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Smoking in Pregnancy and Postpartum: Relationship to Mothers' Choices Concerning Infant Nutrition

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L'objectif de cette étude consistait à examiner le lien possible entre le statut de fumeuse d'une mère et l'alimentation du nourrisson. En 1993, on a pré-sélectionné sur une période de 6 mois des femmes devant accoucher dans 5 hôpitaux de la région d'Ottawa-Carleton en Ontario. Un suivi par téléphone a été effectué auprès des répondantes au troisième mois de la période postpartum, à l'aide d'un questionnaire éprouvé. On a posé aux mères des questions concernant les choix faits par celles-ci quant à l'alimentation du nourrisson, ainsi que leur comportement en tant que fumeuses. On a eu recours à des analyses de régression logistique afin de déterminer l'importance des facteurs démographiques et du tabagisme chez les mères, en lien avec trois pratiques sur le plan de l'alimentation : l'allaitement au biberon dès la naissance, l'interruption de l'allaitement au sein, et le passage aux aliments solides dès la douzième semaine. Au total, 796 femmes ont participé à l'étude longitudinale (taux de suivi : 90 %). Les mères ayant un faible niveau de scolarité, les jeunes mères, les mères monoparentales, séparées ou divorcées et les mères nées à l'étranger avaient davantage tendance à allaiter au biberon dès la naissance. Les femmes ayant un faible niveau de scolarité étaient plus enclines à cesser l'allaitement au sein avant la douzième semaine. Les femmes ayant fumé durant toute la grossesse ou une partie de celle-ci et qui fumaient toujours au moment de l'entrevue avaient, et ce de manière significative, davantage tendance à allaiter au biberon à la naissance ou à avoir cessé d'allaiter au sein à la douzième semaine, comparativement aux non-fumeuses. Les fumeuses étaient aussi plus enclines que les non-fumeuses à inclure, dès la douzième semaine, des aliments solides au régime du nourrisson. Le tabagisme chez les mères s'est avéré un facteur significatif pouvant permettre de prédire, lorsque d'autres facteurs sociodémographiques étaient pris en compte, le mode d'alimentation du nourrisson qui serait privilégié. Ce facteur devrait par conséquent être intégré aux outils d'évaluation clinique en matière d'alimentation du nourrisson. De nouvelles études portant sur le lien entre d'autres dimensions du tabagisme chez la mère et l'alimentation du nourrisson (par ex. les tentatives d'arrêter de fumer, la qualité du soutien de la part du conjoint, le tabagisme chez le conjoint) mériteraient d'être entreprises.

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The objective of this study was to examine the relationship between maternal smoking status and infant nutrition. Women delivering in 5 hospitals in the Ottawa-Carleton region of Ontario were screened for eligibility over a 6-month period in 1993. Follow-up data were collected by telephone at 3 months postpartum using a validated questionnaire. Mothers were retrospectively asked about their infant-feeding choices and their smoking behaviours. Logistic regression analyses were used to determine the significance of demographic factors and maternal smoking behaviours in relationship to 3 feeding practices: bottlefeeding at birth, discontinued breastfeeding by 12 weeks, and introduction of solids by 12 weeks. A total of 796 women participated in the longitudinal study (90% follow-up rate). Less-educated; younger; single, separated or divorced; and foreign-born mothers were more likely to bottlefeed at birth. Less-educated women more often discontinued breastfeeding before 12 weeks. Mothers who had smoked during part or all of their pregnancy and were smoking at the time of the interview were significantly more likely than non-smokers to bottlefeed at birth or to discontinue breastfeeding by 12 weeks. Current smokers were also more likely than non-smokers to have introduced solid food by 12 weeks. Maternal smoking was a significant predictor of infant nutrition, with other sociodemographic factors taken into account. Smoking status should be included in clinical screening tools for infant nutrition. The relationship between other dimensions of maternal smoking (e.g., timing of quitting attempts, degree of partner support, partner's smoking behaviours) and infant-feeding practices warrants investigation.

