels of depressive symptoms was 1.71, with a 95% confidence interval that did not encompass the null value. Similar findings have been reported from studies conducted among White women in European countries (10, 11). Prior studies have demonstrated that as many as 50% of pregnant women will experience elevated levels of depressive symptoms during pregnancy (6, 9). In addition, depression has been termed a disorder of women of childbearing ages (8), and is very prevalent among women ages 18–44 (22). Moreover, results from a national survey of mental illness indicate that the highest prevalence of depression is among Black women of childbearing ages (22). Thus, elevated depressive symptoms is a risk factor for smoking that is quite prevalent among women of childbearing ages and is widespread among pregnant women. More research is clearly warranted about the associations between maternal depressive symptoms as well as depression with prenatal smoking among Black women in the U.S.

Another factor associated with prenatal smoking, which is of interest, is household arrangements for smoking. Women who lived in households in which smoking was allowed had an increased risk of smoking compared to women who lived in households in which no one was allowed to smoke in the home. This has implications for intervention, such that discouraging smoking in the home might reduce smoking among pregnant women. In addition, prohibiting smoking in the home would protect infants from exposure to second-hand smoke. If this finding were replicated in future research, then this would suggest a strategy for intervention among pregnant and postpartum women.

One limitation of this study was the lack of data about urinary cotinine levels among women who reported themselves to be nonsmokers. We were only able to obtain these data for self-reported quitters, due to cost constraints. Given the high level of nondisclosure of continued smoking, it would be instructive, in future research, to obtain urinary cotinine levels from all women who profess to be nonsmokers or quitters.

In summary, our study demonstrated high rates of smoking and nondisclosure of smoking among pregnant Black women in Eastern North Carolina. Our findings also suggested that nondisclosure of smoking among self-reported quitters is higher among women who report quitting after learning of the pregnancy than among those who report quitting before learning of the pregnancy. We also demonstrated significant associations between psychosocial and behavioral factors with prenatal smoking, including maternal depressive symptoms and allowing smoking in the home. Future research and interventions should be focused upon accurate ascertainment of smoking among women at high risk for poor pregnancy outcomes. In addition, confirmation of the findings about depressive symptoms in other studies of women at increased risk for poor pregnancy outcomes might lead to the development of targeted interventions to reduce prenatal smoking among women with elevated depressive symptoms.

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