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The Co-occurrence of Smoking and a Major Depressive Episode among Mothers 15 Months after Delivery

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Abstract

Objective—To examine the association between maternal smoking 15 months after delivery and the occurrence of a major depressive episode in the prior 12 months.

Methods—Data were obtained from the Fragile Families and Child Wellbeing Study, a birth cohort study. In 20 U.S. cities, 4,898 mothers were surveyed at delivery in the years 1998 to 2000. In a survey 15 months later, 4,353 (89%) of the mothers reported their smoking behavior and symptoms of a major depressive episode during the prior 12-months.

Results—At the follow-up survey, 26.6% of mothers reported that they were current smokers and 13.6 % reported that they had symptoms of a major depressive episode during the prior 12 months. After adjusting for sociodemographic characteristics, the prevalence (95% confidence interval) of a major depressive episode was higher among smokers than nonsmokers: 17.7% (15.7%, 19.8%) vs. 12.1% (10.9%, 13.3%). Smoking was also more common among mothers with a major depressive episode than in those without one: 34.0% (30.6%, 37.4%) vs. 25.5% (24.1%, 26.8%).

Conclusion—Smoking and depression often co-occur among mothers with infants. This suggests that these conditions should not be diagnosed or treated in isolation from each other and that the care of mothers and children should be integrated.

Precis—Among 4,353 mothers assessed 15 months after delivery, the prevalence of depression was 46% higher among smokers and the prevalence of smoking was 33% higher among those with depression.

Keywords

Smoking; Depression; Postpartum period; Infant

Introduction

Smoking and depression are two common and treatable maternal conditions that increase children's risk for adverse health outcomes. Approximately 20% of mothers of infants smoke (Colman and Joyce, 2003, Winickoff et al., 2003), and 24% have significant depressive

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symptoms (McLennan et al., 2001). Low birth weight, sudden infant death, asthma, attention-deficit/hyperactivity disorder, and otitis media in children are associated with maternal smoking (National Cancer Institute, 1999, Milberger et al., 1996), while behavior problems, language delay, and depression in children are associated with maternal depression (Downey and Coyne, 1990).

As individual conditions, maternal smoking and depression are increasingly being addressed in children's health care (Olson et al., 2002, Zimmer and Minkovitz, 2003, Frankowski and Secker-Walker, 1989, Kemper et al., 1994, Green and Palfrey, 2002). However, in pediatric clinical practice, the relationship between these two maternal risk factors is not always considered. For example, maternal smoking may worsen a child's asthma symptoms (Strachan and Cook, 1998), and medication adherence may also be poor if the mother is depressed (Bartlett et al., 2004). Clinical research often mirrors the approach in clinical practice, with treatment studies of maternal smoking, for example, not routinely collecting data on maternal depression.

Emerging evidence, however, suggests that the two maternal conditions should be considered together in both pediatric practice and research. Among adults, depressed individuals are more likely to smoke than are those without depression (Lasser et al., 2000, Glassman et al., 1990), and smokers have higher levels of depressive symptoms than nonsmokers (Pomerleau et al., 2003). These observations are consistent with the conditions having a shared neurobiological basis (Tizabi et al., 2000) and pharmacologic treatment (Lineberry et al., 1990, Ahluwalia et al., 2002).

The association between smoking and depression has been demonstrated among women during pregnancy (Pritchard, 1994, Zhu and Valbo, 2002). However, this association during the postpartum period has received much less attention. Following delivery there is an elevated risk for both depression (Cooper and Murray, 1998) and the relapse of smoking (Kahn et al., 2002). Furthermore, infants are particularly vulnerable to the impact of both these maternal conditions. The few previous reports that have examined the association between smoking and depression in mothers with young children have assessed depressive symptoms rather than major depressive disorder (Leiferman, 2002, Kavanaugh et al., 2005, Kahn et al., 2002, Kahn et al., 1999). Other limitations of these studies include convenience sampling (Kahn et al., 1999) or low response rates (Kavanaugh et al., 2005).

Using data from a recent national birth cohort study, we examined the association between the 12-month prevalence of a major depressive episode (MDE) and current smoking in mothers 15 months after delivery. We hypothesized that either smoking or depression would increase the likelihood of the other condition, after controlling for potentially confounding sociodemographic factors.

