HHS Public Access

Author manuscript

Matern Child Health J. Author manuscript; available in PMC 2014 September 01.

Published in final edited form as:

Matern Child Health J. 2013 September ; 17(7): 1167–1174. doi:10.1007/s10995-012-1103-y.

LEAST EXPLORED FACTORS ASSOCIATED WITH PRENATAL SMOKING

Saba W. Masho, MD, MPH, DrPH [Associate Professor],
Departments of Epidemiology and Community Health and Obstetrics and Gynecology; the VCU Institute of Women's Health; the VCU Center on Health Disparities, Virginia Commonwealth University

Diane L. Bishop, BA, MPH,
Department of Epidemiology and Community Health, Virginia Commonwealth University

Lori Keyser-Marcus, PhD [Assistant Professor],
Department of Psychiatry, The VCU Institute of Women's Health, Virginia Commonwealth University

Sara B. Varner, BA,
Department of Psychiatry, Virginia Commonwealth University

Shannon White, MPH, and
National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Prevention and Control

Dace Svikis, PhD [Professor]
Departments of Psychology, Psychiatry, and Obstetrics and Gynecology; the VCU Institute of Women's Health, Virginia Commonwealth University

Abstract

Objectives—Poor pregnancy and birth outcomes are major problems in the United States, and maternal smoking during pregnancy has been identified as one of the most preventable risk factors associated with these outcomes. This study examines less explored risk factors of smoking among underserved African American pregnant women.

Methods—A cross-sectional survey was conducted at an outpatient obstetrics-gynecology clinic of an inner-city university hospital in Virginia from March 2009 through January 2011 in which pregnant women (N=902) were interviewed at their first prenatal care visit. Survey questions included items related to women's sociodemographic characteristics as well as their pregnancy history; criminal history; receipt of social services; child protective services involvement; insurance status; and history of substance abuse, domestic violence, and depression. Multiple logistic regression was conducted to calculate odds ratios and 95% confidence intervals depicting the relationship between these factors and smoking during pregnancy.

Corresponding Author: Saba W. Masho MD, MPH, DrPH, Department of Epidemiology and Community Health, Virginia Commonwealth University, P. O. Box 980212, Richmond, Virginia 23298-0212, Phone: 804-628-2509; Fax: 804-828-9773; swmasho@vcu.edu.

Results—The analysis reported that maternal age [OR= 1.08, 95%CI=1.05–1.12], less than high school education [OR=4.30, 95%CI=2.27–8.14], unemployed [OR=2.33, 95%CI=1.35–4.04], criminal history [OR=1.66, 95%CI=1.05–2.63], receipt of social services [OR=2.26, 95%CI=1.35–3.79] alcohol use [OR=2.73, 95%CI=1.65–4.51] and illicit drug use [OR=1.97, 95%CI=1.04–3.74] during pregnancy were statistically significant risk factors associated with smoking during pregnancy.

Conclusions—In addition to the well known risk factors, public health professionals should be aware that criminal history and receipt of social services are important factors associated with smoking during pregnancy. Social service providers such as WIC and prisons and jails may offer a unique opportunity for education and cessation interventions during the preconception or interconception period.

Keywords

Smoking during pregnancy; Correlates of smoking; Criminal history; Social Services; Preconception health

INTRODUCTION

Maternal smoking during pregnancy is a serious and preventable risk factor that is associated with poor pregnancy outcomes. In the United States, measures of both infant morbidity and mortality have been attributed to maternal smoking, including nearly 20% of low birth weight births, 7.7% of preterm deliveries, one-third of sudden infant deaths (SIDS), and 7.3% of preterm-related deaths [1]. Maternal smoking has also been associated with a host of health conditions in infants and children, including viral and bacterial infections, middle ear effusions, asthma, periodontal disease, and SIDS [2–6].

Despite the documented risks of smoking during pregnancy to both mother and fetus, up to 13% of women in the U.S. continue to smoke during pregnancy [7]. Because of the health risks to both mother and fetus, some consider pregnancy a “window of opportunity” for practitioners to educate female smokers to quit. Studies have reported that women are more likely to quit smoking during pregnancy than at any other time in their lives and smoking cessation is most likely to occur during the first trimester [8]. To fully prevent the deleterious consequences of smoking on mothers and fetuses, health care professionals should be aware of the potential risk factors associated with prenatal smoking.

