Psychological Differences Between Smokers Who Spontaneously Quit During Pregnancy and Those Who Do Not: A Review of Observational Studies and Directions for Future Research

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Abstract

Introduction: Although remarkable interindividual differences among pregnant smokers’ decision/ability to quit have been documented, the psychological factors that may account for these differences have received less attention and comprised the primary aim of this review.

Methods: We searched the medical and behavioral sciences literature from 1996 to November 2011 using PubMed and PsycINFO®. Fifty-one articles were identified based on titles or abstracts. These articles were reviewed in full and searched for quantitative observational studies of population-based or clinical samples, with the main topic of comparing smokers who quit spontaneously during pregnancy with those who did not, utilizing multivariable analyses.

Results: The eight pertinent studies reviewed herein included four longitudinal studies and four cross-sectional analyses. Amidst significant variability among measures used, social support, depressive symptoms, and anxiety appeared unrelated to smoking cessation during pregnancy. Furthermore, when severity of nicotine dependence was controlled, maternal history of attention-deficit/hyperactivity disorder, depression, bipolar disorder, and schizophrenia all showed no independent relationship with smoking cessation during pregnancy, whereas maternal history of conduct disorder did. Secure attachment, prosocial personality, self-esteem, and perceived parenting competence were additional predictors of cessation during pregnancy.

Conclusions: A greater understanding of psychological factors that differentiate smokers who spontaneously quit during pregnancy from those who do not is crucial to the design of more effective prenatal smoking cessation interventions and also may elucidate causal mechanisms that underlie the well-established link between maternal smoking during pregnancy and offspring behavioral problems. Directions for future research and public health and policy implications are discussed.

Introduction

Maternal smoking during pregnancy is one of the most common preventable risk factors for poor pregnancy and birth outcomes in United States and other industrialized nations (Cnattingius, 2004; Floyd, Rimer, Giovino, Mullen, & Sullivan, 1993) and has been associated with an estimated $366 million per year in neonatal healthcare costs in the United States (Adams et al., 2002). Furthermore, children born to mothers who smoked during pregnancy appear to be at an increased risk of developing disruptive behavior disorders in childhood, including attention-deficit/hyperactivity disorder (ADHD) and conduct disorder (Huijbregts, Séguin, Zoccolillo, Boivin, & Tremblay, 2007; Nigg & Breslau, 2007; Wakschlag et al., 1997), as well as serious criminality in adulthood (Pratt, McGloin, & Fearn, 2006). Yet, in the context of this growing evidence for the immediate and long-term adverse consequences associated with smoking during pregnancy, the majority of women who have not quit smoking by their first prenatal visit will continue smoking throughout pregnancy, even when receiving evidence-based prenatal smoking cessation interventions (Lumley et al., 2009).

A substantial body of literature documents a number of psychosocial factors that differentiate women who continue smoking during pregnancy (referred to herein, as pregnancy smokers) from women who quit soon after learning of their
pregnancy (pregnancy quitters) (Panjari et al., 1997; Solomon & Quinn, 2004). Pregnancy smokers are less educated, poorer, less likely to be married (Cnattingius, 2004), have more smokers in their social networks (Homish, Eiden, Leonard, & Kozlowski, 2012), and have greater nicotine dependence, though they may not be less ready to quit (DiClemente, Dolan-Mullen, & Windsor, 2000; Woodby, Windsor, Snyder, Kohler, & DiClemente, 1999). As such, these psychosocial correlates have generally been interpreted as barriers to cessation that account for the inability to quit smoking, presuming that motivation to quit is present, and similar, among all smokers who become pregnant. However, Curry, Grothaus, McBride, Lando, & Pirie (2001) have previously suggested that different types of motivation may be important to examine. For example, pregnancy-related motivation (wanting to be healthy for the baby) is independently predictive of quitting smoking during pregnancy, whereas parenthood-related motivation (not wanting to be known as a smoker by the child) is predictive of continued abstinence after birth. Yet, while smoking cessation during pregnancy has long been described as a deliberate attempt to protect the fetus rather than a long-term intention to quit (Ershoff et al., 1999; Stotts, DiClemente, Carbonari, & Mullen, 1996), there has been surprisingly little investigation into why some smokers may be more spontaneously motivated to “protect the fetus” than others. The purpose of this review was to summarize available empirical data on psychological characteristics that differentiate pregnancy quitters from pregnancy smokers to inform the design of prenatal interventions that can better engage and motivate the substantial majority of pregnancy smokers who remain resistant to current interventions.

