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Smoking Among Pregnant Women with Medicaid Insurance: Are Mental Health Factors Related?

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Abstract Smoking during pregnancy is the single most modifiable risk factor for poor birth outcomes, yet it remains prevalent among low-income women. This study examined factors associated with continued smoking and quitting among pregnant women. A total of 2,203 Medicaid-eligible pregnant women were screened at their first enhanced prenatal services visit for risk factors including demographics, health behaviors (smoking, alcohol and drug use), mental health (history of mental health disorders, current depressive symptoms), and stress. Smoking status was divided into non-smokers, quitters (quit smoking since learning of pregnancy), and continuing smokers. Descriptive statistics and logistic regression models were used to describe the sample and analyze relationships between smoking status and other characteristics. Overall, 57% were non-smokers, 17% quitters, and 26% continuing smokers. Approximately 18% had severe depressive symptoms, 53% had a high stress score, and 33% had a history of mental health problems. Younger women had lower odds of continued smoking as compared to both non-smokers (OR = 0.48, $p < 0.01$) and quitters (OR = 0.56, $p < 0.05$). Older women with less than a 12th grade education had higher odds of continued smoking (OR = 2.17, $p < 0.01$) and quitting (OR = 1.62, $p < 0.05$) as compared to non-smokers. Alcohol use (OR = 2.81, $p < 0.05$) and drug use before pregnancy (OR = 5.32, $p < 0.01$) predicted continued smoking compared to non-smoking. Women with a mental health history (OR = 1.81, $p < 0.01$) and high stress scores (OR = 1.39, $p < 0.05$) had higher odds of continued smoking compared to non-smokers. Mental health history, stress, demographics, current alcohol and past drug use are strongly related to continued smoking in this population.

Keywords Smoking cessation · Pregnancy · Medicaid

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Introduction

Smoking is the single most important preventable cause of death in the United States (US) [1]. Smoking during pregnancy is the single most modifiable risk factor of poor birth outcomes and has been associated with a number of suboptimal outcomes for both the mother and child. Smoking during pregnancy increases the risk of stillbirth, ectopic pregnancy, spontaneous abortion, premature rupture of membranes, abruptio placentae, placenta previa, preterm labor, low birth weight, and infant death [2]. Children born to women who smoked during pregnancy and/or post birth are at increased risk for asthma and respiratory problems, and physical and behavioral problems in childhood [3–5].

Although smoking among pregnant women appears to be declining, it is still prevalent among some subpopulations of women and relapse to smoking after delivery is frequent [6]. The Pregnancy Risk Assessment Monitoring System

(PRAMS) data indicate an overall rate of smoking 3 months before pregnancy of 22.1% and the rate of quitting during pregnancy of 44.8% (2005 data). Nearly 55% of the women who quit smoking during pregnancy resumed smoking within 6 months postpartum [7]. Of particular concern is the high rate of smoking during pregnancy in women of lower socioeconomic status (SES). According to the PRAMS analysis, women on Medicaid had the highest pregnancy-associated smoking rate of 54.7% (compared to those with private insurance at 38.3%), the lowest quit rate during pregnancy at 44.7% (compared to 48.6%), and the highest relapse rate post-partum at 50% (compared to 43.2%) [7].

Other background/demographic factors are also associated with smoking during pregnancy, and include the presence of other smokers in the household, unmarried status, white race, and increased maternal age [6–8]. Recently, however, research has discovered a link between smoking and mental health conditions. Both stress and depression have been found to be associated with continued smoking during pregnancy, and this is especially true for low-income and/or Medicaid-insured populations [9–15].

A recent study found that, among smoking pregnant women, 45.1% had at least one mental disorder, and among those with nicotine dependence, 57.5% met this criterion [16]. After adjusting for demographics and co-morbidity, nicotine dependence during pregnancy was significantly associated with mental disorders, including major depression. However, for those smokers who use cigarettes, but do not have nicotine dependence, the association with mental disorders was explained by the confounding effects of demographic characteristics; whereas those smokers with nicotine dependence have a strong relationship to mental disorders that is not explained by demographic factors, suggesting that nicotine dependence is related to mental disorders independently of socioeconomic factors. Another recent study examined the relationship of mental disorders to smoking in Medicaid-eligible pregnant women. Women smoking during pregnancy were 2.5 times as likely to have a psychiatric disorder, while an association with major depressive disorder was not found [17]. A national survey of mothers with children 19 and under in the home, found that maternal smoking was independently associated with a 70% increased risk of depressive symptoms and that mothers with children on Medicaid were five times more likely to be both a smoker and have a positive depression screen than mothers of children not receiving Medicaid [18].

