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Neighborhood Safety As a Correlate of Tobacco Use in a Sample of Urban, Pregnant women

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Abstract

Objectives—Environmental context has been increasingly recognized as an important determinant of health behavior. This study examined the effects of self-reported neighborhood violence and perceived safety on tobacco use in a sample of low-income, pregnant women.

Methods—Pregnant women (N=1521) being treated at an urban Emergency Room completed a baseline interview where neighborhood safety (self-reported neighborhood violence and perceived safety) as well as individual (demographics, depression symptoms, stress, tobacco use, substance abuse) and social variables (prenatal social environment and number of close friends) were evaluated cross-sectionally. Tobacco use was measured again in a telephone interview at 22 weeks gestation.

Results—In a logistic regression model of baseline smoking status, self-reported neighborhood violence was significantly associated with being a smoker independent of age, education status, lifetime use of cocaine and marijuana and current use of cocaine and marijuana. In a regression model estimating the relationship between these baseline variables and continued prenatal smoking, baseline smoking emerged as the strongest correlate of continued smoking during pregnancy.

Conclusions—These findings suggest that self-reported neighborhood violence had a stronger association with early pregnancy cigarette use compared to ongoing cigarette use in a sample of low-income, pregnant women. Prospective trials are needed to fully elucidate the relationship between individual and social-environmental determinants of tobacco use in this high-risk population.

Keywords

pregnancy; smoking; neighborhood violence

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Contributors

None

Conflict of Interest

None

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1. Introduction

Low-income pregnant women remain a priority population for tobacco-control efforts (U.S. Department of Health and Human Services, 2012). The negative health effects of tobacco use for both the mother (e.g., increased risk of heart disease, cancer, cardiopulmonary disease) (American Cancer Society, 2009; Burns, 2003) and child (e.g., abruption of the placenta, ectopic pregnancy, preterm birth, low-term birth, still birth) (Castles, Adams, Melvin, Kelsch, & Boulton, 1999; Miller, et al., 2010; Roelands, Jamison, Lysterly, & James, 2009; Vardavas, et al., 2010) are well documented. Yet, population estimates suggest that only 11.3% of women aged 18–49 years stop smoking for the duration of their pregnancy (U.S. Department of Health and Human Services, 2012), and there is even evidence of low-income women initiating a smoking habit during their pregnancy (Webb, Culhane, Mathew, Bloch, & Goldenberg, 2011).

Consistent with ecological models of health behavior that suggest individual, social and environmental factors converge to influence health behaviors such as tobacco use (Sallis, Owen, & Fisher, 2008), the documented correlates of prenatal smoking are multi-factorial. For example, individual level variables such as younger age (adolescents and those aged 18–24 years), having less than a high school education (Martin, et al., 2007) and not being married are positively associated with continued smoking throughout pregnancy (Kahn, Certain, & Whitaker, 2002; Penn & Owen, 2002). Increased levels of depressive symptoms and stress have also been highly correlated with prenatal tobacco use, particularly among low-income groups (Munafo, Heron, & Araya, 2008). Social variables such as levels of support from friends as well as having a partner who smokes have been shown to predict continued smoking during pregnancy and for women who do successfully quit, relapse to former smoking patterns in the postpartum period (Homish, Eiden, Leonard, & Kozlowski, 2012; Lu, Tong, & Oldenburg, 2001; Merzel, English, & Moon-Howard, 2010).

Neighborhood safety is an environmental level variable that has been associated with tobacco use, particularly among adolescents where a higher level of neighborhood violence and feeling unsafe have been associated with greater levels of tobacco use. Neighborhood safety has also been shown to be associated with tobacco use in adult populations where perceived neighborhood problems or disorder have been shown to be associated with higher rates of smoking (Ellaway & Macintyre, 2009; Miles, 2006). Living in neighborhoods with high levels of violence is often perceived as stressful. Such stress can cause the human body to experience “fight or flight” reactions that may result in the feeling of fear or anxiety (Cutrona, Wallace, & Wesner, 2006; Hill & Angel, 2005). Tobacco use is a coping mechanism that is used by some individuals to deal with such feelings of anxiety and fear (Hill & Angel, 2005; Miles, 2006). Whether neighborhood safety affects prenatal smoking behavior in low-income women, independent of individual and social level variables, has yet to be tested.

Toward this end, this study examined the effects of perceived neighborhood safety and self-reported neighborhood violence on tobacco use in a sample of low-income, minority pregnant women recruited from the Emergency Room of an urban hospital. We hypothesized that in this population, neighborhood safety would be significantly correlated with tobacco use during pregnancy independent of other individual and social level variables.