Research examining risk factors associated with smoking during pregnancy has amassed in recent years, revealing consistently strong relationships between illicit drug and alcohol use, maternal age, education, parity, and a variety of other socioeconomic and psychosocial variables with prenatal smoking [9–13]. Additionally, maternal depression and its relationship to prenatal smoking have received considerable attention in recent years. Several researchers have found links between depressive symptoms and continued tobacco use during pregnancy [14,15]; however, no firm relationship and directionality has been established between depression and prenatal smoking [16].

Although the associations between some demographic and behavioral variables and maternal smoking during pregnancy have been studied previously, there are many other domains that remain largely uninvestigated. In order to develop effective prevention and intervention strategies, further exploration of additional indicators associated with prenatal smoking is warranted. One such unexplored possible risk factor is criminal history, even though daily smoking rates among female arrestees have been estimated to be as high as 70% [17]. Additionally, criminal history has been strongly associated with illicit substance use among women [18 19], and the majority of female offenders have been found to have history of drug-related charges [20]. Women who are incarcerated are also significantly more likely to smoke, use alcohol, or illicit drugs during pregnancy [21]. However, imprisonment has also been associated with improved birth outcomes, such as a decreased risk of low birth weight, when incarcerated women were compared to a similarly disadvantaged control group [22]. Improving maternal preconception health, including preventing substance use such as smoking, illicit drugs and alcohol, has been suggested as the most effective way to prevent poor pregnancy outcomes [23]. It is important to explore history of incarceration in relation to substance use because prisons and jails can provide access to offer preventive services to high risk women in the preconception and interconception periods. Another factor that requires investigation is the utilization of social services. A large proportion of underserved minority childbearing women are recipients of social services such as WIC, TANF and SSI. While there has been equivocal evidence regarding the impact of WIC participation and smoking, there is some data from the Pregnancy Nutrition Surveillance System (PNSS) to support that enrollment in WIC is associated with a decline in smoking as pregnancy progresses [24]. These preventive services may also offer an opportunity to provide smoking cessation services.

The primary objective of this study was to build on previously established risk factors and examine the unique contributions of less explored variables such as criminal history and social services among low income African American Women. Identification of these factors may help public health professionals to design interventions that target women at high risk of smoking.

METHODS

A cross-sectional survey was conducted from March 2009 through January 2011 at an outpatient obstetrics-gynecology clinic of an inner-city university hospital in Virginia. The survey was part of a screening procedure to determine women's eligibility for a randomized clinical trial. This clinic primarily serves African American, indigent, and uninsured women, as well as women with high-risk pregnancies who require intensive prenatal care. To be eligible to participate in the screening interview, women had to be African American, pregnant, attending their first prenatal care visit, 16 years of age or older and English speaking. Of the 921 women who were invited to participate, 902 (97%) completed the survey. A number of strategies were undertaken to achieve the high response rate. First, research staff had a daily presence within the OB-GYN patient waiting room, which allowed for direct recruitment of participants while they were waiting for clinical appointments. Second, both informed consent and the screening survey were conducted via face-to-face interview with the research staff, which ensured a personal interaction and high-quality data

collection. Finally, participants received a $10 gift card for their time. This study was approved by the Virginia Commonwealth University's Institutional Review Board (VCU-IRB).

The survey instrument included items related to respondents' demographic and socioeconomic characteristics, insurance, receipt of social services, history of substance use, history of domestic violence, history of depression, and criminal history (arrest for offenses other than traffic violations). Survey participants were also asked to indicate the date of their last menstrual period (LMP), their estimated due date and the number of weeks they had been pregnant.