The present study examined the relationships between continued smoking during pregnancy and perceived stress, depressive symptoms, mental health history, and other demographic and behavioral characteristics among a sample of Medicaid-eligible pregnant women. We hypothesized that women continuing to smoke during pregnancy had higher perceived stress, a mental health history, and higher current depressive symptoms as compared to non-smokers and those who quit smoking once finding out they were pregnant. This study was part of a larger state-sponsored project in Michigan, the Michigan Families Medicaid Project, described in more detail elsewhere [19]. Given the high rates of smoking in Medicaid-insured women and the chronic stressors associated with poverty, a better understanding of these relationships may identify issues to be addressed by health policy makers.

Methods

Settings and Participants

As part of the state of Michigan's enhanced prenatal services (EPS) program redesign efforts, a two-tiered prenatal risk screening and assessment tool ("screener") was developed for determining the presence and level of multiple risk factors. Data for this study are part of the Michigan Families Medicaid Project research database and consist of risk screener data from a convenience sample of 2,203 pregnant women enrolled in EPS. The sample includes pregnant women who were eligible for Medicaid insurance, and referred for risk screening to a community-based program certified to deliver EPS. The participants were similar in demographic characteristics to the total population of Medicaid-insured pregnant women in the state and refusal rates were low. The EPS providers included local health departments and private non-profit health agencies that are typical program sites for EPS services in Michigan. More details on the data and the development of the risk screening and assessment tool are available elsewhere [19]. The questioning was not anonymous, but confidential because of the need to know the participant's name to deliver health care. All health care workers received human subjects training and were under strict rules to make it clear to participants that they could decline participation and their participation in the survey would not affect their receiving of health care, but improve it by understanding risk factors for a healthy pregnancy and child. This study was approved by the university and state health department institutional review boards.

Measures and Data Collection

Measures in the screener included demographics, health history and risks, prenatal care, health behaviors, basic needs, and mental health. The screener was completed through face-to-face interviews by a program professional (registered nurse, registered dietitian, social worker, or community health worker) for EPS enrollment. Data were

collected from February 2005 to October 2007. Selected measures used in this paper are presented below.

Demographics

Demographics included age, race/ethnicity, age-appropriate education (defined as lack of age appropriate education if the respondent was older than 18 and had less than a high school education, and age appropriate for other respondents), employment status, and marital status.

Health Behaviors

Tobacco smoking, alcohol and drug use were assessed. First, smoking status was measured using a multiple choice question developed by Mullen et al. [20] which allows women to identify their current smoking status on a continuum that includes options for regular smoking, reduction in smoking during pregnancy, occasional smoking, and quitting during pregnancy [20]. Smoking status (non-smoker, quitter, continuing smoker) was determined by the question: "Which of the following statements would you say best describes your cigarette smoking?" The first answer option being "I did not and do not smoke now," the second "I quit since learning I was pregnant" and three options for various degrees of smoking during pregnancy (same amount, cut down, every once in awhile). All women who answered "yes" to any level of smoking, including quitting since pregnancy were assessed for details of their smoking behavior. Current level of smoking was adapted from a comparable item from PRAMS, with response levels translated from number of cigarettes smoked per day to their equivalence in number of packs smoked to aid recall. The Fagerstrom Test for Nicotine Dependence (FTND) measured level of nicotine addiction [21] and readiness to quit smoking was assessed using a three-item scale [22, 23].

Alcohol use was also measured using a two-tiered approach. The patient's drinking status was first self-reported through a question that was developed using the Mullen et al. [20] smoking question format, followed by a single item assessing current amount of drinking. One question was used as an indicator for the status of other drug use: "In the month before you knew you were pregnant, did you use any street drugs, diet pills, or drugs not prescribed by a physician?" Current drug use was not asked due to concerns of suspected inaccuracy with self-reporting.