2. Methods

2.1. Study Design

To test whether neighborhood safety was significantly correlated with prenatal smoking behaviors (independent of individual and social level variables) pregnant women, prior to 21 weeks gestation who, on average, were between 9–11 weeks gestation at enrollment, completed a baseline study assessment and a subsequent follow-up interview after 22-weeks gestation (Nelson, McMahon, Joffe, & Brensinger, 2003). The average follow-up time from enrollment to follow-up interview was 7 weeks. Thus, a prospective study design utilizing two assessment points was utilized.

2.2. Study Participants

Study participants were pregnant women, prior to 21 weeks gestation, aged 14–40 years who presented at the Emergency Room at the Hospital of the University of Pennsylvania between January 1999 and August 2001. Women who lived outside of the urban center, reported being more than 22-weeks gestation, had a menstrual period in the last 28-days or had a history of hysterectomy were excluded. Other study exclusion criteria included: being postpartum, having a therapeutic or spontaneous abortion in the last 14 days, ectopic, molar or twin pregnancy, non-English speaking or a diagnosis of an acute mental illness. A trained study research assistant conducted the eligibility screening and study consenting process and an in-person interview with each participant. Follow-up information regarding smoking status and pregnancy status were obtained at 22 weeks gestation via telephone. Participants were not counseled to stop smoking as part of the study procedures.

2.3. Study Measures

2.3.1. Demographics—Participant age, race, marital status (single versus partnered), education level (some college versus no college) and employment status (working for pay versus not working for pay) were evaluated at baseline.

2.3.2. Psychological Variables—Depressive symptoms and perceived stress were the psychological variables evaluated. The Center for Epidemiologic Studies-Depression Scale is a 20-item measure of depression symptoms. Each item is rated along a 4-point Likert scale to indicate how frequently in the past week the symptom occurred (0=rarely or none of the time, 3= most of the time). Scores range from 0 to 60, and higher scores indicate a greater degree of depressive symptoms (Radloff, 1977). Perceived stress was measured using the 10-item Perceived Stress Scale (PSS) (Cohen & Williamson, 1988). This self-report instrument evaluates the respondent's perception of stress (e.g., In the last month, how often have you been upset because of something that happened unexpectedly?). Responses are on a 5-point scale from "never" to "very often." The PSS has demonstrated reliability ($\alpha = .78$) and been associated with smoking cessation among pregnant and postpartum women (Park, et al., 2009).

2.3.3. Health Behavior Variables—Body mass index (BMI) was calculated by dividing self-reported weight in pounds*703 by height in inches squared. Attendance to routine prenatal visits was evaluated using a single, dichotomous response item: "Before coming to the hospital today, have you had any routine prenatal visits for this pregnancy?" Not attending prenatal care visits has been shown to increase the odds of continued smoking during pregnancy (Al-Sahab, Saqib, Hauser, & Tamim, 2010). Sedentary behavior was evaluated using a single item where participants were asked to report how many hours per day they had spent sitting or watching television since their last menstrual period. Current and lifetime use of crack or cocaine and marijuana were evaluated. Specifically, participants were asked to respond "yes" or "no" to the following questions: "Have you ever used crack

or cocaine?” and “Have you used crack or cocaine since your last menstrual period?” The same question format was used to evaluate marijuana use. Use of illicit drugs such as cocaine has been strongly correlated with tobacco use, and continued smoking during pregnancy (van Gelder, et al., 2010).

2.3.4. Social Support—Participants were asked to report the number of close friends they had. Number of close friends has been shown to relate to perinatal depression symptoms and birth weight in a sample of pregnant women (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993). The Prenatal Social Environment Inventory (PSEI) is a 41-item survey designed to evaluate chronic and major stressful events (e.g., your husband or boyfriend lost his job) experienced in the last year on a dichotomous scale (Yes/No) (Orr, James, & Casper, 1992). The PSEI has demonstrated reliability among African-American pregnant women (Orr, et al., 1996) and high levels of measured stress has been positively correlated with tobacco use in this population (Nelson, Grisso, et al., 2003).

2.3.5. Neighborhood Safety Variables—Perceived neighborhood safety was evaluated using a single item asking, “How safe do you feel walking in your neighborhood after dark?” Responses were rated on a five-point scale that included: not safe, cautious, comfortable but aware, comfortable and very safe. Self-reported neighborhood violence was a composite variable made up of the following three items: 1) In the past year, how many times has anyone been jumped or attacked in your neighborhood? 2) In the past year, how many times have you seen someone carrying or holding a gun or knife in your neighborhood, not including the police or security officers? 3) In the past year, how many times have you heard the sound of gunfire in your neighborhood? Responses from these items were summed and presented as tertiles (no reported violence, low levels of reported violence and high levels of reported violence).

