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Does quitting smoking during pregnancy have a long-term impact on smoking status?

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Abstract

Background—Although pregnancy is often viewed as a unique opportunity to engage women in positive health changes, including smoking cessation, it is not clear whether, or to what extent, smoking cessation initiated during pregnancy persists long term after pregnancy. The purpose of the present study was to investigate the relation between smoking cessation during pregnancy and smoking status three years later.

Method—Data were drawn from the National Epidemiologic Survey of Alcohol and Relation Conditions (NESARC), a nationally representative sample of over 40,000 adults in the United States. Multiple logistic regression analyses were conducted to examine the relation between smoking cessation during pregnancy and odds of smoking three years later. Smoking status at follow-up of women who continued smoking during pregnancy and women who never smoked were also examined. Analyses controlled for demographic differences.

Results—Smoking cessation during pregnancy was not significantly related to smoking status three years later. However, continued smoking during pregnancy was associated with significantly increased odds of smoking three years later, compared to smokers who were not pregnant at baseline. Among non-smokers, pregnancy at baseline was associated with a significantly decreased likelihood of smoking three years later, compared to women not pregnant at baseline.

Conclusions—The present study uniquely extends previous research on smoking cessation during and following pregnancy. The results call for increased efforts to develop interventions that help new mothers develop and maintain abstinence from smoking.

Keywords

pregnancy; tobacco; smoking cessation

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1. Introduction

Cigarette smoking remains the leading preventable cause of death and disability (Centers for Disease Control and Prevention, 2010a). Despite a reduction in smoking prevalence over the past 25 years, approximately 20% of women in the United States smoke (Centers for Disease Control and Prevention, 2009a). Moreover, there have been recent increases in smoking among women, in particular younger women of lower socioeconomic status and of reproductive age (Centers for Disease Control and Prevention, 2009b).

Although approximately 70% of smokers are motivated to quit (Centers for Disease Control and Prevention, 2010b), approximately 90-95% of smokers who quit smoking on their own (Cohen et al., 1989; Garvey, 1988) and 60-80% of smokers who attend treatment programs, relapse to smoking (Brown and Emmons, 1991; Schwartz, 1987). Approximately 20% of women in the United States smoke during pregnancy and several clinical studies have found quit rates ranging from 30.2%-61.0% during pregnancy (Tong et al., 2009).

Although it is thought that pregnancy is a unique window of opportunity for health care professionals to advise patients to quit smoking (Cnattingius, 2004; Colman and Joyce, 2003), it is not clear whether, or to what extent, smoking cessation initiated during pregnancy persists long term after pregnancy. Several studies suggest that smoking cessation dissipates after birth and that the majority of women resume smoking (e.g., Carmichael and Ahluwalia, 2000; Colman and Joyce, 2003; Fingerhut et al., 1990; Kahn et al., 2002; McBride et al., 1992; McBride and Pirie, 1990; Mullen et al., 1997; O'Campo et al., 1992; Pollak et al., 1997; Tong et al., 2009). For example, Tong and colleagues (2009) recently found that, on average, 53% of women who had quit and were not smoking during their pregnancy resumed smoking at four months post delivery at sites in thirty-one states in the U.S. Clinical investigations with women of lower socioeconomic status also suggest that approximately half of women who quit during pregnancy resume smoking within one year after giving birth (e.g., Cluss et al., 2011). Additionally, this research has identified a number of variables that influence smoking relapse during pregnancy and following birth. Specifically, older age, lower education level, lower income, being unmarried, not having private medical insurance, being pregnant for the second or more time(s), higher smoking level before pregnancy, quitting smoking later during pregnancy, higher alcohol consumption, and living with people or having a partner who smokes have all been shown to be related to continued smoking or relapse after quitting (e.g., Colman and Joyce, 2003; Fingerhut et al., 1990; Kahn et al., 2002; McLeod et al., 2003; Severson et al., 1995). Additionally, there is evidence that internal psychological processes (i.e., intention or readiness to resume smoking) play a role in the process of relapse (Händel et al., 2009a, Händel et al, 2009b, Röske et al., 2006). For example, women with the intention to resume smoking returned to smoking more often within 12 months postpartum than women without the intention to resume smoking, although both groups were at risk for relapse (Röske et al., 2006).