Introduction

The protective health effects of quitting smoking during pregnancy, shielding infants from environmental tobacco smoke, initiating breastfeeding, and delaying the introduction of solid foods have been well documented (American Academy of Pediatrics, Committee on Substance Abuse, 1994; DiFranza & Lew, 1996; Floyd, Rimer, Giovino, Mullen, & Sullivan, 1993; Klonoff-Cohen et al., 1995; Lucas, Brooke, Morley, Cole, & Bamford, 1990). However, relationships between smoking and infant-feeding practices have received less attention. For example, a review (Edwards, 1995) of 14 prospective studies investigating predictors of breastfeeding initiation and duration among postnatal immigrants or ethnic minorities found that only one study (Grossman, Fitzsimmons, Larsen-Alexander, Sachs, & Harter, 1990) examined women's smoking patterns during pregnancy. A thorough understanding of how women's choices about smoking affect their infant-feeding decisions is critical to the design of infant-nutrition programs.

There are both biological and psychological models underlying the hypothesized negative relationship between smoking and breastfeeding. The biological model arises from endocrinologic research indicating that lactogenic hormone levels, particularly prolactin, are altered by cigarette smoke in a manner consistent with reduced milk production (Andersen, Ronn, Tjonneland, Djursing, & Schioler, 1984; Widstrom, Werner, Matthiesen, Svensson, & Uvnas-Moberg, 1991). Studies have

shown that infants of women who smoke exhibit delays in initiating sucking, decreased sucking pressures, and more frequent episodes of colic than infants of non-smoking mothers (Martin, Martin, Streissguth, & Lund, 1978; Said, Patois, & Lellouch, 1984). Hopkinson, Schanler, Fraley, and Garza (1992) demonstrated that smoking reduces breast-milk production and lowers fat concentration in the milk of mothers of pre-term infants. Other authors (Cabello et al., 1991; Vio, Salazar, & Infante, 1991) have reported reduced milk intake by both full- and pre-term infants of smoking mothers. Consistent with this finding, Hill and Aldag (1996) found that insufficient breast milk was more often cited as a reason for a change in feeding patterns among smoking mothers than among non-smoking mothers of term and low-birthweight infants.

Retrospective and cross-sectional studies have found that smokers wean their infants earlier than non-smokers. For example, Redman, Watkins, Evans, and Lloyd (1995) found that women who breastfed for less than 4 months were more likely to be current smokers than women who breastfed longer than 4 months (crude OR 2.83, 95% CI: 1.25, 6.39). Other authors have reported similar findings, with non-smokers being two to four times more likely than smokers to initiate breastfeeding or to wean later (Ever-Hadani, Seidman, Manor, & Harlap, 1994; Feinstein, Berkelhamer, & Gruszke, 1986; Minchin, 1991; Schwartz-Bickenbach, Schulte-Hobein, Abt, Plum, & Nau, 1987). More recent studies have found a dose-response gradient between amount smoked and early breastfeeding cessation (Nafstad et al., 1997) and a stronger likelihood of early weaning among mothers of low-birthweight versus term infants (Hill & Aldag, 1996).

The link between reduced milk production and smoking may also affect the decision to introduce solids earlier. For example, Redman et al. (1995) report that women who terminated breastfeeding prior to 4 months were 3.33 times more likely to introduce solids early than women who terminated breastfeeding later (95% CI: 1.68, 6.62). Little, Lambert, Worthington-Roberts, and Ervin (1994), in their study of maternal smoking and infant weight gain, examined the body mass of 1-year-old infants. They compared three groups: breastfed infants of smokers, breastfed infants of non-smokers, and bottlefed infants of smokers. Breastfed infants of smokers gained more weight and had a significantly higher body mass than the other two groups. The authors hypothesize that this paradoxical finding may be due to smokers having difficulty maintaining milk supply and supplementing with more solid food to soothe fussy babies. Conter, Cortinovis, Patrizia, and Riva (1995) and Nafstad et al. (1997) found that adjusted weight gain in the first year of life was greater in the children of smokers.

The psychological model explaining the relationship between smoking and breastfeeding arises from recent qualitative and quantitative studies of postpartum smoking relapse (Edwards, Sims-Jones, & Hotz, 1996; Sims-Jones et al., 1997). About one third of women who quit smoking during pregnancy do so for the sake of the baby rather than themselves. Furthermore, women who quit for the sake of the baby often indicate an intention to take up smoking again, either soon after delivery or upon termination of breastfeeding. For some women, breastfeeding appears to provide an extension of the period when they quit smoking for the sake of the baby (Edwards & Sims-Jones, 1998). For this cohort, a decision to stop breastfeeding closely coincides with a decision to start smoking again.