2.3.6. Tobacco Use—Tobacco use was evaluated at baseline and follow-up using the item: “Do you smoke cigarettes now?” and “Since [month of last menstrual period], how many cigarettes do you usually smoke per day?” Given the stigma associated with prenatal tobacco use, baseline-smoking status was biochemically verified using urine cotinine. Since self-reported tobacco use was highly correlated with cotinine levels ($r=.79$; $p<.001$), the self-reported data were used in the analysis. Follow-up smoking status was self-reported.

2.4. Statistical Analysis

All statistical analyses were performed using SPSS version 18 (SPSS for Windows, Chicago, IL). The bivariate association between individual (age, race, marital status (single vs. partnered), education, employment, depression symptoms, perceived stress, body mass index, prenatal visits, self-reported substance (crack and marijuana), social (number of close friends, prenatal social environment) and environmental (perceived neighborhood safety and self-reported neighborhood violence) variables with baseline tobacco use was assessed using chi-square (χ^2)-tests of association for nominal or ordinal data, analysis of variance (ANOVA) for interval data and t-tests for continuous data (Table 1). A correlation matrix to evaluate the association between the psychological factors (depressive symptoms and perceived stress), neighborhood safety and tobacco use was examined for exploratory purposes. A linear trend computation was conducted to impute for missing data in the depressive symptoms ($N=3$ missing), perceived stress scale ($N=6$ missing) and self-reported neighborhood violence ($N=10$ missing) variables. Variables significantly associated with tobacco use were entered into a forward stepwise logistic regression model, with neighborhood safety entered into the model in the last step (Table 2).

3. Results

3.1. Participant Characteristics

A total of 1521 women completed the baseline assessment. Of these, 338 (22%) were self-reported smokers, smoking an average of 7 cigarettes per day ($SD=6.2$). The majority of the sample was Black ($N=1401$; 92%). Forty-one women (3%) reported being White, 24 (1.5%) Asian/Pacific Islander, 11 (1%) Hispanic, 11 (1%) Native American and the remainder self-identified their race as “other.” The mean age of the sample was 23.5 years ($SD=5.6$) and most of the women reported being with a partner ($N=1216$; 80%). Approximately one-quarter ($N=343$; 24%) of the sample had received some post-high school training or attended college and three-quarters ($N=1119$; 74%) reported working for pay (Table 1). Approximately one third of the baseline sample ($N=465$; 31%) completed the follow up assessment. The women in this sub-sample were largely partnered ($N=360$; 77%), attended some college ($N=311$, 67%) and worked for pay ($N=350$; 75%). The demographic characteristics of the participants who completed the follow-up assessment were not significantly different from the participants not completing the follow-up assessment.

3.2. Individual Level Correlates of Smoking Behavior

Demographic variables associated with baseline smoking included age, education level and employment. Race was not analyzed since the majority of the sample was Black. Smokers were significantly older ($M=25$ ($SD=6.2$) vs. $M=23$ ($SD=5.3$); $t=-5.6$, $p<.001$) and less likely to have attended college ($\chi^2=49.14$, $p<.001$) than non-smokers. Smokers were also less likely to work for pay ($\chi^2=5.43$, $p<.01$) than non-smokers (Table 1).

Baseline levels of depressive symptoms ($t=-4.0$, $p<.01$) and perceived stress ($t=-4.0$, $p<.01$) were significantly associated with tobacco use. With regard to health behavior variables, attendance to routine prenatal visits ($\chi^2=6.8$; $p<.05$), lifetime use of cocaine ($\chi^2=94.1$; $p<.01$) and marijuana ($\chi^2=157.6$; $p<.01$) and current use of cocaine ($\chi^2=5.5$; $p<.05$), marijuana ($\chi^2=56.5$; $p<.01$) and alcohol ($t=-.65$; $p<.01$) were also significantly associated with current tobacco use. Although current use of cocaine and marijuana were significantly correlated with smoking behavior, the small number of users ($N=30$; $N=370$) precluded inclusion in the multivariate models.

3.3. Social Level Correlates of Smoking Behavior

Number of close friends and prenatal social environment were not associated with baseline smoking status (Table 1).

3.4. Environmental Level Correlates of Smoking Behavior

A significant association between individual perceived safety and self-reported neighborhood violence was found ($r=-.31$, $p<.01$) where higher levels of reported violence were related to lower levels of perceived safety. Perceived safety was significantly associated with baseline tobacco use ($F=2.66$, $p<.01$) as was self-reported neighborhood violence ($F=17.93$, $p<.01$).