The extant work in this area of research has a few limitations. First, to our knowledge, no previous studies have examined whether, or to what degree, smoking status during pregnancy has an impact on smoking trajectories beyond the initial postpartum period. Given the growing awareness of the health risks (e.g., SIDS, asthma, infantile colic, eye problems) associated with exposure to secondhand smoke, especially for infants and young children, it is possible that some women quit smoking after the initial postpartum period. Quitting at this time may occur among women who smoke throughout their pregnancies as well as women who quit smoking during pregnancy but resume smoking after birth. Second, study samples have typically been drawn from specific geographic regions and/or predominantly socioeconomonically disadvantaged clinical samples who are at high risk for

prenatal smoking. It therefore remains unclear whether and to what degree these findings generalize to the general population.

The present study examined data from two administrations of the National Epidemiologic Survey of Alcohol and Relation Conditions (NESARC). Wave 1 was conducted during 2001-2002, and Wave 2 was conducted three years later. The goal of the present study was to investigate whether smoking cessation during pregnancy predicts decreased likelihood of smoking three years later. We also examined two additional interrelated questions: 1) whether continued smoking during pregnancy is predictive of smoking three years later; and 2) whether pregnancy has an impact on smoking status and/or smoking initiation among lifetime non-smokers. We hypothesized that pregnant women who indicated that they quit smoking during pregnancy at Wave 1 would be less likely to smoke at three year follow-up than smokers who were not pregnant at Wave 1. Although many women relapse to smoking postpartum, we expected that some women who quit during pregnancy would remain abstinent and that this group would therefore be less likely to smoke than women who were not pregnant at Wave 1 and thus did not have a reason to quit smoking. We also predicted that women who were pregnant and continued to smoke at Wave 1 would be more likely to smoke at three year follow-up than smokers who were not pregnant at Wave 1, because women who do not quit during pregnancy may be 'hardened smokers' who are also less likely to quit at other times (Hughes and Brandon, 1993). Lastly, we hypothesized that pregnancy would act as a protective factor against smoking initiation among non-smokers, such that non-smoking women who were pregnant at Wave 1 would be less likely to smoke at three year follow-up than non-smoking women who were not pregnant at Wave 1. Based on the research described above that indicates that a variety of demographic characteristics influence smoking relapse following pregnancy, we controlled for the demographic characteristics included in the NESARC (i.e., age, race, marital status, education, and household income) in all of our analyses to ensure that these variables did not account for the relations we found between smoking status during pregnancy and smoking status three years later.

2. Method

2.1 Participants

The National Epidemiologic Survey of Alcohol and Relation Conditions (NESARC; Grant et al., 2009; Grant et al., 2004) is a nationally representative longitudinal survey of the adult, non-institutionalized, civilian population of the United States, which is conducted by the United States Census Bureau under the direction of the National Institute on Alcohol Abuse and Alcoholism (NIAAA). Wave 1 was conducted in 2001-2002 with a sample of 43,093 respondents age 18 and over (Grant et al., 2003a). Wave 2 was a three year prospective follow-up comprising 34,653 of the Wave 1 respondents, representing a response rate of 86.7% of Wave 1 respondents at Wave 2 (Grant and Kaplan, 2005). Trained lay interviewers with at least five years experience conducted face-to-face assessments using computer-assisted software. Informed consent was obtained from all participants before beginning the interviews.