Mental Health and Stress

The Cohen Perceived Stress Scale (PSS-4) was used to measure stress [24]. A PSS-4 score of five or more was considered indicative of high perceived stress. The two-question Patient Health Questionnaire (PHQ-2) and the Edinburgh Postnatal Depression Screen (EPDS) were used to measure current depressive symptoms [25, 26]. History of mental illness was assessed through a single item asking if the patient had ever been treated for or told that they have depression, bipolar disorder, or schizophrenia.

Data Analysis

To determine the outcome of interest in this study, smoking status, women in the sample were classified into the following categories: (1) non-smokers (women that reported never smoking or not smoking at the time of becoming pregnant), (2) quitters (women who reported smoking upon pregnancy, but quitting after learning of their pregnancy), and (3) continuing smokers (women who reported smoking upon pregnancy and continuing to smoke after notification of their pregnancy, including those who cut down on their level of smoking).

To determine current depressive symptoms, screened depression scores were determined by the EPDS. First, the PHQ-2 assessed the presence of any current depression symptoms. Second, the extent of depression (EPDS score of ≤ 9 = not depressed; 9–12 = mild-moderately depressed; and ≥ 13 = seriously depressed) was assessed for all women answering yes to one or both of the PHQ-2 questions, based on their EPDS score. If a woman did not have a positive response to any of the two PHQ-2 questions and skipped all EPDS questions as instructed by the skip pattern in the screener, she was considered as not having depressive symptoms.

Descriptive statistics (counts and percentages) were reported to document smoking behavior during pregnancy and various characteristics of the women in this study. Mixed logistic regression analyses (SAS procedure NLMIXED) were used to identify the independent effect of each factor considered, statistically controlling for the effects of all other variables included. The key explanatory variables considered were current depressive symptoms, history of mental health problems, and stress. Age, age-appropriate education, race, marital status, employment status, alcohol use and drug use were the additional covariates included in the regressions. As the data were collected from multiple EPS locations, a hierarchical model for the logistic regressions was used. To test whether the nesting of individuals within those locations influenced the analysis, logistic regression analyses were run both ignoring and then accounting for the hierarchical structure of the data. It was found that accounting for the hierarchical structure of the data did not change the results (reported in Table 2) in meaningful ways and the results maintained their significance at standard statistical thresholds ($p < 0.01$; $p < 0.05$).

The nested logistic results were reported, including the odds ratios and the 95% confidence intervals.

Results

Pregnant Women

Table 1 describes the characteristics of the women in this study overall and by smoking status. Twenty-four percent of the pregnant women were African-American, 73% were unmarried, and 36% were employed. Approximately 30% lacked age-appropriate education, which is older than 18 and a less than high school education. Overall, 26% of women were continuing smokers and 17% were quitters. There are higher percentages of mildly depressed and severely depressed women among the continuing smokers (19 and 24%) and among the quitters (16 and 19%) versus non-smokers (13 and 14%). In addition, there were higher percentages of women with mental health history among smokers (48%) and quitters (35%) versus non-smokers (26%). Higher percentages of smokers and quitters presented at increased levels of perceived stress: 63% of smokers, 54% of quitters and 48% of non-smokers.

Association of Smoking with Demographic Characteristics, Stress, Depressive Symptoms and Mental Health

Table 2 provides the results of logistic regressions on three binary outcomes: smoking versus non-smoking; smoking versus quitting; quitting versus non-smoking. Logistic regressions indicated that women younger than 19 had lower odds ratios (OR) of continued smoking as compared both to the non-smokers (OR = 0.48, $p < 0.01$) and to the quitters (OR = 0.56, $p < 0.05$). African-American women had lower odds of smoking vs. non-smoking (OR = 0.34, $p < 0.01$) or quitting vs. being a non-smoker (OR = 0.44, $p < 0.01$). Alcohol use and drug use during pregnancy also predicted continued smoking compared to non-smoking.

Women with a mental health medical history (OR = 1.81, $p < 0.01$) and women with high stress scores (OR = 1.39, $p < 0.05$) had higher odds of continued smoking compared to non-smoking. Current depressive symptoms, as reported by the EPDS, were not associated with increased odds of being a smoker versus non-smoker, or of continuing to smoke versus quitting during pregnancy.