There is another reason to focus on psychological differences between pregnancy quitters and pregnancy smokers. A central question in child development research concerns whether prenatal smoking has a direct etiological role in the development of problem behaviors in children via teratological effects or whether prenatal smoking is a marker for intergenerational processes associated with the tendency to smoke during pregnancy (Huijzink, 2009; Knopik, 2009). Regarding direct effects, intraterine nicotine exposure may adversely affect fetal brain development in ways that predispose children to behavior problems (Baler, Volkow, Fowler, & Benveniste, 2008; Bruin, Gerstein, & Holloway, 2010; Cornelius & Day, 2009; Dwyer, McQuown, & Leslie, 2009). Moreover, amidst the rapidly developing field of epigenetic research, some studies suggest that prenatal cigarette smoke exposure may cause heritable changes in gene expression or cellular phenotype in both fetal and placental tissues (Murphy et al., 2012; Panjari et al., 1997; Suter, Abramovici, & Aagaard-Tillery, 2010; Suter et al., 2011), and that certain genotypes may be particularly susceptible to these epigenetic changes (Manacci et al., 2010). On the other hand, a number of other processes that are associated with prenatal smoking may also account for child behavior problems including the transmission of genes associated with nicotine dependence (Agrawal et al., 2008), and other prenatal health behaviors associated with smoking, that also affect the intrauterine environment (Adegboye, Rossner, Neovius, Lourenço, & Linné, 2010). Environmental influences after birth may also account for the development of problem behaviors in children exposed to prenatal smoking. For example, difficult child temperament associated with intrauterine exposure to nicotine (Martin, Dombrowski, Mullis, Wisenbaker, & Huttunen, 2006; Wakschlag, Pickett, Kasza, & Loeber, 2006) may evoke less-sensitive parenting behaviors in parents (Ganiban, Ulbricht, Saudino, Reiss, & Neiderhiser, 2011), and these parenting behaviors may influence the emergence of behavior problems in later childhood and adolescence (Trentacosta & Shaw, 2008).

One way to separate these mechanisms is to utilize research designs that can separate genetic and environmental influences on child development (Knopik 2009; Lynskey, Agrawal, & Heath, 2010). Such genetically informed twin and adoption studies have suggested that unmeasured maternal factors associated with smoking during pregnancy, and not prenatal smoking per se, may account for behavioral problems in early childhood (Lavigne et al., 2011), behavioral difficulties in adolescence (Kuja-Halkola, D’Onofrio, Iliadou, Långström, & Lichtenstein, 2010), and the later development of criminal behavior in adulthood (D’Onofrio et al., 2010). Stated differently, maternal psychological factors associated with both the decision to continue smoking during pregnancy and the parenting behaviors after birth may confound the relationship between pregnancy smoking and child behavior problems. In fact, smoking cessation during pregnancy may even result in better child outcomes than would be expected from the absence of intrauterine nicotine exposure alone. Pickett, Wood, Adamson, DeSouza, & Wakschlag (2008) have shown that the infants of pregnancy quitters display easier temperaments when compared with the infants of pregnancy smokers but also when compared to the infants of nonsmokers. Similarly, Robinson et al. (2010) showed that children of smokers who quit by the 18th week of gestation, followed from ages 2–14, actually exhibited lower levels of externalizing and internalizing behaviors when compared with the children of nonsmokers. In summary, psychological factors associated with the decision to quit smoking may be a strong predictor of psychological and behavioral outcomes in children. Identifying these psychological factors, and understanding how they influence other prenatal health behaviors, parenting behaviors, and subsequent child behaviors, is crucial to illuminating the causal mechanisms involved in the development of child behavioral problems associated with maternal smoking during pregnancy.

These causal mechanisms have significant public health and social implications since substance use and antisocial personality disorders in adulthood, two potential outcomes resulting from untreated problem behaviors in children (Gelhorn, Sakai, Price, & Crowley, 2007), effect significant costs to afflicted individuals, their families and neighborhoods, and society at large, through violent and drug-related crime, and criminal institutionalization (Webster-Stratton & Taylor, 2001; Cohen & Piquero, 2009). Maternal smoking during pregnancy is among the costly, preventable, yet seemingly intractable public health problems whose solution will likely require a multidisciplinary approach that combines insights from the biomedical, behavioral, and social sciences (Livingood et al., 2011). As such, by summarizing the literature from these fields on psychological characteristics associated with smoking cessation during pregnancy, we aimed to provide insights for future research relevant to the intervention and prevention of associated morbidity in mothers and their children. This review was guided by the question, formulated a priori, Are there psychological factors in smokers that may contribute to spontaneous cessation during pregnancy, beyond a mere absence of presumed barriers to cessation?
Methods