The present analyses included women who reported pregnancy in the past year at Wave 1 (n = 1,517), and a comparison group consisting of all women of the same age range who were not pregnant at Wave 1. Women reported their age, race (white, black, Latino, other), marital status (married/living as married, widowed/divorced/separated, or never married), education (less than high school, high school or GED, some college/AA, or college or more), and household income (less than $15K, $15-30K, $30-50K, $50-100K or $100 or more) at Wave 1.

2.2 Procedure

Professional interviewers (n = 1,800) from the Census Bureau used computer-assisted software with built-in skip, logic, and consistency checks to conduct the interviews. Interviewers were experienced with other national health-related surveys, had an average of five years of experience, and received additional training from NIAAA. Regional supervisors re-contacted a random 10% of all respondents for quality control purposes. A randomly selected subset of respondents was re-interviewed with 1 to 3 complete sections of the Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV; Grant et al., 2001). This was used as a test-retest reliability study of the NESARC measures (Grant et al., 2003b). In the small number of cases when accuracy was uncertain, the data were discarded and a supervising interviewer repeated the interview. Detailed descriptions of the methodology, sampling, and weighting procedures have been reported elsewhere (Grant and Kaplan, 2005; Grant et al., 2003b).

2.3 Measures

2.3.1 Cigarette use during pregnancy—Respondents were considered to have smoked during their pregnancy if they reported current smoking, regular smoking during the past year, and being currently pregnant at Wave 1. Respondents were considered to have stopped smoking during pregnancy if they reported lifetime smoking but no smoking within the past year. Lifetime smoking was defined as smoking 100 or more cigarettes during their lifetime.

2.3.2 Pregnancy—Women were asked if they were currently pregnant at each interview (Wave 1 and Wave 2). Only women ages 18-40 who were pregnant at Wave 1 were included in these analyses in order to ensure that the comparison group of women who were not pregnant were of relatively similar age.

2.4 Statistical Analysis Strategy

Logistic regression analyses were used to estimate odds ratios and 95% confidence limits to examine the relation between smoking cessation during pregnancy and smoking status 3 years later among lifetime smokers. We also tested two ancillary effects: 1) the relation between smoking during pregnancy and smoking status 3 years later among lifetime smokers; and 2) the relation between not smoking during pregnancy and smoking status 3 years later among lifetime non-smokers. The reference group for all analyses was women (both smokers and non-smokers) who were not pregnant at Waves 1 or 2. Each of these analyses were adjusted for age, race, marital status, education, and household income (collected at Wave 1).

3. Results

3.1 Smoking cessation during pregnancy and odds of smoking three years later

Among lifetime smokers, there was a marginally significant trend for women who quit smoking during pregnancy to be more likely to smoke three years later (OR = 1.33 [0.99, 1.79]) than smokers who were not pregnant at Wave 1 (see Table 1). This trend disappeared after controlling for demographic differences (OR = 0.99 [0.74, 1.31]).

3.2 Smoking during pregnancy and odds of smoking three years later

Among lifetime smokers, women who smoked during pregnancy were significantly more likely to smoke three years later (OR = 1.36 [1.11, 1.66]) than smokers who were not pregnant at Wave 1, and this relationship remained significant and virtually unchanged after adjusting for demographic differences (see Table 2).

3.3 Non-smokers during pregnancy and odds of smoking three years later

Among lifetime smokers, not smoking during pregnancy was associated with significantly reduced odds of smoking three years later (OR = 0.59 [0.53, 0.67]), compared with non-smokers who were not pregnant at Wave 1 (see Table 3). This relation was only slightly attenuated by adjusting for differences in demographic characteristics (OR = 0.68 [0.59, 0.77]).