3.5. Correlation between Psychological, Neighborhood Safety and Smoking Behavior Variables

In a correlation matrix, including depressive symptoms, perceived stress, self-reported neighborhood violence, perceived neighborhood safety and baseline smoking, depressive symptoms were found to be significantly correlated with perceived stress ($r=.6$, $p<.01$) and self-reported neighborhood violence ($r=.2$, $p<.01$) and perceived neighborhood safety ($r=-.2$, $p<.01$) were also related to depressive symptoms. Perceived stress was correlated with

self-reported neighborhood violence ($r=.1$, $p=.04$) and perceived neighborhood safety ($r=-.1$, $p<.01$). Self-reported neighborhood violence was significantly associated with perceived neighborhood safety ($r=-.3$, $p<.01$) and baseline smoking ($r=.2$, $p<.01$).

3.6. Relative Association of Reported Neighborhood Safety with Tobacco Use

A logistic regression model of baseline smoking status that included all variables with a significant association with baseline smoking (i.e. age, education, working for pay, depression symptoms, perceived stress scale, routine prenatal visits, lifetime use of cocaine marijuana, current alcohol use, self-reported neighborhood violence and perceived neighborhood safety) and controlled for gestational age at baseline was created. Variables with a significance level of less than 0.2 were retained and the model re-run (Table 2). The individual level variables age, education, routine prenatal care, lifetime use of cocaine and marijuana were independently and significantly associated with prenatal smoking. Self-reported neighborhood violence was also a significant, independent correlate of prenatal smoking ($\text{Exp}(B)=1.4$ ($CI=1.13-1.68$), $p<.01$). To estimate the variance that self-reported neighborhood violence added to the model, the regression was re-run with and without the self-reported neighborhood violence variable. The Cox & Snell R square increased from .16 to .18. As a validation check, the regression model was re-run using only data from participants who completed the follow-up assessment ($N=465$). The results from this sub-sample regression model paralleled the model from the larger sample, self-reported neighborhood violence remained a significant correlate of smoking status independent of the other variables.

3.7. Association between Self-reported Neighborhood Violence and follow-up Smoking Status

Of the 1521 participants who completed the baseline assessment, 465 completed the 22-week follow-up assessment. This low rate of subject follow up data can partially be attributed to the fact that subjects who were 22 weeks gestation at baseline would have not required a follow up interview and women reporting an induced abortion or experiencing a spontaneous abortion during the follow-up period did not complete a follow-up interview. Of the 465 pregnant women who completed the follow-up assessment, 53 (11%) reported continued smoking. In a logistic regression model of follow-up smoking status, baseline smoking status was the only significant correlate of continued smoking ($\text{Exp}(B) = 32.9$ ($CI=12.68-85.49$), $p<.01$) independent of participant age, education, gestational age, attendance to prenatal care visits, lifetime use of cocaine and marijuana and self-reported neighborhood violence.

4. Discussion

Tobacco use among low-income, minority women who are pregnant is a health problem with critical ramifications for both the mother and child. Twenty-two percent of the pregnant women in this sample smoked. Our data suggest that self-reported neighborhood violence is a significant correlate of early pregnancy tobacco use in this urban population and that early pregnancy tobacco use is then the strongest correlate of continued prenatal smoking (up to 22 weeks gestation).

Previous work examining the role of environmental factors on prenatal health has largely focused on the effects of neighborhood factors on birth weight. Neighborhood indicators of socio-economic disadvantage for example have been closely linked with poor birth outcomes such as low-birth weight (Rauh, Andrews, & Garfinkel, 2001; Roberts, 1997). Neighborhood factors may affect birth outcomes by influencing maternal health behaviors such as tobacco use (Schempf, Strobino, & O'Campo, 2009). Consistent with this premise

are data showing that higher levels of neighborhood fear and perceptions of neighborhood disorganization are associated with increased drug use, including tobacco (Lambert, Brown, Phillips, & Jalongo, 2004; Mulia, Schmidt, Bond, Jacobs, & Korcha, 2008; Theall, Sterk, & Elifson, 2009). Data from the current study converge with these lines of evidence by showing that self-reported neighborhood violence was significantly associated with early prenatal tobacco use. In addition, the influence of neighborhood violence is ongoing throughout pregnancy since violence is related to early cigarette use, or lack of smoking cessation in early pregnancy, and the consequence of neighborhood violence remains with continued, ongoing cigarette use during pregnancy.