Literature Search
To search the medical literature, we utilized PubMed, the bibliographic reference database of the National Library of Medicine, which comprises more than 21 million citations for biomedical literature from MEDLINE, life sciences journals, and online books, using the search terms, pregnancy and smoking cessation alone and in combination. Results were limited to original journal articles on humans (see Figure 1). Using identical search parameters, we also searched PsycINFO®, an abstracting and indexing database with more than three million records devoted to peer-reviewed literature in the behavioral sciences and mental health. The search was begun on October 31, 2011; identification of all potentially relevant articles was performed by the first author; both authors were then involved in the extraction of articles and synthesis of results.

Study Selection and Study Characteristics
Inclusion criteria are described in Figure 1. We selected original research papers published between January 1, 1996, and November 3, 2011 (when search was completed), with the primary aim of comparing smokers who quit during pregnancy with smokers who did not. Because we were interested in psychological differences related to spontaneous motivation to quit smoking in the context of pregnancy, we limited studies to population-based or clinical samples, excluding studies on women participating in smoking cessation interventions. This was especially important so as to include smokers with psychological illness, who are usually excluded from intervention trials. Study design was further limited to quantitative studies that included controls for sociodemographic factors associated with lifetime smoking using multivariable analyses.

Results

Study Characteristics
Forty-six papers of potential relevance were initially identified through a review of titles and/or abstracts and procured at full length to determine relevance and compliance with selection criteria. An additional five articles were identified through references of selected papers. Among these 51 papers, 13 were...
Table 1. Key characteristics of reviewed studies on psychological differences between smokers who spontaneously quit during pregnancy and those who do not (1996–2011)