Our classification of women's smoking status was based on their response to the question, "When did you last smoke a cigarette?" Response options to this question were: never smoked, and smoked today, past 7 days, past month, past 3 months, past 6 months, past year, more than a year ago. Those who indicated they had "smoked today" were classified as smokers, and those who indicated they had not smoked that day, were classified as nonsmokers. Additionally, separate analyses were conducted among those who smoked in the past 7-days and 30-days to examine factors for women who were occasional smokers. Alcohol use ("When did you last drink something containing alcohol?,") illicit drug use ("When did you last use illicit or street drugs (e.g., marijuana, cocaine, crack, heroin, etc.)?"), and prescription drug abuse (defined as taking prescription drugs not prescribed by a doctor or taking an amount greater than what a doctor prescribed), were classified based on whether they reported using these substances within the preceding month.

The 3-item "Partner Violence Screen" was used to ascertain risk for past and current domestic abuse [25]. This instrument has been validated in health care settings, and asks women if they fell safe in their current relationship, if a partner from previous relationship makes them feel unsafe currently, and if they have been "hit, kicked, punched, or otherwise hurt by someone in the past year?" Women were classified as displaying "depressive symptoms" if they respond affirmatively to either of the following questions adapted from the 2-item Patient Health Questionnaire (PHQ-2) [26]: "During the past month, have you felt down, depressed, or hopeless more days than not?", and "During the past month, have you had little interest or pleasure in doing things more than not?" Women were classified as having a criminal history if they reported having been arrested or incarcerated for any reason other than traffic violations. Women were classified as having received social services if they reported having participated in the Temporary Assistance for Needy Families (TANF) program, the Supplemental Security Income (SSI) program, the Special Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC), or other social service programs such as food stamp.

Data analysis

Descriptive analyses were conducted to assess the distribution of demographic, social, reproductive and behavioral characteristics of the survey respondents by smoking status. The unadjusted relationship between study variables and the prevalence of smoking was examined and odds ratios and 95% confidence intervals (95% CI) were calculated. A separate multiple logistic regression analyses were conducted to assess factors associated

with prenatal smoking among those who smoked today, past 7-days and 30-days. Each of the variables was tested and factors significantly contributing to the fitness of the model were retained. To identify the best predictor model, the −2 log likelihood was examined using best-subset model. Models that include variables contributing to the best fit model were retained.

RESULTS

Of the 902 pregnant women interviewed 898 (99.6%) women provided a valid response to the smoking question. Table 1 describes the study population. The average age of the study population was 24.8 (SD = 5.9) years, and the average duration of their pregnancies was 15.1 (SD = 8.3) weeks (Table 1). Nearly 17% of the women reported smoking the day of their prenatal visit and 26% and 32% reported smoking in the past 7- and 30-days, respectively. A significant proportion of women reported having had a high school education and being unemployed; and a majority reported being single and having public insurance. Approximately 45% reported experiencing depressive symptoms; 19% reported having a criminal history; 63% receiving social services; 8% reported having had contact with child protective services; and 14.6% reported alcohol, and 6.9% illicit drug use during the previous month.

The results of the unadjusted and adjusted analyses showed that maternal age, education level, employment status, criminal history, receipt of social services alcohol and illicit drug use during pregnancy were statistically significantly associated with smoking on the day of the prenatal care, in the past 7-days and past 30-days (Table 2 and 3). While depression contributed to the overall fitness of all the models, it only showed a statistically significant estimate among those who smoked in the past 30-days. The odds of smoking on the day of the prenatal care, in the past 7-days and past 30-days among women who have reported criminal history was 1.66 [OR=1.66, 95% CI=1.05–2.63], 2.23 [OR=2.23, 95% CI=1.47–3.38] and 2.67 [OR=2.67, 95% CI=1.78–3.99) times higher than those who reported no criminal history, respectively. The odds of smoking on the day of the prenatal care, in the past 7-days and past 30-days among recipients of social services was 2.3 [OR=2.26, 95% CI=1.35–3.79), 2.0 [OR=1.98, 95%CI= 1.30–3.02] and 1.6 [OR=1.61, 95% CI=1.11–2.34] times higher than their non- recipient counterparts, respectively.

DISCUSSION

The current study reported a statistically significant association between prenatal smoking and the less explored variables, criminal history and receipt of social services. Additionally, this study confirmed previous findings showing smoking during pregnancy to be associated with maternal age, education level, insurance status, and use of alcohol and illicit drugs during pregnancy [11–13]. These factors were consistently significant regardless of women’s smoking status (the day of the prenatal care, past 7 or 30 days).