Our hypothesis that neighborhood factors, independent of individual level factors, would remain a significant correlate of continued prenatal smoking (up to 22 weeks gestation) was not supported; instead, the strongest correlate of continued smoking during pregnancy was baseline-smoking status. This implies that self-reported neighborhood violence has a considerable impact on smoking during early pregnancy, and perhaps an ongoing influence of continued smoking during pregnancy. A limitation of this study is that self-reported neighborhood violence was not evaluated at follow-up. One way to interpret these data would be in consideration of nicotine dependence levels; higher levels of nicotine dependence are associated with a lower likelihood of sustained abstinence (Schnoll, et al., 2011; Ward, Vander Weg, Sell, Scarinci, & Read, 2006), and in pregnant women, a higher level of risk denial about the negative effects of smoking during pregnancy have been found (Tombor, Urban, Berkes, & Demetrovics, 2010). Given that some pregnant women spontaneously quit during pregnancy (El-Mohandes, El-Khorazaty, Kiely, & Gantz, 2011), it is plausible that the women who continue to smoke into the later stages of their pregnancy are influenced less by ongoing external, environmental factors and more by biological factors such as level of nicotine dependence.

There are potentially some clinical and policy-level implications from these data. First, these data suggest that poly-substance abuse among urban women represents a risk factor for continued smoking during pregnancy and that multidisciplinary treatment approaches for this medically underserved group are warranted (Keegan, Parva, Finnegan, Gerson, & Belden, 2010). These data also suggest that multi-level smoking cessation intervention approaches that consider individual, psychosocial and environmental level variables targeted to women of child-bearing age (i.e., prior to conception) are necessary, especially in light of evidence that, on average, 8–12 quit attempts are needed before cessation is achieved (Centers for Disease Control and Prevention, 2001). Lastly, since baseline-smoking levels were the strongest correlate of continued smoking during pregnancy (independent of other psychosocial and neighborhood safety variables), psychosocial based smoking cessation interventions (Oncken and Kranzler, 2009) in conjunction with pharmacotherapy (Coleman et al., 2011) may be necessary to achieve smoking cessation in highly-nicotine dependent pregnant women. Further work is needed to ensure the feasibility and safety of this approach.

Data from this study should be considered in the context of some limitations. First, participants were recruited from an Emergency Room and the data were largely cross-sectional, with follow-up data being collected from only a sub-set of participants (31%). Future work in this area should enroll a broader sample of pregnant women to reduce the possibility of selection bias and evaluate change in variables such as perceived neighborhood safety and self-reported neighborhood violence across time. Second, while this analysis was guided by an ecological model of health behavior, there are other important individual, social and environmental correlates of smoking behavior that were not evaluated as part of this study. For example, gestational history (Haskins et al., 2010), nicotine dependence (Schnoll, et al., 2011), partner smoking status (Everett, Bullock, Longo, Gage,

& Madsen, 2007), experience of racial discrimination (Maxson, Edwards, Ingram, & Miranda, 2012; Nguyen, Subramanian, Sorensen, Tsang, & Wright, 2010), and exposure to tobacco advertising (Hanewinkel, Isensee, Sargent, & Morgenstern, 2011; Hoek, Gifford, Pirikahu, Thomson, & Edwards, 2010) have all been shown to relate to tobacco use and ability to quit; future studies would benefit from considering the role of these variables on smoking behavior in minority pregnant women in order to control for their effects. Lastly, given the high correlation between perceived stress, depressive symptoms and self-reported neighborhood violence (see section 3.5), it could be argued that neighborhood violence served as an indirect measure of stress in this study. This is a plausible hypothesis that warrants consideration in a fully powered longitudinal study.

Despite these limitations, our data indicate that self-reported neighborhood violence is a significant correlate of early tobacco use among urban pregnant women and baseline smoking status was the strongest correlate of continued prenatal smoking. These data suggest that smoking cessation programs delivered to this population should be multi-level and address individual, social and environmental factors that contribute to tobacco use.