<table>
<thead>
<tr>
<th>Authors (date)</th>
<th>Study population, N</th>
<th>Study design/measurement of smoking cessation</th>
<th>Psychological characteristics measured</th>
<th>Control variables used</th>
<th>Psychological factors associated with smoking cessation</th>
<th>Psychological factors not associated with smoking cessation</th>
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<tbody>
<tr>
<td>Appleton &amp; Pharoah (1998)</td>
<td>Married, middle-class, pregnant women who booked care with a midwife in Wales, United Kingdom; N = 662</td>
<td>Longitudinal assessment in early pregnancy (14 weeks) with follow-up during late pregnancy; self-report</td>
<td>Emotional support from partner, perceived support, depressive symptoms</td>
<td>Age, gestational age at first assessment, education, housing status, presence of income support, parity, number of cigarettes smoked before pregnancy, partner smoking change, number of smokers in social network, joint pregnancy planning</td>
<td>Greater perceived support</td>
<td>Emotional support from partner or family members, depressive symptoms</td>
</tr>
<tr>
<td>Goedhart et al. (2009)</td>
<td>Older, well-educated Dutch women obtaining prenatal care in Amsterdam; N = 1,947</td>
<td>Cross-sectional assessment at 12 weeks pregnancy; self-report</td>
<td>Depressive symptoms, general anxiety, pregnancy-related anxiety, job strain, physical/sexual violence</td>
<td>Age, parity, ethnicity, education, cohabitation status, amount of smoking before pregnancy, smokers in environment, desirability of pregnancy, violence, birthplace, ethnicity, parity, diabetes risk factors, pre-pregnancy alcohol and drug use, number of cigarettes per day prior to pregnancy</td>
<td>Moderate pregnancy-related anxiety, lower job strain</td>
<td>Depressive symptoms, general anxiety</td>
</tr>
<tr>
<td>Haskins et al. (2010)</td>
<td>Low-income Hispanic women attending public obstetric and midwifery practices in northeastern United States; N = 351</td>
<td>Cross-sectional assessment in early pregnancy; self report</td>
<td>Perceived stress and stressful life events in early pregnancy</td>
<td>Age, education, income, language preference (English or Spanish), birthplace, ethnicity, parity, diabetes risk factors, pre-pregnancy alcohol and drug use, number of cigarettes per day prior to pregnancy</td>
<td>Lower perceived stress in early pregnancy</td>
<td>Stressful life events in early pregnancy</td>
</tr>
<tr>
<td>Holtrop et al. (2010)</td>
<td>Unmarried, unemployed non-Hispanic White, Medicaid-eligible, prenatal clinic sample with high school education in midwestern United States; N = 2,203</td>
<td>Cross-sectional assessment at first prenatal visit; self-report</td>
<td>Perceived stress, depressive symptoms, history of mental illness (depression, bipolar disorder, or schizophrenia)</td>
<td>Age, race/ethnicity, education, employment status, marital status, nicotine dependence, alcohol use, drug use in the month before pregnancy</td>
<td>None found</td>
<td>Perceived stress, mental health history, depressive symptoms</td>
</tr>
<tr>
<td>Kodl &amp; Wakschlag (2004)</td>
<td>Non-Hispanic, White, working-class women receiving prenatal care in midwestern United States; N = 93</td>
<td>Longitudinal assessments at three times during pregnancy; self-report and urinary cotinine confirmation</td>
<td>History of conduct disorder and ADHD</td>
<td>Age, race/ethnicity, marital status, household income, parity, educational attainment, age at smoking initiation and regular smoking, mean pre-pregnancy smoking rate, number of prior quit attempts, nicotine dependence</td>
<td>Conduct disorder history (independent of smoking-specific factors)</td>
<td>ADHD history</td>
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(Continued)
<table>
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<tr>
<th>Authors (date)</th>
<th>Study population, N</th>
<th>Study design/measurement of smoking cessation</th>
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<th>Psychological factors not associated with smoking cessation</th>
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<tr>
<td>Maxson et al. (2011)</td>
<td>Low-income, non-Hispanic, Black women in southeastern United States; N = 1,518</td>
<td>Longitudinal; assessments at initiation of prenatal care, later in pregnancy, and at delivery; self-report</td>
<td>Perceived stress, depression, neuroticism, extraversion, openness, agreeableness, conscientiousness, general self-efficacy</td>
<td>Age, race, education, committed relationship status, household income, initiation of prenatal care before or after first trimester</td>
<td>Agreeableness</td>
<td>Perceived stress, self-efficacy, depression, neuroticism, extraversion, negative paternal support, perceived racism, interpersonal support, positive paternal support, subjective social standing</td>
</tr>
<tr>
<td>Pickett et al. (2009)</td>
<td>Population sample of low-income ethnic minority women (Indian, Pakistani/Bangladeshi, Black) in United Kingdom; N = 18,225</td>
<td>Cross-sectional; assessment at approximately 9 months postpartum; self-report</td>
<td>Interpersonal problems, problems in maternal adaptive functioning</td>
<td>Age, race/ethnicity, education, marital status, household income, social class</td>
<td>Lower psychological distress, greater self-esteem, greater sense of control, greater parenting competence</td>
<td>Having time with friends</td>
</tr>
<tr>
<td>Wakschlag et al. (2003)</td>
<td>Clinical sample of non-Hispanic, White women with high school education and low to moderate household income in midwestern United States; N = 96</td>
<td>Longitudinal beginning during pregnancy; self-report with biochemical verification at each prenatal visit</td>
<td>History/pattern of problem behaviors</td>
<td>Age, race/ethnicity, education, married to father of baby, household income, employment status at start of pregnancy, number of children in the household</td>
<td>Fewer interpersonal problems, fewer problem behaviors, fewer problematic health behaviors</td>
<td>-</td>
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Smokers who spontaneously quit during pregnancy and those who do not

excluded because they did not measure psychological characteristics, 8 papers involved intervention samples, 6 studies involved lumping of spontaneous quitters with nonsmokers, 6 studies were review articles, 5 studies primarily focused on child outcomes, 3 studies measured change in smoking rather than cessation, and 2 studies did not control for sociodemographic correlates of lifetime smoking.

Studies varied substantially with regard to sample size and the racial and ethnic composition of participants (Table 1). With the exception of studies by Appleton & Pharoah (1998) and Goedhart, van der Wal, Cuijpers, & Bonsel (2009), samples were comprised primarily of low-income or working-class women. Half of the studies utilized a prospective design with at least two assessments in the perinatal period; the other studies were cross-sectional assessments ranging from early pregnancy to 9 months postpartum. Only two studies (Kodl & Wakschlag, 2004; Wakschlag et al., 2003) utilized biomarker confirmation of reported smoking status. Five out of the eight studies controlled for smoking-related factors prior to pregnancy including the number of cigarettes smoked per day before pregnancy (Appleton & Pharoah, 1998; Goedhart et al., 2009; Kodl & Wakschlag, 2004), the number of smokers in the immediate environment or social networks (Appleton & Pharoah, 1998; Goedhart et al., 2009), the age of smoking initiation and onset of daily smoking, and the number of prior quit attempts (Kodl & Wakschlag, 2004). Two studies formally assessed the level of nicotine dependence (Holtrop et al., 2010; Kodl & Wakschlag, 2004).