Last, we conducted an exploratory analysis of the relationship between depression intensity (EPDS score) and nicotine addiction (FTND) in smokers using a basic linear

Table 1 Characteristics of pregnant women by smoking status during pregnancy

	Smoker categories (n; %)[a]			
	Total ($N = 2,159$)	Smoker ($n = 566$)	Quitter ($n = 367$)	Non-smoker ($n = 1,226$)
Demographic				
<19 years of age	395 (18.54)	86 (15.36)	74 (20.67)	235 (19.39)
<12th grade education and ≥18 years of age	652 (30.39)	222 (39.43)	112 (30.52)	318 (26.17)
African American race	476 (24.08)	74 (14.62)	69 (19.88)	333 (29.63)
Unmarried	1,535 (72.51)	459 (83.15)	309 (85.60)	767 (63.70)
Employed	781 (36.31)	190 (33.86)	153 (41.69)	438 (35.81)
Depressive symptoms				
Screened negative for depression: EPDS score <9	1,420 (67.57)	316 (57.04)	235 (65.46)	870 (73.11)
Screened positive for mild-to-moderate depression: EPDS score 9–12	313 (14.88)	106 (19.13)	57 (15.88)	150 (12.61)
Screened positive for severe depression: EPDS score ≥13	369 (17.55)	132 (23.83)	67 (18.66)	170 (14.29)
Mental health history				
Medical history of depression, bipolar, & schizophrenia	616 (33.01)	236 (47.58)	111 (35.24)	269 (25.50)
Level of stress				
Stress: PSS-4 score ≥5	1,091 (53.19)	349 (63.11)	192 (54.08)	550 (48.12)
Other behaviors				
Alcohol use	52 (2.49)	25 (4.71)	9 (2.51)	18 (1.48)
Drug use month before knew pregnant	234 (11.86)	119 (23.11)	65 (18.62)	50 (4.51)

EPDS edinburgh postnatal depression scale; *PSS-4* cohen perceived stress scale-4

[a] Counts and percentages are calculated based on the valid, non-missing, responses

Table 2 Relationship of smoking status to demographic characteristics, mental health, and other behaviors

Variables	Smoking (vs. non-smoking)	95% Confidence intervals of odds ratios		Smoking (vs. quitting)	95% Confidence intervals of odds ratios		Quitting (vs. non-smoking)	95% Confidence intervals of odds ratios	
Demographic									
<19 years of age	**0.48****	0.32	0.72	**0.56***	0.35	0.89	0.80	0.54	1.20
<12th grade education and ≥18 years of age	**2.17****	1.58	2.98	**1.62***	1.10	2.38	1.35	0.94	1.94
African American race	**0.34****	0.22	0.52	0.64	0.37	1.08	**0.44****	0.29	0.67
Unmarried	**3.37****	2.37	4.81	0.79	0.49	1.30	**3.73****	2.42	5.74
Employed	0.87	0.64	1.19	0.76	0.52	1.10	1.17	0.83	1.63
Depressive symptoms									
Screened positive for mild-to-moderate depression: EPDS score 9–12	1.25	0.82	1.91	0.98	0.59	1.63	1.31	0.81	2.10
Screened positive for severe depression: EPDS score ≥13	1.23	0.80	1.90	0.94	0.56	1.57	1.22	0.75	1.99
Mental health history									
Medical history of depression, bipolar, & schizophrenia	**1.81****	1.29	2.53	1.37	0.92	2.05	1.24	0.85	1.83
Level of stress									
Stress: PSS-4 score ≥5	**1.39***	1.00	1.92	1.43	0.95	2.14	1.05	0.73	1.51
Other behaviors									
Alcohol use	**2.81***	1.17	6.74	1.67	0.63	4.45	1.57	0.54	4.60
Drug use month before knew pregnant	**5.32****	3.19	8.88	1.24	0.78	1.96	**4.31****	2.55	7.31

Multivariate logistic regression analysis. Due to missing values in 6–14% of observations, we also included in the above regressions indicators for missing values in Medical history of depression, bipolar, and schizophrenia, Stress: PSS-4 score ≥5, African American, and Drug use month before knew pregnant (not reported)

EPDS edinburgh postnatal depression scale; *PSS-4* cohen perceived stress scale-4

* <.05; ** <.01

regression. A basic graphic linear fit of this simple regression (unreported in this paper) shows a strong, meaningful, and highly statistically significant relationship between EPDS score and Fagerstrom score: a 1 point increase in the Fagerstrom score is, on average, associated with a 0.44 point increase in the EPDS total score ($p < 0.01$).