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References

- Al-Sahab B, Saqib M, Hauser G, Tamim H. Prevalence of smoking during pregnancy and associated risk factors among Canadian women: a national survey. *BMC Pregnancy Childbirth*. 2010; 10:24. [PubMed: 20497553]
- American Cancer Society. *Cancer Facts and Figures*. Atlanta, Ga: American Cancer Society; 2009.
- Burns DM. Epidemiology of smoking-induced cardiovascular disease. *Prog Cardiovasc Dis*. 2003; 46:11–29. [PubMed: 12920698]
- Castles A, Adams EK, Melvin CL, Kelsch C, Boulton ML. Effects of smoking during pregnancy. Five meta-analyses. *Am J Prev Med*. 1999; 16:208–215. [PubMed: 10198660]
- Centers for Disease Control and Prevention. *Women and Smoking. A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2001.
- Cohen, S.; Williamson, G. Perceived stress in a probability sample of the United States. In: Spacapan, S.; Oskamp, S., editors. *The social psychology of health: Claremont Symposium on applied social psychology*. Newbury Park, CA: Sage; 1988.
- Collins NL, Dunkel-Schetter C, Lobel M, Scrimshaw SC. Social support in pregnancy: psychosocial correlates of birth outcomes and postpartum depression. *J Pers Soc Psychol*. 1993; 65:1243–1258. [PubMed: 8295121]
- Cutrona CE, Wallace G, Wesner KA. Neighborhood Characteristics and Depression: An Examination of Stress Processes. *Curr Dir Psychol Sci*. 2006; 15:188–192. [PubMed: 18185846]
- El-Mohandes AA, El-Khorazaty MN, Kiely M, Gantz MG. Smoking cessation and relapse among pregnant African-American smokers in Washington, DC. *Matern Child Health J*. 2011; 15(Suppl 1):S96–105. [PubMed: 21656058]
- Everett KD, Bullock L, Longo DR, Gage J, Madsen R. Men's tobacco and alcohol use during and after pregnancy. *Am J Mens Health*. 2007; 1:317–325. [PubMed: 19482813]
- Hanewinkel R, Isensee B, Sargent JD, Morgenstern M. Cigarette advertising and teen smoking initiation. *Pediatrics*. 2011; 127:e271–278. [PubMed: 21242217]

- Hill TD, Angel RJ. Neighborhood disorder, psychological distress, and heavy drinking. *Soc Sci Med*. 2005; 61:965–975. [PubMed: 15955398]
- Hoek J, Gifford H, Pirikahu G, Thomson G, Edwards R. How do tobacco retail displays affect cessation attempts? Findings from a qualitative study. *Tob Control*. 2010; 19:334–337. [PubMed: 20671091]
- Homish GG, Eiden RD, Leonard KE, Kozlowski LT. Social-environmental factors related to prenatal smoking. *Addict Behav*. 2012; 37:73–77. [PubMed: 21945011]
- Kahn RS, Certain L, Whitaker RC. A reexamination of smoking before, during, and after pregnancy. *Am J Public Health*. 2002; 92:1801–1808. [PubMed: 12406812]
- Keegan J, Parva M, Finnegan M, Gerson A, Belden M. Addiction in pregnancy. *J Addict Dis*. 2010; 29:175–191. [PubMed: 20407975]
- Lambert SF, Brown TL, Phillips CM, Ialongo NS. The relationship between perceptions of neighborhood characteristics and substance use among urban African American adolescents. *Am J Community Psychol*. 2004; 34:205–218. [PubMed: 15663207]
- Lu Y, Tong S, Oldenburg B. Determinants of smoking and cessation during and after pregnancy. *Health Promot Int*. 2001; 16:355–365. [PubMed: 11733454]
- Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Kirmeyer S, Munson ML. Births: final data for 2005. *Natl Vital Stat Rep*. 2007; 56:1–103. [PubMed: 18277471]
- Maxson PJ, Edwards SE, Ingram A, Miranda ML. Psychosocial differences between smokers and non-smokers during pregnancy. *Addict Behav*. 2012; 37:153–159. [PubMed: 22000409]
- Merzel C, English K, Moon-Howard J. Identifying women at-risk for smoking resumption after pregnancy. *Matern Child Health J*. 2010; 14:600–611. [PubMed: 19653085]
- Miles R. Neighborhood disorder and smoking: findings of a European urban survey. *Soc Sci Med*. 2006; 63:2464–2475. [PubMed: 16904800]
- Miller EC, Cao H, Wen SW, Yang Q, Lafleche J, Walker M. The risk of adverse pregnancy outcomes is increased in preeclamptic women who smoke compared with nonpreeclamptic women who do not smoke. *Am J Obstet Gynecol*. 2010; 203:334, e331–338. [PubMed: 20579958]
- Mulia N, Schmidt L, Bond J, Jacobs L, Korcha R. Stress, social support and problem drinking among women in poverty. *Addiction*. 2008; 103:1283–1293. [PubMed: 18855817]
- Munafo MR, Heron J, Araya R. Smoking patterns during pregnancy and postnatal period and depressive symptoms. *Nicotine Tob Res*. 2008; 10:1609–1620. [PubMed: 18988073]
- Nelson DB, Grisso JA, Joffe MM, Brensinger C, Shaw L, Datner E. Does stress influence early pregnancy loss? *Ann Epidemiol*. 2003; 13:223–229. [PubMed: 12684187]
- Nelson DB, McMahon K, Joffe M, Brensinger C. The effect of depressive symptoms and optimism on the risk of spontaneous abortion among innercity women. *J Womens Health (Larchmt)*. 2003; 12:569–576. [PubMed: 13678512]
- Nguyen KH, Subramanian SV, Sorensen G, Tsang K, Wright RJ. Influence of experiences of racial discrimination and ethnic identity on prenatal smoking among urban black and Hispanic women. *J Epidemiol Community Health*. 2010
- Orr ST, James SA, Casper R. Psychosocial stressors and low birth weight: development of a questionnaire. *J Dev Behav Pediatr*. 1992; 13:343–347. [PubMed: 1401118]
- Orr ST, James SA, Miller CA, Barakat B, Daikoku N, Pupkin M, Engstrom K, Huggins G. Psychosocial stressors and low birthweight in an urban population. *Am J Prev Med*. 1996; 12:459–466. [PubMed: 8955776]
- Park ER, Chang Y, Quinn V, Regan S, Cohen L, Viguera A, Psaros C, Ross K, Rigotti N. The association of depressive, anxiety, and stress symptoms and postpartum relapse to smoking: a longitudinal study. *Nicotine Tob Res*. 2009; 11:707–714. [PubMed: 19436040]
- Penn G, Owen L. Factors associated with continued smoking during pregnancy: analysis of socio-demographic, pregnancy and smoking-related factors. *Drug Alcohol Rev*. 2002; 21:17–25. [PubMed: 12189000]
- Radloff L. The CES-D scale: A new self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.