In general, women who have been incarcerated tend to be less educated, more likely to be unemployed and uninsured, and more likely to smoke and use illicit drugs than women who have not been incarcerated. Similarly, women who receive social services tend to have these

risk factors suggesting that providers of these special populations should make special effort to target and educate women about the consequences of smoking and offer smoking cessation programs earlier in the pregnancy or before they become pregnant.

The current analyses revealed that older women, those with less education, and unemployed women were more likely to smoke during pregnancy. Consistent with the findings of this study, results from a previous study showed the likelihood of smoking during pregnancy to be associated with maternal education level and employment status [11]. The study reported that younger women were more likely to smoke during pregnancy, unlike the results of this study where the likelihood of smoking is higher among older women. One possible explanation for this difference is that smoking prevention efforts targeting youth may have contributed to the decline in smoking among younger women. The finding of this study that women with less than a high school education were substantially more likely to smoke during pregnancy than women with more than a high school education was consistent with findings of Gilman et al. [11] and Agrawal et al. [12]. Women with lower levels of education may have less access to smoking cessation programs than women with higher levels, and the programs available to them may be less effective [27,28].

Although the relationship between smoking and postpartum depression has been studied fairly extensively, relatively fewer studies have examined the relationship between smoking and prenatal depression. Results of a recent review by Lancaster et al. indicated no consistent association between smoking during pregnancy and prenatal depression [29]; however, results of several other studies have shown smoking during pregnancy to be a predictor of depression during pregnancy [30–33]. The finding of this study showed a statistically significant association between smoking in the past 30-days and depression but the association didn't reach significance among those who smoked on the day of the prenatal care and in the past 7-days. Due to the small number of women who reported smoking more recently, there may have been insufficient power to detect a statistically significant difference. Research results suggest that depressed smokers face more challenges in attempting to quit than non-depressed smokers do, including a more negative mood during nicotine withdrawal, a higher level of nicotine dependence, and a greater likelihood of relapse [34, 35]. The possible association between prenatal smoking and depression indicates that health care professionals should consider screening pregnant smokers for depression and provide them with treatment options.

Unlike previous studies [36–38], whose results showed a strong association between violence and smoking, this study did not find physical violence to be a significant correlate of smoking during pregnancy in our adjusted analysis (despite its statistical significance in the unadjusted analysis). This difference in adjusted findings may be due to differences in the type of confounders controlled in the studies. Additionally, few women (18%) in this study reported to be married or living with a partner.

This study examined factors associated with antenatal smoking among inner city African American pregnant women and examined factors that are not typically assessed. Identification of these risk factors is the key to designing successful interventions. Public health interventions that have proven to be effective in reducing smoking rates in the general

population and also impact smoking in pregnancy include increasing the price of cigarettes and using advertisements to educate the public about the harmful effects of tobacco [39–42]. To fully prevent the deleterious consequences of smoking, women should also refrain from smoking prior to conception, particularly during the months immediately before the pregnancy. Moreover, because underserved minority women (such as those in our study) tend to enter prenatal care late, the window of opportunity for preventing the adverse consequences of smoking during pregnancy is even shorter among them. Therefore, it is important for public health providers to design smoking-cessation interventions that target women before they conceive with a life course perspective for intervention. Furthermore, efforts should be made to reach preconception and interconception women beyond the clinical setting. Prisons and jails and social service programs may be appropriate venues to reach women for such interventions. Additionally, organizational policy changes such as the implementation of smoke-free prisons and jails coupled with smoking cessation programs may provide women the opportunity to quit smoking.

Despite its strengths in examining factors that have not been well investigated, this study has some of limitations. This study used self reported data to examine smoking status. Due to social desirability, it is possible that smokers might have been misclassified as non smokers. This may have resulted in underestimation or lack of an association with some of the variables. A recent article by Dietz et al reported that non-disclosure of smoking status was higher among active pregnant smokers, especially among non-Hispanic Blacks [43]. However, findings of this study were fairly consistent with the findings of other studies [11–15]. This study was unable to investigate the roles of other factors such as partner's history of smoking and secondhand smoke, and life time difficulty to quitting smoking. Lastly, this study reported odds ratios instead of prevalence odds ratio which might have overestimated the association.