Methods

Study Design and Sample

The Fragile Families and Child Wellbeing Study is a birth cohort study of 4,898 children and their parents. The design of the study is described elsewhere in detail (Reichman et al., 2001), and it is briefly summarized here. The children were born in the years 1998 to 2000 in 20 US cities in 15 states. Nonmarital births, so called "fragile families," were over sampled relative to marital births (3:1). Families were considered ineligible (<5% of sampled births) for any of the following reasons: the child was being placed for adoption, the mother did not speak either English or Spanish well enough to understand the survey, the father was deceased, or the mother (or child) was too ill after delivery for the mother to complete the interview. In addition, approximately two-thirds of the 75 birth hospitals did not allow mothers less than 18

years of age to participate. Among eligible mothers, 82% of those married and 87% of those unmarried agreed to participate.

At delivery, mothers completed a baseline survey in the birth hospital. Approximately 15 months after delivery, 4,365 (89%) of the mothers completed a follow-up survey by telephone. The institutional review boards at all birth hospitals, as well those at Princeton University and Columbia University, approved the data collection procedures. All participants gave informed written consent.

Maternal Smoking and Major Depression

Data on maternal smoking and depression were obtained in the follow-up survey, but these data were not obtained in the survey at delivery. A mother was considered a current smoker (yes/no) if she reported smoking cigarettes during the preceding month. The presence of an MDE in the prior 12 months was assessed with version 1.0 of the World Health Organization Composite International Diagnostic Interview-Short Form (CIDI-SF) (Kessler et al., 1998). We used the suggested CIDI-SF scoring method (Walters et al., 2002) to classify a mother as having had an MDE. To be classified in this way, a mother had to report having had a two-week period during the preceding 12 months during which she experienced either dysphoric mood (felt sad, blue, or depressed) or anhedonia (lost interest in most things) to a significant degree (the symptom lasted for at least most of the day, almost every day). She also had to report having had at least 3 other symptoms of major depression listed in the *Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition* (DSM-IV) (American Psychiatric Association, 1994), such as feeling tired, having trouble sleeping, or thinking about death.

Because version 1.0 of the CIDI-SF contained a minor error in the question skip pattern (Kessler, 2002), 164 mothers who reported feeling sad or depressed were not subsequently asked the questions about the intensity of their symptom of anhedonia. To avoid underestimating the prevalence of MDE in the sample, we classified 112 of these mothers as having had an MDE because they reported some degree of anhedonia and at least two of the other DSM-IV depressive symptoms.

Sociodemographic Variables

Six sociodemographic variables were obtained from the survey at delivery, and these included the mother's age, race/ethnicity, education, number of children in the household, and relationship status with the child's biological father. The income-to-poverty ratio was calculated as the household income divided by the income at the federal poverty threshold for the year of the income report and the household size. In 2000, the income at the poverty threshold for a household of 4 was \$17,463 (US).

Statistical Analysis

The final analytic sample contained 4,353 cases after excluding 12 cases that were missing data on either smoking or depression. We analyzed both current smoking and the 12-month prevalence of an MDE as binary (yes/no) variables. To account for potentially confounding sociodemographic characteristics, we used generalized linear models to determine the adjusted prevalence of smoking among those with and without an MDE and the adjusted prevalence of an MDE among smokers and non-smokers. We used a logistic regression model, with MDE as the dependent variable, to determine the adjusted odds of an MDE among smokers. In addition, we used interaction terms in these logistic models to assess whether household income or education significantly modified the relationship between smoking and major depression.

Results

Almost half of the mothers were non-Hispanic Black and over one fourth were Hispanic (Table 1). At the time of delivery, over one third of mothers reported an annual household income below the federal poverty threshold, and, consistent with the sampling design, one fourth were married to the child's father at the time of delivery.

At the time of follow-up survey, which occurred at a mean (SD) of 15.0 (3.5) months after delivery, 13.6% of mothers reported having experienced symptoms of an MDE in the prior 12 months. Smoking was reported by 26.6% of mothers, either smoking or an MDE by 30.3%, and both smoking and an MDE by 5.0%.

Examination of bivariate associations between the sociodemographic factors and smoking and depression revealed the following: smoking was more common in mothers who had lower income and education levels and who were white, unmarried and younger; an MDE was more common in mothers who had lower income levels, were unmarried, and had more children (Table 1).

After adjusting for sociodemographic characteristics, the prevalence (95% confidence interval [CI]) of an MDE was 5.6 (95% CI: 3.2, 8.1) percentage points higher among smokers than among nonsmokers (Table 2), a relative increase in prevalence of 46%. Similarly, the prevalence of smoking was 8.5 (95% CI: 4.8, 12.2) percentage points higher among mothers with an MDE than in those without one, a relative increase in prevalence of 33% (Table 3).