Psychological differences measured may be broadly characterized into three domains: psychological stress, generally, or in the context of mental illness (Appleton & Pharoah, 1998; Goedhart et al., 2009; Haskins, Bertone-Johnson, Pekow, Carbone, & Chasan-Taber, 2010; Holtrop et al., 2010; Maxson, Edwards, Ingram, & Miranda, 2012; Pickett, Wilkinson, & Wakschlag, 2009), social support versus individual characteristics (Appleton & Pharoah, 1998; Maxson et al., 2011; Pickett et al., 2009), and psychological traits reflected by a pattern of problem behaviors (Kodl & Wakschlag, 2004; Pickett et al., 2009; Wakschlag et al., 2003).

Psychological Stress and Smoking Cessation

The six reviewed studies that examined the relationship between women's psychological stress during pregnancy and smoking cessation pregnancy showed mixed results, though the constructs measured varied substantially. Goedhart et al. (2009) assessed general anxiety and pregnancy-related anxiety, among other psychosocial variables, and found that neither general anxiety nor pregnancy-related anxiety differentiated pregnancy smokers from pregnancy quitters. Rather, pregnancy-related anxiety that was neither extremely high nor extremely low was predictive of smoking cessation. Lower job strain was an additional predictor of cessation. Pickett et al. (2009) also found a relationship between lower psychological distress and smoking cessation during pregnancy. Haskins et al. (2010) assessed stress in a more nuanced way by measuring both stressful life events during pregnancy and perceived stress, finding that only lower perceived stress was predictive of smoking cessation during pregnancy. Two other studies, however, did not find an association between perceived stress and smoking cessation during pregnancy (Holtrop et al., 2010; Maxson et al., 2011). The study by Holtrop et al. (2010), one of only two reviewed studies that controlled for the level of nicotine dependence using formal measurement, found no relationship between stress, mental health history, or depressive symptoms, and smoking cessation during pregnancy. Finally, the only longitudinal study focusing on psychological stress during pregnancy was conducted by Maxson et al. (2011); this study also did not find a relationship between perceived stress or depression, and smoking cessation.

Social Support and Smoking Cessation

The three studies that examined the relationship between social support during pregnancy and smoking cessation all found no independent relationship (Appleton & Pharoah, 1998; Maxson et al., 2011; Pickett et al., 2009), but identified individual characteristics that were related. Pickett et al. (2009) showed that greater self-esteem, personal sense of control, and parenting competence predicted smoking cessation, whereas Maxson et al. (2011) found that the personality trait, agreeableness, was predictive of smoking cessation, independent of the level of nicotine dependence. Finally, Appleton & Pharoah (1998) utilized a regression model to predict which factors, among a number of relational factors, accounted for the failure to quit smoking during pregnancy in a clinical sample of predominantly middle-class married women in the United Kingdom. In these women, attitudes toward relationships, and the capacity to utilize social support, rather than social support itself, or even joint pregnancy planning with their partners, predicted smoking cessation during pregnancy.

Problem Behavior and Smoking Cessation

Two longitudinal studies, both of which included biomarker confirmation of reported smoking status during pregnancy, examined whether a pattern of problem behaviors, both past (Kodl & Wakschlag, 2004) and present (Wakschlag et al., 2003), differentiated pregnancy smokers from pregnancy quitters. Kodl & Wakschlag (2004) found that having a history of conduct disorder, but not ADHD, was predictive of continued smoking versus quitting during pregnancy and that this relationship persisted when controlling for the level of nicotine dependence, age of smoking initiation, age of onset of daily smoking, mean prepregnancy smoking rate, and the number of prior quit attempts. Similarly, Wakschlag et al. (2003) conceptualized pregnancy smoking as a maternal problem behavior in the context of a lifetime history of problem behaviors. As hypothesized, they found that, compared with pregnancy quitters, pregnancy smokers endorsed significantly more behaviors that violated social norms (dropping out of high school, exhibiting truancy or theft as an adolescent, and having been arrested), had more interpersonal problems (lying, running away from home as a teen, having children with multiple partners, having aggressive and irritable relationships), and exhibited other problematic health behaviors (obtaining prenatal care late in pregnancy, not using prenatal vitamins). The authors concluded that pregnancy smoking may be a marker for the tendency to behave in ways that yield immediate benefit with little regard for long-term personal or social costs.
Discussion

In this review of observational studies from the past 15 years, we identified only eight quantitative studies that specifically examined psychological differences between smokers who spontaneously quit and those who do not. We will discuss findings in the context of related work with the goal of illuminating directions for future research.