Discussion

As with other studies, the pre-pregnancy smoking rate was high in this population. In this study, we find a pre-pregnancy smoking rate of 43% including 17% who reported quitting since finding out they were pregnant plus 26% who are still smoking. Quit rates are similar at 39% to the PRAMS Medicaid-specific data quit rates of 44.7% [7].

Consistent with other work, we found that continued smoking during pregnancy was associated with the demographic characteristics of unmarried status, white race, and increased maternal age [6–8] and alcohol and drug use [27, 28]. We also found that mental health history was associated with continued smoking, [16, 17] and the magnitude of the relationship was similar to other published work [17].

However, in contrast to other studies, [12–14, 18] we did not find an association between current depressive symptoms and continued smoking, once demographic and other behavioral factors were considered in regression models. One possible reason for this difference is that most of the other studies utilized the Center for Epidemiologic Studies-Depression (CES-D) [29] scale to measure current depressive symptoms, while we used the Edinburgh Postnatal Depression Scale. It is possible that the questions in the respective scales assessed different aspects of depressive symptoms. Another consideration is that the strong relationship between nicotine dependence and depressive symptoms suggests that perhaps it is really nicotine addiction not just current smoking that creates the stronger relationship.

Current smoking had the strongest behavioral relationship with current alcohol and past drug use, measured by the magnitude of the odds ratios. It is possible that some women have a combination of social or coping behaviors in these substances used together and that they are unwilling

or unable to abstain from use during pregnancy. We also found that a high level of perceived stress was only associated with continuing smoking versus non-smoking, and not with quitting. Other studies have not found a relationship between stress and smoking status [15, 30].

The implications of this and other research is that in both pregnancy and other adult smoking populations, smoking and mental health conditions are related; and that furthermore, the rate of smoking is higher among pregnant and adult populations that are of lower income. What is not clear is the extent to which each factor (smoking, low-income, mental health conditions) influences the other. Given that this was a cross-sectional study, we cannot determine causality, and further investigation into this relationship is warranted.

In addition to the cross-sectional nature of the data, limitations of this work also include the fact that the data were collected as part of a routine screener in participating EPS locations in Michigan. The dataset is a convenience sample of women who were referred to or made contact with the EPS program and are, therefore, not completely representative of the state of Michigan. Given that it was a screener for the EPS provider to deliver the best care, it is possible that respondents answered in a socially desirable manner and that some undesirable behaviors or factors may be underreported, although recent studies of smoking status find that self-report of smoking status is generally reliable [31, 32]. Smoking status was not biochemically verified.

In conclusion, we found a high rate of smoking among this population of Medicaid-eligible pregnant women at their initial prenatal visit. We also found that history of mental illness and high levels of stress were associated with continued smoking as compared to non-smokers. Maternal health programs, such as EPS, that serve this population should incorporate successful smoking cessation interventions for the health of the mothers and baby to improve pregnancy and birth outcomes. Programs should be developed and provided to low-income women to address both mental health issues and/or substance use (alcohol, other drugs) along with smoking cessation as a means to improve cessation outcomes. Current recommendations to use minimal approaches based on advice and referral to cessation-only limited counseling may be inadequate [33]. According to the most recent PRAMS report "Because higher rates of smoking during pregnancy were observed among Medicaid-enrolled women, comprehensive Medicaid coverage of tobacco-dependence treatments needs to be made available for all smokers who want to quit" [7]. Additionally, given the high rate of smoking relapse post-partum, another avenue for future research is to explore the relationship of mental health, stress and other behaviors with smoking and smoking relapse post-partum. Quitters should be included in some level of smoking cessation to prevent relapse.

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