- Rauh VA, Andrews HF, Garfinkel RS. The contribution of maternal age to racial disparities in birthweight: a multilevel perspective. *Am J Public Health*. 2001; 91:1815–1824. [PubMed: 11684610]
- Roberts EM. Neighborhood social environments and the distribution of low birthweight in Chicago. *Am J Public Health*. 1997; 87:597–603. [PubMed: 9146438]
- Roelands J, Jamison MG, Lyster AD, James AH. Consequences of smoking during pregnancy on maternal health. *J Womens Health (Larchmt)*. 2009; 18:867–872. [PubMed: 19514829]
- Sallis, J.; Owen, N.; Fisher, E. Ecological models of health behavior. In: Glanz, K.; Rimer, BK.; Viswanath, K., editors. *Health Behavior and Health Education*. 4. San Francisco: Jossey-Bass; 2008.
- Schempf A, Strobino D, O'Campo P. Neighborhood effects on birthweight: an exploration of psychosocial and behavioral pathways in Baltimore, 1995--1996. *Soc Sci Med*. 2009; 68:100–110. [PubMed: 18995941]
- Schnoll RA, Martinez E, Tatum KL, Glass M, Bernath A, Ferris D, Reynolds P. Increased self-efficacy to quit and perceived control over withdrawal symptoms predict smoking cessation following nicotine dependence treatment. *Addict Behav*. 2011; 36:144–147. [PubMed: 20869812]
- Theall KP, Sterk CE, Elifson KW. Perceived neighborhood fear and drug use among young adults. *Am J Health Behav*. 2009; 33:353–365. [PubMed: 19182981]
- Tombor I, Urban R, Berkes T, Demetrovics Z. Denial of smoking-related risk among pregnant smokers. *Acta Obstet Gynecol Scand*. 2010; 89:524–530. [PubMed: 20199361]
- U.S. Department of Health and Human Services. *Healthy People 2020*. Washington, DC: Office of Disease Prevention and Health Promotion; 2012.
- van Gelder MM, Reefhuis J, Caton AR, Werler MM, Druschel CM, Roeleveld N. Characteristics of pregnant illicit drug users and associations between cannabis use and perinatal outcome in a population-based study. *Drug Alcohol Depend*. 2010; 109:243–247. [PubMed: 20171023]
- Vardavas CI, Chatzi L, Patelarou E, Plana E, Sarri K, Kafatos A, Koutis AD, Kogevinas M. Smoking and smoking cessation during early pregnancy and its effect on adverse pregnancy outcomes and fetal growth. *Eur J Pediatr*. 2010; 169:741–748. [PubMed: 19953266]
- Ward KD, Vander Weg MW, Sell MA, Scarinci IC, Read MC. Characteristics and correlates of quitting among black and white low-income pregnant smokers. *Am J Health Behav*. 2006; 30:651–662. [PubMed: 17096622]
- Webb DA, Culhane JF, Mathew L, Bloch JR, Goldenberg RL. Incident smoking during pregnancy and the postpartum period in a low-income urban population. *Public Health Rep*. 2011; 126:50–59. [PubMed: 21337931]

Highlights

- Continued smoking during pregnancy remains a public health problem, particularly for low income women
- While much work has looked at the individual and social level factors, less is known about the neighborhood and environmental factors that may influence prenatal smoking behavior
- Self-reported neighborhood violence was found to contribute to cigarette use in the early stages of pregnancy
- Ongoing cigarette use in later pregnancy (22 weeks gestation) was most influenced by early stage cigarette use.