Nicotine Dependence May Confound Mental Illness–Pregnancy Smoking Link

As increased rates of mental disorders have been observed among nicotine-dependent smokers in the general adult population (John, Meyer, Rumpf, & Hapke, 2004), some have proposed that smoking serves as a form of self-medication for psychiatric symptoms (Poirier et al., 2002), making cessation and sustained abstinence more challenging (Ferguson et al., 2003; Blalock, Robinson, Wetter, & Cinciripini, 2006; Weinberger, Desai, & McKee, 2010). Furthermore, previous studies comparing women who smoke during pregnancy with women who do not (thereby combining pregnancy quitters with nonsmokers) have shown that pregnancy smokers are more likely to be depressed (Zuckerman, Amaro, Bauchner, & Cabral, 1989; Linares Scott, Heil, Higgins, Badger, & Bernstein, 2009; Orr, Blazer, & Orr, 2012) and meet criteria for any psychiatric disorder (Flick et al., 2006). Yet, barring quantitative approaches, only by comparing pregnancy smokers with pregnancy quitters, while controlling for smoking-related factors present before pregnancy (Melanko, Leraas, Collins, Fields, & Reynolds, 2009; Perkins et al., 2008), can we truly determine whether depressive or other psychiatric symptoms are barriers to cessation.

The results of such studies comprising this review, particularly those by Holtrop et al. (2010) and Kodl and Wakschlag (2004), actually suggest no independent relationship between smoking cessation during pregnancy and depression, ADHD, bipolar disorder, or schizophrenia, after nicotine dependence is controlled. This seems contrary to some studies showing associations between prenatal smoking, depression, and anxiety (Massey et al., 2011), yet consistent with findings from other studies of pregnant smokers (Ludman et al., 2000; Munafo, Heron, & Araya, 2008) and studies of smokers from the general population (John et al., 2004). It is possible then that while psychiatric illnesses are over-represented among habitual cigarette smokers, their presence may not necessarily be predictive of unsuccessful cessation. With the exception of a history of conduct disorder, we have proposed that trait impulsivity associated with ADHD may account for one-third of the variance in maternal smoking during pregnancy and that maternal ADHD may explain the increased risk of ADHD in the offspring of pregnancy smokers (Agrawal et al., 2010). Thus, we might expect that the prevalence of ADHD would differentiate pregnancy smokers from pregnancy quitters. However, the study by Kodl & Wakschlag (2004) showed that a history of conduct disorder, not ADHD, predicted continued smoking during pregnancy, when the effects of nicotine dependence and other smoking-related factors were controlled. This is consistent with previous studies on the relationship between novelty seeking, a component of trait impulsivity (Flory et al., 2006) and cessation of tobacco, alcohol, and illicit drug use during pregnancy. Specifically, while novelty seeking may differentiate lifetime substance users from nonusers, it may not differentiate pregnancy users from pregnancy quitters when prepregnancy substance use is controlled (Massey et al., 2011). Thus, while impulsivity associated with ADHD may be related to the development of nicotine dependence in early adulthood (Rodriguez, Tercyak, & Audrain-McGovern, 2008), impulsivity may not necessarily be a barrier to quitting smoking during pregnancy.

Rather, as suggested by Kodl and Wakschlag (2004) and Wakschlag et al. (2003), psychological traits related to a history of conduct disorder and adult problem behaviors, respectively, may be more predictive of the decision to quit or continue smoking during pregnancy, independent of impulsivity and nicotine dependence. As conduct disorder is characterized by a pattern of behaviors that violate social norms and the rights of others (American Psychiatric Association, 2000), unmeasured maternal traits accounting for behavior that deviates from social norms, and/or a relative disregard for others, may also result in diminished motivation to quit smoking during pregnancy. This idea is supported by Goodhart et al. (2009) finding that extremely low pregnancy-related anxiety (and possibly low concern about the pregnancy) predicted continued smoking during pregnancy. Furthermore, maternal antisocial behavior may be predictive of the continued use of any addictive substance during pregnancy (Massey et al., 2012).