In summary, this study reported that the likelihood of smoking during pregnancy was significantly higher among women with a criminal history and social services utilization. These findings suggest that in addition to being alert for established sociodemographic factors, health care professionals should be aware of criminal history as an important predictor of prenatal smoking. Additionally, social services provider agencies such as WIC, and prisons and jails could provide an opportunity to reach these high risk populations.

We recommend that future studies of the relationship between various factors and maternal smoking during pregnancy should determine women's smoking status on the basis of laboratory tests rather than self reports, involve a more nationally representative sample of pregnant women, and investigate the effects of factors such as previous attempts to quit and exposure to second-hand smoke.

Acknowledgments

This study was supported by Cooperative Agreement Number 5U58DP000983 from the Centers for Disease Control and Prevention and by NIH 5 P60 MD002256-03 from the National Center on Minority Health and Health Disparities. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the sponsors.

References

1. Dietz PM, England LJ, Shapiro-Mendoza CK, et al. Infant morbidity and mortality attributable to prenatal smoking in the U.S. Am J Prev Med. 2010; 39:45–52. [PubMed: 20547278]
2. Lanari M, Giovannini M, Giuffré L, et al. Prevalence of respiratory syncytial virus infection in Italian infants hospitalized for acute lower respiratory tract infections, and association between respiratory syncytial virus infection risk factors and disease severity. Pediatr Pulmonol. 2002; 33:458–465. [PubMed: 12001280]
3. Nuorti JP, Butler JC, Farley MM, et al. Cigarette smoking and invasive pneumococcal disease. N Engl J Med. 2000; 342:681–689. [PubMed: 10706897]
4. Ey JL, Holberg CJ, Aldous MB, et al. Passive smoke exposure and otitis media in the first year of life. Pediatrics. 1995; 95:670–677. [PubMed: 7724301]
5. Burr ML, Anderson HR, Austin JB, et al. Respiratory symptoms and home environment in children: A national survey. Thorax. 1999; 54:27–32.9. [PubMed: 10343627]
6. Wisborg K, Kesmodel U, Henriksen TB, et al. Exposure to tobacco smoke in utero and the risk of stillbirth and death in the first year of life. Am J Epidemiol. 2001; 154:322–327. [PubMed: 11495855]
7. Tong VT, Fones JR, Dietz PM, et al. Trends in smoking before, during and after pregnancy-Pregnancy Risk Assessment Monitoring System (PRAMS), United States, 31 Sites, 2000–2005. MMWR. 2009; 58(SS04):1–29.
8. Cnattingius S, Lindmark G, Meirik O. Who continues to smoke while pregnant? J Epidemiol Community Health. 1992; 46:218–221. [PubMed: 1645075]
9. Chasnoff IJ, Neuman K, Thornton C, et al. Screening for substance use in pregnancy: A practical approach for the primary care physician. Am J Obstet Gynecol. 2001; 184:752–758. [PubMed: 11262483]
10. Svikis D, Henningfield J, Gazaway P, et al. Tobacco use for identifying pregnant women at risk of substance abuse. J Reprod Med. 1997; 42:299–302. [PubMed: 9172121]
11. Gilman SE, Breslau J, Subramanian SV, et al. Social factors, psychopathology, and maternal smoking during pregnancy. Am J Public Health. 2008; 98:448–453. [PubMed: 17600245]
12. Agrawal A, Knopik VS, Pergadia ML, et al. Correlates of cigarette smoking during pregnancy and its genetic and environmental overlap with nicotine dependence. Nicotine Tob Res. 2008; 10:567–78. [PubMed: 18418779]
13. Hammarstrom A, Janlert U. Unemployment - an important predictor for future smoking: A 14-year follow-up study of school leavers. Scand J Public Health. 2003; 31:229–232. [PubMed: 12850978]
14. Zhu SH, Valbo A. Depression and smoking during pregnancy. Addict Behav. 2002; 27:649–658. [PubMed: 12188598]
15. Linares TJ, Heil SH, Higgins ST, et al. Depressive symptoms predict smoking status among pregnant women. Addict Behav. 2009; 34:705–708. [PubMed: 19411145]
16. Goedhart G, Van der Wal MF, Cuijpers P, Bonsel GJ, et al. Psychosocial problems and continued smoking during pregnancy. Addict Behav. 2009; 34:403–406. [PubMed: 19070436]
17. Durrah TL, Rosenberg TJ. Smoking among female arrestees: Prevalence of daily smoking and smoking cessation efforts. Addict Behav. 2004; 29:1015–1019. [PubMed: 15219351]
18. Staton M, Leukefeld C, Webster JM. Substance use, health, and mental health: Problems and service utilization among incarcerated women. Int J Offender Ther Comp Criminol. 2003; 47:224–239. [PubMed: 12710367]
19. Taylor, BG.; Newton, PJ.; Brownstein, HH. Arrestee Drug Abuse Monitoring (ADAM) 2000 Annual Report. Washington, DC: National Institute of Justice; 2003. Drug use among female arrestees.
20. Greenfield, L.; Snell, L. Women Offenders. Washington, DC: Bureau of Justice Statistic; 1999. (NCJ Publication No. 175688). http://bjs.ojp.usdoj.gov/content/pub/pdf/wo.pdf [Accessed 2/16/12]
21. Knight M, Plugge E. Risk factors for adverse perinatal outcomes in imprisoned pregnant women: A systematic review. BMC Public Health. 2005; 5:111. [PubMed: 16229740]