The unadjusted odds (95% confidence interval) of an MDE in the prior 12 months was 1.72 (95% CI: 1.44, 2.07) for mothers who were smoking 15 months after delivery compared to those who were not. After adjustment for all six sociodemographic covariates in a multivariate logistic regression model, the odds ratio was 1.54 (95% CI: 1.27, 1.88). When interaction terms were added to the regression model, we found no evidence that the risk relationship between smoking and MDE was different between mothers with higher and lower household incomes (income-to-poverty ratio ≤ 2.00 vs. > 2.00) or between mothers with higher and lower education levels ($\leq$ high school degree vs. $>$ high school degree) (data not shown). Our findings about the association between depression and smoking were not meaningfully different when we re-ran all our logistic regression models after re-classifying the 112 mothers affected by the CIDI-SF skip pattern error as not having an MDE.

Discussion

In a sample of 4,353 mothers surveyed 15 months after delivery, we have shown that the 12-month prevalence of a major depressive episode was 46% higher among smokers and that the prevalence of smoking was 33% higher among those had a major depressive episode in the prior 12 months. These findings suggest that the two maternal health conditions most frequently singled out as pediatric risk factors—depression and smoking— should not be diagnosed or treated in isolation from each other and that the health care of mothers and children should be integrated.

Comparisons to prior studies

We are aware of two other data sets from national surveys that investigators have used to examine the association between smoking and depressive symptoms in mothers with young children. Two reports used data from the National Maternal and Infant Health Survey (1988–1991) to assess the relationship between smoking and depressive symptoms in mothers at two time points, approximately 17 and 35 months after delivery (Leiferman, 2002, Kahn et al., 2002). At each time point, the odds of smoking were 20% greater among mothers who had

significant depressive symptoms (scores ≥ 16 on the Center for Epidemiologic Studies Depression Scale). The odds of smoking were 40% greater at 35 months for those who had significant depressive symptoms at both 17 and 35 months. Another report used data from the more recent Social Climate Survey of Early Child Health and Well-Being, which included mothers with children in a much broader age range (any child less than 19 years of age) (Kavanaugh et al., 2005). The adjusted odds of a positive depression screen were 1.7 (95% CI: 1.1, 2.6) for those mothers who smoked. However, this survey, though national, involved only 702 mothers, was limited to three questions assessing depressive symptoms (Kemper and Babonis, 1992), reached only mothers in households with telephones, and had a low response rate (61%).

Study Limitations and Strengths

Although this was a large sample of birth mothers from 15 US states, the findings cannot be applied to all US mothers with infants. The mothers in this study were drawn exclusively from large US cities, and single mothers were over-sampled. From this analysis, we cannot infer a casual association, in either direction, between depression and smoking. However, we controlled for a number of potentially confounding sociodemographic factors present at birth, and a high percentage of the birth mothers were followed up 15 months after delivery. The study did not collect biomarkers for smoking. However, rather than assessing depressive symptoms, the survey assessed the 12-month prevalence of a major depressive episode, based on DSM-IV criteria.

Implications of the Findings

To address the fact that smoking and depression frequently co-occur in mothers with young children requires two important changes in the health care delivery system: identifying and treating these conditions together and increasing access to primary care for mothers. Although there is ample evidence that both of these chronic conditions can be treated (Wells et al., 2000, Miranda et al., 2003, Fiore, 2000), this requires a system of comprehensive, continuous, and coordinated health care for the mothers that goes beyond pregnancy. To our knowledge, few studies have focused on primary health care for mothers during the early parenting years (Misra et al., 2000, Haas and McCormick, 1997). Relatively little is known about the types of health care providers visited by mothers (Henderson et al., 2002) or the content of the care provided, including whether clinicians consider both smoking and depression together or assess the potential impacts of these two conditions on children. Lack of health insurance is a major barrier to health care for mothers (Guyer et al., 2002). Although some US states have expanded Medicaid health insurance for low-income mothers, the average income limit for this coverage is 67% of the US poverty threshold (Henry J. Kaiser Family Foundation, 2005).

In addition to increasing access to health care for mothers, there are other challenges to integrating the care of mothers and children. From the perspective of those providing pediatric health care, maternal smoking and depression can be viewed as “sentinel” conditions because they are common and impact many aspects of child health. However, pediatric primary care clinicians understandably report lacking the time, skills, and mandate to treat mothers in a manner consistent with recommended practice guidelines (Oncken et al., 2000, Olson et al., 2002, Perez-Stable et al., 2001, Frankowski and Secker-Walker, 1989, Frankowski et al., 1993). An interim approach for pediatricians may be to develop a referral network of adult health care providers. Some mothers may need assistance finding an adult clinician, whereas others may be encouraged to reconnect with their existing primary care provider. To our knowledge, there has been little research on potential strategies to help pediatricians enhance referrals of mothers to adult health care providers.