4. Discussion

Our results indicate that although many lifetime smokers stop smoking during pregnancy, this behavior change does not appear to have a long-term impact on smoking trajectory. Women who quit smoking during pregnancy were actually more likely to smoke three years later than smokers who were not pregnant at Wave 1, although this finding was accounted for by demographic characteristics. Future research should examine the mechanisms that explain relapse to smoking following birth and potential individual differences (moderators) that may contribute to this effect. For example, the stress of raising children or certain psychological symptoms (e.g., anxiety, depression) may contribute to relapse among women who quit smoking during pregnancy. The present research also suggests that certain demographic characteristics may explain relapse. Gaining a better understanding of the relation between pregnancy and smoking over time, and the factors that influence this relationship, may be useful for developing more effective clinical and community based interventions aimed at this vulnerable population during this critical period.

With regard to our ancillary questions, women who smoked during pregnancy were more likely to continue to smoke at three year follow-up than smokers who were not pregnant at Wave 1. This finding suggests that women who smoke during pregnancy may be a group of hardcore smokers who are either unmotivated to quit smoking or who have particular difficulty quitting. In either case, smoking cessation interventions that target the unique needs of this group of smokers will be important for improving the health of both mothers and infants. Given the physical and emotional strains of pregnancy and the initial postpartum period, it may be particularly beneficial to target smoking cessation efforts toward women before they become pregnant. Additionally, non-smoking pregnant women were even less likely to start smoking after they had a child, compared to non-smoking women who were not pregnant. In other words, pregnancy, or having a child, was protective against the subsequent initiation of smoking. Since the majority of smokers begin smoking early in life (Ziedonis et al., 2008), usually before they become parents, this finding is not surprising. This work is broadly consistent with past research and theory suggesting that there is benefit to preventing the onset of smoking in general (Ziedonis et al., 2008).

It is notable that the present study was largely informed by extant work on smoking cessation and pregancy. However, the current study does not naturally measure or test all possible predictors of cessation. In the future, research could address other theoretically-relevant predictors such as those derived from social-cognitive models of behavior change (e.g., the Transtheoretical Model; DiClemente and Prochaska, 1982; Prochaska et al., 1991) or Teaching Moments approach (e.g, McBride et al., 2003). These models, although distinct, highlight the importance of various psychological processes such as motivation to quit, self-efficicay in quitting, and beliefs about (internal and external) resources available to help quit behavior. With the inclusion of these models and the study of cognitive processes in future work, more integrated theoretical models of smoking cessation and pregnancy, and interventions to help pregnant women and new mothers quit smoking, can likely be developed.

The present study has three notable strengths. First, it was conducted using a large, representative sample, which allows for generalizability to the U.S. population. Second, smoking was measured prospectively at two time points, whereas previous studies have relied primarily on retrospective recall of smoking during pregnancy (e.g., Fingerhut et al., 1990; Kahn et al., 2002). Third, the follow-up period (3 years) was substantially longer than previous studies that we are aware of among this population, which have generally examined women only during the first year postpartum (and usually retrospectively).

As with all research, there are limitations that should be considered when interpreting the results of this study. First, because the NESARC does not focus solely on smoking during pregnancy, the questions were not worded to target this population, and therefore there may have been some imprecise measurement in terms of exactly when individuals stopped/resumed smoking in relation to their pregnancies. Second, smoking status was self-reported and not biochemically verified; therefore we can not be certain that respondents' reports were accurate. In particular, some women may have underreported their smoking during pregnancy due to the stigma surrounding this behavior (Floyd et al., 1993; Ford et al., 1997). However, many women did report that they smoked during pregnancy, allowing us to examine how this behavior affects smoking behavior 3 years later. Third, the NESARC does not measure all of the variables that have been linked in previous work to continued smoking during pregnancy and relapse postpartum, so we were only able to control for some of these variables. For example, two variables that have been especially important in past research that are not included in the NESARC are partner smoking (Severson et al., 1995) and intention to resume smoking (Händel et al., 2009a, Händel et al., 2009b, Röske et al., 2006).