Supporting these findings are the results of O'Campo, Faden, Brown, and Gielen's (1992) prospective study of psychosocial factors affecting infant-feeding practices between 6 and 12 weeks postpartum. After adjusting for sociodemographic characteristics in a logistic regression analysis, the investigators found that a mother's decision to use formula rather than to breastfeed was the only significant predictor of postpartum smoking relapse (OR 2.7, 90% CI: 1.1, 6.6).

Methods

The purpose of this analysis was to examine the relationship between smoking status during pregnancy/postpartum and infant-nutrition practices. Data for this study were collected as part of a three-group randomized controlled trial designed to test the effectiveness of alternative approaches to postpartum follow-up for lower-risk primiparas (mail-out package either alone or in combination with a phone call by a clerk reminding women to attend a postpartum support group; or a telephone "visit" by a public health nurse). Methods are detailed elsewhere (Edwards & Sims-Jones, 1997). Briefly, women delivering in five hospitals serving the Ottawa-Carleton region were screened for eligibility over a 6-month period in 1993 using data on hospital liaison forms. Inclusion criteria were: primiparous, singleton birth, gestation 35 weeks or more, no congenital abnormalities, and identified as lower risk by the hospital liaison referral process. Follow-up data were collected by phone at 3 months postpartum using a validated questionnaire that obtained self-reported data on infant-feeding and maternal-smoking status.

Predictor and Outcome Variables

For the principal analysis, response categories for sociodemographic variables were collapsed as follows: mother's age (15–24; 25–29; 30–34;

35 or over), education completed (less than high school diploma; high school diploma or greater), annual household income ($20,000 or less; $21,000 or more), country of birth (Canada; elsewhere), and marital status (married; living common-law; single, separated, or divorced).

Three categories of smoking behaviours were coded: did not smoke during pregnancy or smoked during some or all of pregnancy but quit at time of interview (quit smokers); smoked during some or all of pregnancy and smoking at time of interview (current smokers); or never smoked (non-smokers). Non-smokers were defined as women who had never smoked or had smoked less than 100 cigarettes in their lifetime.

The outcome variables were defined as exclusive or partial bottle-feeding initiated at birth, discontinuation of breastfeeding by 12 weeks postpartum, and introduction of solid foods by 12 weeks. Solids were defined as any food other than milk, water, or vitamin or fluoride supplements. Responses to study questions were used to derive three dichotomous (yes or no) outcome variables: (a) bottlefeeding at birth; (b) discontinued breastfeeding by 12 weeks postpartum; and (c) solids introduced by 12 weeks postpartum.

Analysis

Relationships between sociodemographic variables, smoking status, and each of the three feeding practices were examined using the Pearson chi-square. All predictor variables with a chi-square having a probability of .25 or less were considered to be potentially important predictors and were included in initial logistic regression models. Two-way interaction terms were tested in the three models to identify any combined effects of the mother's age with other predictors. A backwards stepwise logistic regression procedure was followed, where the inclusion of individual predictors was determined by the significance of the Wald statistic associated with each regression coefficient. Predictors that were not found to be significant were dropped for successive iterations in the model-fitting process. Final models were considered significant based on the overall chi-square test of fit.

Possible relationships between patterns of missing responses and the dependent or independent variables were examined to ensure that the findings were not biased by excluding from the analysis mothers who did not respond to some questions. All analyses were run using *SPSS 6.1.2 for Windows* (SPSS Inc., 1995).

Results

Sample

Of the 972 women initially found to be eligible for the study, 873 (90%) were contacted at 3 months postpartum when their final eligibility was ascertained and their consent to be interviewed requested. Forty-four women were subsequently determined to be ineligible. Only 31 mothers (3%) refused to participate. In total, 788 women completed the interview. One woman did not provide any demographic information and was not included in the analysis. Smoking outcomes were computed for 787 women. However, 18 of these women reported quitting smoking prior to pregnancy, not smoking throughout pregnancy, and relapsing during the postpartum period. This subgroup was excluded from the main analysis because theoretically it was considered inappropriate to include them with the current smokers; yet the number of women in this subgroup was too small to include in the logistic regression due to the occurrence of singularities. Thus a cohort of 769 women provided information used to analyze predictors of both bottlefeeding at birth and introduction of solids by 12 weeks postpartum. The subcohort of 674 women who had initiated breastfeeding at birth was examined to identify predictors of breastfeeding cessation by 12 weeks.