22. Knight M, Plugge E. The outcomes of pregnancy among imprisoned women: a systematic review. British Journal of Obstetrics and Gynaecology. 2005; 112:1467–74. [PubMed: 16225564]
23. Masho SW, Keyser-Marcus L, Varner, et al. Addressing perinatal disparities using community-based participatory research: Data into action. J Community Psychol. 2011; 39:292–302. [PubMed: 23459130]
24. Joyce T, Racine A, Yunzal-Butler C. Reassessing the WIC effect: evidence from the Pregnancy Nutrition Surveillance System. J Policy Anal Manage. 2008; 27(2):277–303. [PubMed: 18401924]
25. Feldhaus KM, Koziol-McLain J, Amsbury HL, Norton lM, Lowenstein SR, Abbott JT. Accuracy of 3 Brief Screening Questions for Detecting Partner Violence in the Emergency Department. JAMA. 1997; 277:1357–1361. [PubMed: 9134940]
26. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. Med Care. 2003; 41:1284–1292. [PubMed: 14583691]
27. Bonollo DP, Zapka JG, Stoddard AM, et al. Treating nicotine dependence during pregnancy and postpartum: understanding clinician knowledge and performance. Patient Educ Couns. 2002; 48:265–74. [PubMed: 12477611]
28. Pullon S, Webster M, McLeod D, et al. Smoking cessation and nicotine replacement therapy in current primary maternity care. Aust Fam Physician. 2004; 33:94–96. [PubMed: 14988974]
29. Lancaster CA, Gold KJ, Flynn HA, et al. Risk factors for depressive symptoms during pregnancy: a systematic review. Am J Obstet Gynecol. 2010; 202:5–14. [PubMed: 20096252]
30. Bowen A, Muhajarine N. Prevalence of antenatal depression in women enrolled in an outreach program in Canada. J Obstet Gynecol Neonatal Nurs. 2006; 35:491–8.
31. Flynn HA, Marcus SM, Barry KL, et al. Rates and correlates of alcohol use among pregnant women in obstetrics clinics. Alcohol Clin Exp Res. 2003; 27:81–7. [PubMed: 12544010]
32. Vander Weg MW, Ward KD, Scarinci IC, et al. Smoking-related correlates of depressive symptoms in low-income pregnant women. Am J Health Behav. 2004; 28:510–21. [PubMed: 15569585]
33. Ward KD, Vander Weg MW, Sell MA, et al. Characteristics and correlates of quitting among black and white low income pregnant smokers. Am J Health Behav. 2006; 30:651–62. [PubMed: 17096622]
34. Hoffman S, Hatch MC. Depressive symptomatology during pregnancy: evidence for an association with decreased fetal growth in pregnancies of lower social class women. Health Psychol. 2000; 19:535–43. [PubMed: 11129356]
35. Gierisch, JM.; Bastian, LA.; Calhoun, PS., et al. [Accessed 2/16/12.] Comparative Effectiveness of Smoking Cessation Treatments for Patients With Depression: A Systematic Review and Meta-analysis of the Evidence. VA-ESP Project #09-010. 2010. http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0009495/pdf/TOC.pdf
36. Goedhart G, Van der Wal MF, Cuijpers P, et al. Psychosocial problems and continued smoking during pregnancy. Addict Behav. 2009; 34:403–6. [PubMed: 19070436]
37. McFarlane J, Parker B, Soeken K. Physical abuse, smoking, and substance use during pregnancy: prevalence, interrelationships, and effects on birth weight. J Obstet Gynecol Neonatal Nurs. 1996; 25:313–20.
38. Jesse DE, Graham M, Swanson M. Psychosocial and spiritual factors associated with smoking and substance use during pregnancy in African American and White low-income women. J Obstet Gynecol Neonatal Nurs. 2006; 35:68–77.
39. Ringel JS, Evans WN. Cigarette taxes and smoking during pregnancy. Am J Public Health. 2001; 91:1851–6. [PubMed: 11684615]
40. Van Walbeek C. A simulation model to predict the fiscal and public health impact of a change in cigarette excise taxes. Tob Control. 2010; 19:31–6. [PubMed: 19850550]
41. Gilmore AB, Branston JR, Sweanor D. The case for OFSMOKE: how tobacco price regulation is needed to promote the health of markets, government revenue and the public. Tob Control. 2010; 19:423–30. [PubMed: 20876078]
42. Rivara FP, Ebel BE, Garrison MM, et al. Prevention of smoking-related deaths in the United States. Am J Prev Med. 2004; 27:118–25. [PubMed: 15261898]