Conclusion

In a national sample of mothers surveyed 15 months after delivery, we demonstrated the frequent co-occurrence of smoking and depression. This suggests the need to develop a system of screening, referral, and treatment that considers both of these maternal conditions together. This is not feasible without an adequately financed system of primary health care for mothers that extends beyond pregnancy. Such a system is a potential solution to improving the health and well-being of children by also addressing the health and well-being of their mothers.

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Table 1

Point prevalence of smoking and 12-month prevalence of a major depressive episode (MDE) in mothers by level of sociodemographic factors

Sociodemographic factors	Prevalence of factor, n (%) ^a	Prevalence of maternal condition, %	
		Smoker	MDE
Income-to-poverty ratio			
<1.0	1551(35.6)	31.9	15.7
1.00– 1.99	1120(25.7)	28.5	15.9
2.00– 2.99	684(15.7)	25.9	11.8
≥3.00	998(22.9)	16.8	9.2
<i>p</i> value ^b		<0.001	<0.001
Education			
Less than high school	1467(33.7)	34.8	15.4
High school degree or equivalent	1326(30.5)	28.1	12.7
Some college	1082(24.9)	21.2	14.4
College graduate or more	473(10.9)	9.1	8.2
<i>p</i> value		<0.001	0.001
Race/ethnicity			
Hispanic	1164(26.8)	18.0	12.0
White, non-Hispanic	944(21.7)	36.5	13.6
Black, non-Hispanic	2074(47.7)	27.3	14.8
Other race, non-Hispanic	162(3.7)	21.0	10.5
<i>p</i> value		<0.001	0.097
Relationship status with child's father			
Married	1069(24.6)	12.9	10.8
Cohabiting	1583(36.4)	31.0	13.9
Single	1701(39.1)	31.1	15.2
<i>p</i> value		<0.001	0.004
Age (years)			
<20	780(17.9)	30.5	13.5
20–29	2578(59.2)	27.2	14.0
≥30	995(22.9)	22.0	12.8
<i>p</i> value		<0.001	0.60
Number of children in household			
1	1458(33.5)	27.0	11.9
2–3	2189(50.3)	24.7	14.0
≥4	670(15.4)	32.4	16.4
<i>p</i> value		<0.001	0.014

^a Where total is <4,353 for any characteristic, subjects had missing data. Percentage may not add to 100.0% due to rounding.

^b All *P* values are for chi-square tests, two-tailed.

Data are from the Fragile Families and Child Wellbeing Study (1999–2001).

Table 2
Prevalence and odds of a major depressive episode in mothers during the prior 12 months by smoking status

	Prevalence of a major depressive episode, % (95% confidence interval)		Odds of a major depressive episode, odds ratio (95% confidence interval)	
	Unadjusted	Adjusted ^a	Unadjusted	Adjusted ^a
Smoker				
No (n = 3,195)	11.8 (10.6, 13.0)	12.1 (10.9, 13.3)		1.00
Yes (n = 1,158)	18.7 (16.8, 20.7)	17.7 (15.7, 19.8)	1.72 (1.44, 2.07)	1.54 (1.27, 1.88)

^a Adjusted for the following covariates which were entered into the regression models as the categorical variables described in Table 1: income-to-poverty ratio, education, race/ethnicity, relationship status with the child's father, age, and number of children in the household. The sample size for these adjusted analyses was 4,303 due to some cases with missing data on covariates.

Data are from the Fragile Families and Child Wellbeing Study (1999-2001).

Table 3

Prevalence of smoking in mothers by history of a major depressive episode during the prior 12 months

	Prevalence of smoking % (95% confidence interval)	
	Unadjusted	Adjusted ^a
Had major depressive episode		
No (n = 3,759)	25.0 (23.6, 26.4)	25.5 (24.1, 26.8)
Yes (n = 594)	36.5 (33.0, 40.1)	34.0 (30.6, 37.4)

^a Adjusted for the following covariates which were entered into the regression models as the categorical variables described in Table 1: income-to-poverty ratio, education, race/ethnicity, relationship status with the child's father, age, and number of children in the household. The sample size for these adjusted analyses was 4,303 due to some cases with missing data on covariates.

Data are from the Fragile Families and Child Wellbeing Study (1999–2001).