There is a common perception that pregnancy offers an opportunity, or “teachable moment,” for improvements in health (Cnattingius, 2004; Colman and Joyce, 2003). Smoking cessation is one common health improvement that can benefit both the mother and the baby. However, the present study suggests that the sensitive period of pregnancy does not appear to be the great time of change that it is commonly thought to be. Given the risks associated with exposure to secondhand smoke (e.g., SIDS, asthma, infantile colic, eye problems), especially in infancy and early childhood, the results from the present study call for increased efforts to develop interventions that help new mothers maintain abstinent from smoking.

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Table 1

Among lifetime smokers, odds of smoking three years later among women who stopped smoking during pregnancy

	Model 1		Model 2	
	OR	**95% CI**	**OR**	**95%CI**
Non-pregnant (referent)				
Pregnant at Wave 1	1.33	[0.99, 1.79]	0.99	[0.74, 1.31]
Age (continuous)			0.95	[0.93, 0.97]
Race (White = referent)				
Black			1.18	[0.95, 1.46]
Latino			0.41	[0.31, 0.55]
Other			1.94	[1.52, 2.46]
Marital Status (married/living as married = referent)				
Widowed/divorced/separated			1.80	[1.22, 2.67]
Never married			1.21	[0.95, 1.53]
Educated (college = referent)				
Less than high school			2.20	[1.49, 3.24]
High school/GED			2.09	[1.67, 2.60]
Some college/AA			2.28	[1.93, 2.69]
Household Income ($100k+ = referent)				
Less than $15k			1.74	[1.15, 2.65]
$15k-$30k			1.87	[1.26, 2.77]
$30k-$50k			1.08	[0.84, 1.39]
$50k-$100k			1.23	[1.02, 1.48]

Table 2

Among lifetime smokers, odds of smoking three years later among women who smoked during pregnancy

	Model 1		Model 2	
	OR	**95% CI**	**OR**	**95%CI**
Non-pregnant (referent)				
Pregnant at Wave 1	1.36	[1.11, 1.66]	1.36	[1.12, 1.67]
Age (continuous)			1.02	[1.01, 1.02]
Race (White = referent)				
Black			0.81	[0.71, 0.91]
Latino			0.50	[0.46, 0.55]
Other			0.68	[0.59, 0.79]
Marital Status (married/living as married = referent)				
Widowed/divorced/separated			1.25	[1.08, 1.45]
Never married			1.19	[1.06, 1.34]
Educated (college = referent)				
Less than high school			2.70	[2.33, 3.13]
High school/GED			2.42	[2.11, 2.78]
Some college/AA			1.86	[1.67, 2.07]
Household Income ($100k+ = referent)				
Less than $15k			2.23	[1.85, 2.70]
$15k-$30k			2.02	[1.72, 2.38]
$30k-$50k			1.61	[1.43, 1.82]
$50k-$100k			1.45	[1.29, 1.63]

Table 3
Among lifetime non-smokers, odds of smoking three years later

	Model 1		Model 2	
	OR	**95% CI**	**OR**	**95%CI**
Non-pregnant (referent)				
Pregnant at Wave 1	0.59	[0.53, 0.67]	0.68	[0.59, 0.77]
Age (continuous)			0.96	[0.95, 0.97]
Race (White = referent)				
Black			0.93	[0.81, 1.07]
Latino			0.89	[0.79, 1.01]
Other			0.83	[0.63, 1.10]
Marital Status (married/living as married = referent)				
Widowed/divorced/separated			2.13	[1.77, 2.57]
Never married			2.09	[1.87, 2.34]
Educated (college = referent)				
Less than high school			4.24	[3.28, 5.48]
High school/GED			2.94	[2.53, 3.42]
Some college/AA			1.77	[1.53, 2.05]
Household Income ($100k+ = referent)				
Less than $15k			1.50	[1.27, 1.77]
$15k-$30k			1.45	[1.21, 1.74]
$30k-$50k			1.38	[1.20, 1.60]
$50k-$100k			1.07	[0.92, 1.25]