Findings

Among the 769 women included in the analysis, 317 (41.2%) had smoked more than 100 cigarettes in their lifetime; 183 (23.8%) who had either quit for the pregnancy or had smoked during some or all of the pregnancy were not smoking at the time of the interview, while 128 (16.6%) were smoking at the time of the interview. A large proportion of smoking women (69%) had tried to quit during pregnancy. Quit attempts occurred most frequently during the first trimester.

The demographic characteristics of mothers differed across smoking categories (Table 1). Compared to non-smokers, quit and current smokers were younger, had less education and lower incomes, were less often married, and were more often Canadian-born. Among the three smoking cohorts, current smokers had the highest rates of bottlefeeding at birth and breastfeeding cessation by 12 weeks. Current smokers were also more likely to have introduced solid foods by 12 weeks than non-smokers or quit smokers (Table 2).

Table 1 *Demographie Profile of Sample by Smoking Status*[a]

Characteristic	Total Sample (*N* = 769) %	Non-Smokers (*N* = 586) %	Quit Smokers (*N* = 55) %	Current Smokers (*N* = 128) %
Age (years)				
15–24	16.5	12.8	29.1	28.1
25–29	37.3	37.5	40.0	35.2
30–34	36.2	38.4	27.3	29.7
35 and over	10.0	11.3	3.6	7.0
Education[a]				
Less than high school diploma	24.4	18.6	41.8	43.8
High school diploma or some post-secondary	16.5	16.2	7.3	22.7
College or university graduation	58.8	65.2	50.9	32.9
Marital Status[a]				
Single, separated, divorced	8.8	6.7	16.4	15.6
Living common-law	9.6	6.5	12.7	22.7
Married	81.5	86.9	70.9	61.7
Country of Birth				
Canada	79.4	76.7	87.3	88.3
Elsewhere	20.6	23.3	12.7	11.7
Household Income[b]				
$20,000 or less	11.3	9.4	17.0	17.1
$21,000–$39,000	19.9	18.7	26.4	22.7
$40,000–$59,000	22.8	22.2	24.5	24.4
$60,000 or over	46.0	49.7	32.1	35.8

[a] Proportions do not always sum to 100% due to subgrouping or rounding errors.
[b] Fifty-three women did not respond to income questions.

Table 2 *Proportion of Mothers' Infant-Feeding Practices by Maternal Smoking Behaviours*[a]

Infant-Feeding Practice Total $N = 769$	Non-Smokers % (*N*)	Quit Smokers % (*N*)	Current Smokers % (*N*)	Chi-Square	*p* Value
Initiated breast-feeding at birth					
Yes	91.1 (534)	83.6 (46)	73.4 (94)	31.3	$p < .001$
No	8.9 (52)	16.4 (9)	26.6 (34)		
Partial or exclusive bottlefeeding at birth					
Yes	47 (275)	47.3 (26)	76.6 (98)	37.3	$p < .001$
No	53 (311)	52.7 (29)	23.4 (30)		
Discontinued breast-feeding by 12 weeks[a]					
Yes	27.3 (145)	34.8 (16)	52.1 (49)	23.2	$p < .001$
No	72.7 (389)	65.2 (30)	47.9 (45)		
Introduced solid food by 12 weeks					
Yes	38 (222)	45.5 (25)	70.3 (90)	44.6	$p < .001$
No	62 (364)	54.5 (30)	29.7 (38)		

[a] Only women who had initiated breastfeeding were asked about continuing breastfeeding at 12 weeks postpartum ($N = 674$).

As shown in Table 3, there were some differences in the predictor variables retained in each logistic regression model. Smoking status was, however, a consistent predictor of each feeding behaviour. Final models for the three feeding practices were significant based on the overall chi-square for model fit ($p < .0001$). No interaction terms were retained in final models.

Initiation of bottlefeeding at birth was significantly greater among current smokers than non-smokers. Compared to non-smokers and women 35 years of age or older, current smokers and women aged 15 to 24 were significantly more likely to have introduced solid foods by 12 weeks postpartum.

To explore the possibility that successful quit attempts during pregnancy influenced outcomes, logistic regression models were constructed and tested using only those responses from the 128 mothers who were smoking at the time of the interview. Predictors were identical to those used in the main analysis, with the addition of information about quit attempts during pregnancy or postpartum (yes or no).