Although these hypotheses are speculative and somewhat disturbing, the study by Maxson et al. (2011) provides further support for the importance of personality in the decision to quit or continue smoking during pregnancy. In this longitudinal study of over 1,500 smokers, women who quit smoking during pregnancy displayed higher agreeableness compared with women who did not quit, whereas perceived stress, self-efficacy, neuroticism, depression, emotional support from the baby's father, and perceived social standing did not (Maxson et al., 2011). Agreeableness is one of five major personality dimensions, which reflects concern for cooperation and social harmony (Graziano & Eisenberg, 1997), and has been linked to empathy and helping behavior (Graziano, Habashi, Sheese, & Tobin, 2007). Similarly, Bradstreet et al. (in press) recently found that individual differences in generosity, measured by social discounting (Rachlin & Jones, 2008), differentiated...
pregnancy quitters from pregnancy smokers participating in a voucher-based smoking cessation intervention. Whether generosity (or lack thereof) is also directed toward the fetus during pregnancy is unknown, though Bradstreet and colleagues’ results raise the possibility that differences in generosity toward others may account for differences in smoking behavior in response to pregnancy. Replicating this study in a population-based or clinical sample would be important to determine whether social discounting is related to smoking cessation in the absence of financial incentives. Nonetheless, results from this review, combined with related studies, suggest that the way smokers regard the needs of others may also be predictive of their behavior regarding the needs of their fetus during pregnancy.

In light of this possibility, it is important to avoid viewing the desire to quit smoking for the fetus, and the ability to do so, as mutually exclusive processes, thereby blaming mothers who continue to smoke during pregnancy. One of the strongest predictors of prenatal smoking is lower socioeconomic status (Cnattingius, 2004), which may reflect the effect of low social and economic capital on the capacity to make health behavior changes (Ahnquist, Wamala, & Lindstrom, 2012), particularly in the context of nicotine, a highly addictive substance (Pontieri, Tanda, Orzi, & Di Chiara, 1996). However, we speculate that the emotional experience associated with pregnancy, such as acknowledging the unique needs of the developing fetus, may, in and of itself, be reinforcing or rewarding in a way that competes with the motivational drive to smoke. This idea has been previously proposed in the context of postnatal behaviors. Attachment-based interventions for substance abusing women that increase the quality of mother–infant interactions improve not only the quality of the mother–infant relationship but also the subsequent abstinence rates (Pajulo, Suchman, Kalland, & Mayes, 2006; Suchman, DeCoste, Castiglioni, McMahon, Rounsaville, & Mayes, 2010). In this way, then, the desire to protect the fetus may actually make smoking cessation easier, consistent with the observation that spontaneous pregnancy quitters achieve abstinence rates superior to their nonpregnant counterparts (Hughes et al., 1992; Solomon & Quinn, 2004). Future longitudinal studies that provide specific measures of concern for fetal well-being during pregnancy are important to confirm this hypothesis, which has important implications for the design of prenatal smoking cessation interventions. For example, parenting interventions designed to increase mothers’ concern or investment in their offspring (Olds, 2007; Olds, 2008), beginning in pregnancy, may be a powerful means to effect behavioral changes in both prenatal smoking and parenting behaviors.

Secure Attachment versus Amount of Social Support

Women who smoke during pregnancy may have less social support compared with women who do not (Elsenbruch et al., 2007), but results from this review do not support the importance of social support in smoking cessation. The study by Appleton & Pharoah (1998) suggested that lower perceived support, measured by the depend subscale of the Revised Adult Attachment Scale (Collins & Read, 1990), rather than lower actual emotional support, was predictive of the failure to quit smoking during pregnancy. Although not the explicit focus of their study, these results suggest that maternal attachment security may be a promising candidate predictor of smoking cessation during pregnancy and a novel target for intervention.

The potential role of attachment style in addictive behaviors is not a new concept. Psychodynamically oriented researchers have long conceptualized attachment insecurity as a risk factor in the developmental trajectory of substance-use disorders (Kohut, 1977; Cook, 1991; Thorberg & Lyvers, 2006; Walant, 1995) and have proposed that individuals who are insecurely attached may smoke cigarettes, drink alcohol, or use drugs to regulate emotional distress (Brennan & Shaver, 1995; Golder, Gillmore, Speker, & Morrison, 2005; Kassel, Wardle, & Roberts, 2007; McNally, Palfai, Levine, & Moore, 2003; Miljkovitch, Pierrehumbert, Karmaniola, Bader, & Hallon, 2005). Interestingly, maternal smoking during pregnancy has been associated with poor mother–child attachment after birth (Chittleborough, Lawlor, & Lynch, 2012), leading some to postulate about the role of attachment in adverse child psychological outcomes associated with smoking during pregnancy (Lavigne et al., 2011). If insecure attachment is also related to the failure to quit smoking during pregnancy, interventions that improve attachment security in pregnant smokers may increase the chances of quitting during pregnancy and also improve relationship quality with their children in the future. Longitudinal studies that examine attachment security in smokers as a predictor of cessation during pregnancy and include adequate controls for nicotine dependence and the psychological correlates identified in this review are important to confirm the relationship between maternal attachment style and prenatal smoking behavior. Furthermore, comparing mother–child attachment quality among smokers who quit during pregnancy and smokers who do not could elucidate the role of maternal attachment style among the causal mechanisms accounting for poor child behavioral outcomes associated with pregnancy smoking.