43. Dietz PM, Homa D, England LJ, et al. Estimates of nondisclosure of cigarette smoking among pregnant and nonpregnant women of reproductive age in the United States. Am J Epidemiol. 2011; 173:355–9. [PubMed: 21178103]

Table 1

Maternal Characteristics

Characteristics	Total		Smoked		
	N	Mean (SD)	Today (N=149)	Past 7-days (N=82)	Past month (N=59)
Mean age in years (SD)	848	24.8 (5.9)	26.6(6.5)	26.1(6.2)	25.7(5.9)
Mean gestational age in weeks (SD)	848	15.1 (8.3)	15.5(8.3)	14.7(8.3)	14.3(8.2)
	N	%	%	%	%
Education					
< High School	262	26.5	45.6	41.6	37.6
High School graduate	398	44.3	43.0	42.9	43.8
> High School	238	29.2	11.4	15.6	18.6
Employment					
Unemployed	447	49.9	73.8	68.4	65.4
Part-time	137	15.3	10.7	13.0	13.8
Full-time	312	34.8	15.4	18.6	20.8
Marital status					
Single	709	79.0	79.2	81.4	82.4
Married/living together	159	17.7	14.8	13.9	12.8
Other	30	3.3	6.0	4.8	4.8
Insurance					
Private	141	15.8	7.5	8.7	8.7
Public	658	73.9	85.7	84.7	83.3
Self pay	91	10.2	6.8	6.6	8.0
Alcohol use	130	14.5	28.2	28.6	26.9
Illicit drug use	62	6.9	17.4	18.2	17.2
Prescription drug abuse	29	3.2	6.0	6.5	5.2
History of physical violence	71	7.9	11.4	12.6	12.4
Criminal history	167	18.7	36.8	36.1	34.9
Child protective services involvement	68	7.7	19.7	14.4	12.8
Receive Social Services	570	63.5	83.2	79.2	75.9

Characteristics	Total		Smoked		
	N	Mean (SD)	Today (N=149)	Past 7-days (N=82)	Past month (N=59)
Depressive symptoms	399	44.4	59.1	57.6	57.2