Table 3 *Maternal Characteristics Related to Infant-Feeding Practices*

Maternal Characteristics (predictor variables)	Odds Ratios (95% CI's) for Feeding Practices[a]		
	MODEL 1 Bottlefeeding at Birth (N = 769) OR (95% CI)	**MODEL 2 Discontinued Breastfeeding by 12 Weeks Postpartum (N = 674)[a] OR (95% CI)**	**MODEL 3 Introduced Solids by 12 Weeks Postpartum (N = 769) OR (95% CI)**
Age Group (years)			
15–24	–	–	2.33 (1.28, 4.26)[b]
25–29			1.25 (0.74, 2.12)
30–34			0.78 (0.46, 1.33)
35 and over			1.0
Marital Status			
Single, separated, divorced	2.90 (1.53, 5.49)[b]	–	–
Living common-law	1.39 (0.81, 2.37)		
Married	1.0		
Smoking Status			
Current smoker	3.01 (1.89, 4.78)[b]	2.48 (1.56, 3.93)[b]	3.53 (2.31, 5.38)[b]
Quit smoker	0.79 (0.44, 1.43)	1.14 (0.59, 2.21)	1.16 (0.65, 2.05)
Non-smoker	1.0	1.0	1.0
Country of Birth			
Outside Canada	1.50 (1.04, 2.19)[b]	–	–
Canada	1.0		
Education			
Less than high school diploma	2.01 (1.38, 2.93)[b]	2.19 (1.47, 3.26)[b]	–
High school diploma or greater	1.0	1.0	

[a] Only women who had initiated some breastfeeding were asked about continuing breastfeeding (N = 674). [b] The regression coefficient for this predictor is significant in the model ($p < .05$, based on Wald statistic). – Predictors not retained in the backward stepwise logistic model.

Results indicate that less education is associated with bottlefeeding initiation and breastfeeding cessation prior to 12 weeks (OR 2.64, 95% CI: 1.07, 6.49; OR 4.29, 95% CI: 1.75,10.6, respectively). However, the variable "women's quit attempts" was not found to be a significant predictor of infant-nutrition choices.

As discussed above, 18 women (2.3%) who had not smoked at all during pregnancy but resumed smoking after the birth were omitted from the main analysis. In a separate analysis (not shown here) these women were found to be most similar to the current smokers. Including these women with the current smokers group neither altered the set of predictors entering any of the three models nor significantly changed the computed odds ratios.

Discussion

Consistent with other studies, results indicate a strong relationship between maternal smoking status and infant nutrition. Smoking was the only factor associated with all three outcomes: initial choice of bottle- over breastfeeding, early discontinuation of breastfeeding, and early introduction of solids. While smoking is a proxy for other personal and situational factors (Stewart et al., 1996), smoking emerged as an independent predictor when other sociodemographic variables were controlled for in the analysis. Examining three smoking status groups in our analyses allowed us to identify current smokers rather than quitters as the subgroup most in need of early interventions targeting infant nutrition.

There were some notable differences in the sociodemographic predictors retained in each model. Only age was retained as a predictor of the introduction of solids, whereas level of education was the only predictor of early breastfeeding cessation. However, bottlefeeding initiation at birth was predicted by three sociodemographic factors: marital status, level of education, and whether immigrant or Canadian-born. These differences in sociodemographic predictors may reflect varying mechanisms of influence between each of the predictors and the infant-nutrition outcomes. For example, immigrants have been identified as less likely than non-immigrants to initiate breastfeeding (Baranowski, Bryan, Rassin, Harrison, & Henske, 1990; Bryant, 1989; Greene-Finestone, Feldman, Heick, & Luke, 1989; Jacobson, Jacobson, & Frye, 1991), but a similar relationship with the early introduction of solid foods has not been reported.

The study had several limitations. First, interviews were conducted at 3 months postpartum, providing retrospective data for predictor variables and for one of the feeding outcomes (bottlefeeding at birth). With the exception of marital status and family income, all of the sociodemographic predictor variables would have been stable for the initial 3 months postpartum. Thus it is unlikely that bias was introduced by changes in sociodemographic predictor variables for that 3-month period. However, the retrospective nature of data collection does not allow us to confirm the temporal relationship between smoking status and outcome variables. For example, we do not know with certainty whether smoking relapse postpartum preceded or succeeded breastfeeding cessation. Nor do we have data on the time lapse between smoking relapse and change in infant-nutrition practices. Therefore we cannot establish causal links between smoking status and feeding choices.