Capacity for Emotional Regulation versus Lower Stress

Our findings regarding the relationship between psychological stress and smoking cessation during pregnancy were mixed, with some studies supporting a relationship (Goedhart et al., 2009; Haskins et al., 2010; Pickett et al., 2009) and others finding no relationship (Holtrop et al., 2010; Maxson et al., 2011). This might be explained by a more nuanced relationship between stress and smoking cessation, reflective of the heterogeneity in experiences among pregnant smokers, as suggested by Goedhart et al. (2009), who found that extremely high and extremely low pregnancy-related anxiety were both associated with continued smoking during pregnancy. For example, smokers with extremely high anxiety may feel unable to quit if smoking is a coping mechanism for anxiety, whereas smokers with very low pregnancy-related anxiety may exhibit a low level of concern about the effect of smoking on their pregnancy. An alternative explanation is that the perception of stress, rather than the number of stressful life events during pregnancy, may be more important (Haskins et al., 2010). It is possible, then, that the capacity for emotional regulation, rather than the amount of stress itself, is more predictive of successful smoking cessation during pregnancy. This conclusion, if confirmed through future research, is hopeful, considering that sources of socioeconomic stress experienced by pregnant smokers are difficult to modify over the course of pregnancy, whereas the ability to manage this stress may be more malleable.
It is important not to confuse this review with a formal systematic review of literature; we anticipated an important gap in empirical literature regarding our research question and aimed to provide a synthesis of available studies to guide future directions in research. Regarding the question driving this review, whether there are psychological factors that contribute to spontaneous smoking cessation during pregnancy, the recent study by Maxson et al. (2011) most directly addressed this question, suggesting that concern for social harmony and cooperation is predictive of smoking cessation during pregnancy, though the severity of nicotine dependence, not controlled in this study, may confound this relationship. Other reviewed studies, through their examination of psychological risks that differentiated pregnancy smokers from pregnancy quitters, offer some promising areas for future inquiry. Specifically, understanding the relations among concern for fetal well-being, maternal attachment security, and prenatal smoking cessation may elucidate both novel targets for intervention and unexplored pathways by which smoking during pregnancy influences the development of child behavioral problems.

It is worthwhile to comment on the potential social and public health implications of these results, particularly if they are confirmed in future work. Given the small effect sizes achieved by best-practice smoking cessation interventions to date (Lumley, 2009), if psychological characteristics of pregnancy smokers, and not only smoking during pregnancy per se account for psychopathology in offspring (mediated by genetic transmission and/or subsequent parenting behaviors, for instance) perhaps resources should also be directed at the development of psycho-educational and parenting interventions for pregnancy smokers, rather than a singular focus on smoking cessation. This is especially true given the growing behavioral genetics research suggesting the importance of parenting behavior in moderating the effects of genetic risk and prenatal drug exposures on child behavioral outcomes (Leve, Harold, Ge, Neiderhiser, & Patterson, 2010; Marceau et al., 2012; Narusyte et al., 2011). To effectively prevent the intergenerational transmission of risks associated with prenatal smoking, there is a great need for a multidisciplinary approach that capitalizes on empirical knowledge from a number of fields in addition to medicine. These fields include behavioral and social sciences, decision sciences, child development, behavioral genetics, and neuroscience; only in this way can we be assured that valuable resources are targeted at the maternal behaviors that are the most influential to child outcomes.

Conclusion

Clearly, more research using large, representative samples of pregnant women, prospective designs, biomarker confirmation of smoking status during pregnancy, and adequate controls for characteristics associated with lifetime smoking are needed to identify sources of psychological resilience among smokers who are able to quit during pregnancy.

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Declaration of Interests

None declared.

References


Smokers who spontaneously quit during pregnancy and those who do not


Smokers who spontaneously quit during pregnancy and those who do not