Table 1

Association between study variables and smoking status

	N=1521		
	Smoker ^I (N=338; 22%)	Non-Smoker (N=1183; 78%)	Test statistic
Demographic Variables			
Age	M=25 (6.2)	M=23 (5.3)	t= -5.6 ^{**}
Marital Status			
Single	N=68 (20%)	N=237 (20%)	
Partnered	N=270 (80%)	N=946 (80%)	X ² = .973
Education Level			
No College	N=165 (49%)	N=337 (29%)	
Some College	N=173 (51%)	N=846 (71%)	X ² = 49.14 ^{**}
Working for Pay			
No	N=106 (31%)	N=296 (25%)	
Yes	N=232 (69%)	N=887 (71%)	X ² = 5.43 [*]
Psychological Variables			
CES-D (Depression symptoms)	M=21.5 (11.87)	M=18.6 (11.51)	t= -4.0 ^{**}
Perceived Stress Scale	M=6.8 (3.5)	M=6.0 (3.5)	t= -4.0 ^{**}
Health Status/Behavior Variables			
Weeks Gestation at Baseline Interview	M=9.5 (4.5)	M=9.9 (4.6)	t= 1.2
Body Mass Index	M=27.0 (7.0)	M=26.8(6.9)	t= -.38
Routine Prenatal Visits			
No	N=252 (75%)	N=794 (67%)	
Yes	N=86 (25%)	N=389 (33%)	X ² = 6.8 [*]
How many hours in day spent standing	M=6.7(4.2)	M=6.4(4.8)	t= -1.1
How many hours in day spent sitting/watching TV	M=6.5 (4.4)	M=6.5(5.8)	t= -.04
Current use of cocaine (N=100)			
No	N=36 (61%)	N=34 (83%)	
Yes	N=23 (39%)	N=7 (17%)	X ² = 5.5 [*]
Lifetime use of cocaine			
No	N=276 (82%)	N=1143 (97%)	
Yes	N=62 (18%)	N=40 (3%)	X ² = 94.1 ^{**}
Current use of marijuana (N=771)			
No	N=131(48%)	N=370 (75%)	
Yes	N=144 (52%)	N=126 (25%)	X ² = 56.5 ^{**}
Lifetime use of marijuana			
No	N=68 (20%)	N=696 (59%)	
Yes	N=270 (80%)	N=487 (41%)	X ² = 157.6 ^{**}

	N=1521		
	Smoker ^I (N=338; 22%)	Non-Smoker (N=1183; 78%)	Test statistic
Current alcohol consumption	M=2.45(2.3)	M=1.8(1.6)	t= -.65 ^{**}
<i>Social Variables</i>			
Number of close friends	M=2.78(4.6)	M=2.84(4.5)	t= .21
Prenatal Social Environment	M=13.38(6.2)	M=11.33(5.9)	t= -5.45
<i>Neighborhood Safety Variables</i>			
Self-Reported Neighborhood Violence			
0 (no reported violence)	N=56 [*] (16%)	N=352 [*] (30%)	
1 (violence reported on some days)	N=165 (49%)	N=575 (49%)	
2 (violence reported everyday)	N=117 [*] (35%)	N=256 [*] (21%)	F= 17.93 ^{**}
Perceived Neighborhood Safety			
1 (Not Safe)	N=51 [*] (15%)	N=126 [*] (11%)	
2	N=83 (25%)	N=268 (23%)	
3	N=145 (43%)	N=515 (44%)	
4	N=33 [*] (10%)	N=181 [*] (15%)	
5 (Very Safe)	N=26 (7%)	N=91 (7%)	F=2.66 [*]

^I Self-reported smoking status was significantly correlated with urine cotinine levels ($r=.75$, $p<.001$)

^{*} $p<.05$

^{**} $p<.01$

Table 2

Logistic Regression Model showing Correlates of Smoking Status at Baseline (Smoking = 1)

	B	S.E.	Exp(B) (95% C.I)	p
Participant Age	.07	.01	1.07 (1.05–1.11)	.00
Education (College vs. No College)	–.86	.15	.42 (0.48–0.72)	.00
Attendance to Prenatal Care (yes =1)	–.34	.17	.72 (0.52–0.99)	.04
Gestational Age	–.01	.02	.99(.96–1.03)	.68
Lifetime use of Cocaine (yes =1)	.87	.26	2.39 (1.44–3.96)	.00
Lifetime use of Marijuana (yes=1)	1.47	.16	4.37 (3.21–5.95)	.00
Self-reported Neighborhood Violence	.32	.10	1.38 (1.07–1.60)	.01