Second, approximately one third of the women enrolled in this study were randomized to receive a telephone visit consisting of an assessment and a brief educational intervention. While the decision to initiate breastfeeding took place prior to the visit, the decision to stop breastfeeding early or to introduce solids may have been influenced by the visit. However, prior analysis (Edwards & Sims-Jones, 1997) indicates no clinically or statistically significant differences in infant-care practices between women who did and did not receive telephone visits, thus suggesting the absence of a cointervention bias.

Third, self-report data were used for all variables. Other authors (Margolis, Keyes, Greenberg, Bauman, & La Vange, 1997; Nafstad et al., 1996) have cited a tendency for pregnant and postpartum women to under-report smoking. No biochemical testing was used in this study. Therefore we are unable to determine what proportion of women were misclassified as quit smokers when they should have been in the current-smokers group. Similarly, there may have been some underreporting of the use of solid food and the introduction of bottlefeeding by women knowledgeable about infant-feeding recommendations. This effect may have been mitigated somewhat by having the interview take place at 3 months postpartum rather than closer to the time of birth. Furthermore, several authors have documented a high level of accuracy of self-reports for infant-feeding practices (Launer et al., 1992; Quandt, 1987).

Finally, women enrolled in the study were lower-risk primiparas as reflected in the sociodemographic profile of the sample. We compared the characteristics of our sample with a cohort of primiparas recruited

from hospitals in our region in 1994 (Stewart et al., 1994). Women in our study were older and more educated. However, both samples were nearly identical with respect to immigration and marital status. The impact of socio-economic status and age on smoking and infant-feeding decisions needs to be better understood before results can be generalized with confidence to higher-risk women.

Several implications for targeting and delivering postpartum follow-up services result from this study. Smoking status is a strong predictor of infant-feeding choices immediately following delivery and within the first few months postpartum. Therefore relevant questions about a woman's smoking history should be asked to guide decision-making about the allocation of follow-up services. In the early postpartum period, examples of such questions include: "Did you quit smoking during your pregnancy? If yes, are you currently smoking or are you planning to start smoking again?"

In this study, only current smoking was a significant predictor of the three feeding outcomes. Women who had quit during pregnancy and were not smoking at 3 months postpartum were not significantly different from non-smokers with respect to the three feeding practices. Findings support the inclusion of smoking-related interventions as a core component of all infant-nutrition programs. Given the two models underlying the relationship between smoking and feeding practices, two types of interventions are required. First, mothers who are smoking when they initiate breastfeeding or who resume smoking while breastfeeding require guidance on minimizing infant exposure to ingested nicotine and ensuring adequate levels of lactation. Second, women whose breastfeeding termination demarcates a return to smoking require early intervention to reduce the risk of smoking relapse. Such interventions include encouraging women to consider quitting smoking not just for the sake of the baby but also for themselves, and preparing women to handle risky situations that may lead them to smoke (Edwards, Sims-Jones, Hotz, & Cushman, 1997; Hotz, Edwards, Sims-Jones, & Cushman, 1996).

Overall, findings are consistent with both the biological and psychological models explaining the relationship between maternal smoking and infant-feeding status. However, as with other research involving secondary analyses of data sets, the original study was not designed with the primary purpose of examining relationships between maternal smoking and infant feeding. Thus the present analysis was limited to an examination of predictors assessed in the original study. Potential confounding factors include the mother's reasons for quitting

smoking; the timing of her intention to resume smoking; her partner's smoking status; the support of her family and friends for her smoking choices during pregnancy and postpartum; and her plans to return to work (Beaudry & Dufour, 1991; McBride & Pirie, 1990; Mullen, Richardson, Quinn, & Ershoff, 1997; Pollack & Mullen, 1997; Sims-Jones et al., 1997). Since factors such as social influences and employment status affect both breastfeeding practices and smoking decisions, future research should investigate potential interactions among these variables. A prospective longitudinal study assessing this expanded set of predictors during pregnancy and postpartum would not only help to validate explanatory models, but would also assist in the refinement of assessment guidelines and the development of stage-matched interventions.

In conclusion, this study supports the relationship between a mother's smoking status and her infant-feeding practices. Findings indicate that irrespective of a mother's quit attempts during pregnancy, smoking during the postpartum period is a predictor of sub-optimal feeding practices. Early interventions are required to target both the prevention of smoking relapse among women who quit smoking during pregnancy and the promotion of breastfeeding initiation and continuation among smokers.

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