Table 2

Factors Associated with Smoking during Pregnancy - Unadjusted

Characteristics	Smoked today OR (95%CI)	Smoked past 7 days OR (95%CI)	Smoked past month OR (95%CI)
Age in years	1.06 (1.03–1.09)***	1.05 (1.03–1.08)***	1.04 (1.02–1.06)**
Gestational age in weeks	1.01 (0.99–1.03)	0.99 (0.97–1.01)	0.98 (0.97–1.00)
Education			
<High school	5.77 (3.27–10.16) ***	4.24 (2.74–6.57)***	3.26 (2.20–4.82)***
High school grad	2.76 (1.58–4.83) ***	2.08 (1.37–3.16) **	1.81 (1.52–2.60)**
>High school	Referent	Referent	
Employment			
Unemployed	4.10 (2.55–6.60)***	3.42 (2.35–4.98)***	3.08 (2.19–4.32)***
Part-time	1.66 (0.85–3.26)	1.75 (1.05–2.94)***	1.73 (1.09–2.75)*
Fulltime	Referent	Referent	
Marital Status			
Single	1.24 (0.76–2.03)	1.43 (0.94–2.18)	1.68 (1.13–2.50)*
Married/living together	Referent	Referent	
Other	2.67 (1.08–6.57)*	2.30 (0.99–5.31)	2.89 (1.29–6–46)*
Insurance type			
Private	Referent	Referent	
Public	2.80 (1.47–5.34)**	2.53 (1.53–4.18)***	2.66 (1.68–4.22)***
Self pay	1.46 (0.59–3.59)	1.19 (0.58–2.47)	1.57 (0.83–2.98)
Alcohol use	2.94 (1.93–4.48)***	3.76 (2.56–5.53)***	3.93 (2.67–5.77)***
Illicit drug use	4.18 (2.44–7.17)***	7.18 (4.11–12.52)***	10.33 (5.41–19.74)***
Prescription drug abuse	2.33 (1.04–5.22)*	3.22 (1.53–6.78)**	2.31 (1.10–4.86)*
History of physical violence	1.66 (0.93–2.94)	2.13 (1.30–3.51)**	2.32 (1.42–3.77)**
Criminal history	3.10 (2.10–4.58)***	3.91 (2.74–5.56)***	4.40 (3.09–6.25)***
CPS involvement	4.42 (2.63–7.43)***	3.0 (1.81–4.96)***	2.71 (1.64–4.46)***
Depression	2.03 (1.42–2.91)***	2.05 (1.51–2.77)***	2.16 (1.62–2.86)***
Receive Social Services	3.37 (2.14–5.31)***	2.76 (1.94–3.93)***	2.32 (1.69–3.17)***

*** p <0.0001

** <0.01

* p <0.05

Table 3

Correlates of Smoking during Pregnancy

Characteristics	Smoked Today	Smoked in Past 7 Days	Smoked in Past Month
Age in years	1.08 (1.05–1.12)***	1.07 (1.04–1.10)***	1.05 (1.02–1.08)
Education			
<High school	4.30 (2.27–8.14)***	3.59 (2.08–6.19)***	2.55 (1.57–4.15)***
High school grad	2.54 (1.37–4.68)**	2.10 (1.29–3.46)**	1.77 (1.15–2.74)*
>High school	Ref	Ref	Ref
Employment**			
Unemployed	2.33 (1.35–4.04)**	1.98 (1.24–3.17)**	2.01 (1.33–3.03)**
Part-time	1.17 (0.56–2.45)	1.12 (0.–2.45)	1.42 (0.84–2.41)
Fulltime	Ref	Ref	
Alcohol use	2.73 (1.65–4.51)***	3.56 (2.25–5.65)***	3.47 (2.21–5.44)***
Illicit drug use	1.97 (1.04–3.74)*	3.51 (1.85–6.65)***	5.08 (2.50–10.32)***
Criminal history	1.66 (1.05–2.63)*	2.23 (1.47–3.38)***	2.67 (1.78–3.99)*
Depression	1.39 (0.93–2.09)	1.37 (0.97–1.96)	1.46 (1.05–2.02)*
Receive Social Services	2.26 (1.35–3.79)**	1.98 (1.30–3.02)**	1.61 (1.11–2.34)*

*** p <0.0001

** <0.01

* p <0.05