Health-Related Behavior and Beliefs of Pregnant Smokers

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To determine the association of smoking with other health-compromising behavior and beliefs during pregnancy, a cross-sectional survey of 1,203 women in the United Kingdom assessed smoking status, stage of change, fetal health locus of control, alcohol consumption, folic acid intake, and use of vitamin and iron supplements. Twenty percent were current smokers, and 33% were alcohol users. Pregnant smokers (especially those in the precontemplative stage) were less likely to increase folic acid intake, less likely to take vitamin and iron supplements, and less likely to feel personally responsible for the health of the fetus. Infants of smokers may be placed at an intrauterine disadvantage, not only in terms of smoking, but also in terms of nutrition.

Key words: smoking, pregnant women, stage of change, fetal health locus of control, folic acid, vitamin and iron supplements

Epidemiological studies have demonstrated negative health outcomes associated with maternal smoking, such as low birth weight, premature birth, fetal and infant mortality, and adverse effects on development (Brooke, Anderson, Bland, Peacock, & Stewart, 1989; Castles, Adams, Melvin, Kelsch, & Boulton, 1999; Gilliland, Li, & Peters, 2001; Kleinman, Pierre, Madans, Land, & Schramm, 1988; Kolas, Nakling, & Salvesen, 2000; Malloy, Kleinman, Land, & Schramm, 1988; Tuthill, Stewart, Coles, Andrews, & Cartlidge, 1999). Although a United Kingdom study has suggested that the effects on birth weight and cognitive function may be resolved in later childhood (MacArthur, Knox, & Lancashire, 2001), the overwhelming weight of evidence leads to the conclusion that maternal smoking is linked with infant death and childhood health problems.

Maternal smoking is associated with low socioeconomic status (SES), low educational attainment, and having a partner who smokes (Ebrahim, Floyd, Merritt, Decoufle, & Holtzman, 2000; Haslam, 1999; Haslam & Draper, 2000; Haslam, Draper, & Goyder, 1997; Wakefield, Gillies, Graham, Madeley, & Symonds, 1993). In addition to socioeconomic variables, it is important to assess health beliefs, because psychological factors are potentially easier to influence than socioeconomic factors (Smith, 1970).

Prochaska and DiClemente’s (1982) stages of change model states that people abandoning health-compromising behavior progress through a series of stages. Prochaska, Norcross, and DiClemente (1994) argued that stage determines receptiveness to different forms of health education. Precontemplative individuals are more influenced by graphic health information, whereas practical advice is more appropriate for those in later stages. Haslam and Draper (2000) found that women further along the cycle of change were more convinced about the dangers of smoking during pregnancy. Haslam (2000) has argued that antenatal smoking cessation interventions need to be tailored to the pregnant woman’s stage of change.

An important concept relating to health beliefs is that of locus of control, and Labs and Wurtele (1986) developed the Fetal Health Locus of Control (FHLC) Scale, which measures the extent to which pregnant women feel personally responsible for the health of their unborn baby. High Internal subscale scores are associated with greater lifestyle changes and positive health behaviors during pregnancy (Bielawska-Batorowicz, 1993; Spirito, Ruggiero, McGarvey, Coustan, & Graff Low, 1990; Walker, Cooney, & Riggs, 1999), and pregnant smokers are less likely to score highly on the Internal subscale than nonsmokers (Stewart & Streiner, 1995).

This study assessed pregnant women’s smoking status; smoking stage of change; FHLC; alcohol consumption; folic intake, important in reducing the risk of neural tube defects (Medical Research Council Study Group, 1991; Werler, Shapiro, & Mitchell, 1993); and use of vitamin and iron supplements. Our hypothesis was that maternal smoking would be associated with other health-compromising behavior and health beliefs during pregnancy.

Method

Participants

The questionnaire was administered to 1,203 consecutive women attending antenatal clinics in three hospitals in the United Kingdom (Leicester.
Royal Infirmary, National Health Service Trust; Princess Anne Hospital in Southampton; and Salisbury District Hospital) over a 3-month period. Respondents completed and returned the questionnaire in the clinic waiting area. Refusal rates in each hospital were very low, less than 1%, because clinic staff incorporated the questionnaire into other paperwork that respondents completed during their antenatal visit.

**Measures**

This cross-sectional survey used a structured, self-completion questionnaire that assessed SES, smoking status/smoking stage of change, alcohol use, folic acid (supplements and/or increased dietary intake), and vitamin and iron supplement use. The questionnaire contained nine items from the FHLC Scale (Labs & Wurtele, 1986), consisting of three items from each of the Internal, Chance, and Powerful Other subscales. These items were selected on the basis of whether they related to the focus of the study and whether they had high internal reliability scores relative to other items in the subscale. The nine selected items contained statements (e.g., “My unborn child’s health can be seriously affected by my dietary intake during pregnancy”), to which respondents could answer strongly agree, agree, don’t know, disagree, or strongly disagree. The full questionnaire was extensively piloted and refined in the light of pilot studies.

Those who answered “yes” to the question “Do you smoke now?” were classified as current smokers. Ex-smokers were asked, “How long since you gave up smoking?” and ascribed to the action stage if they had quit less than 6 months ago or the maintenance stage if they had quit more than 6 months ago. Six months is the widely accepted cutoff point between action and maintenance used in other studies. Current smokers were asked, “Are you intending to give up smoking in the next month?” and those who answered “yes” were ascribed to the preparation stage. Current smokers were also asked, “Are you intending to give up smoking in the next six months?”, and those who answered “yes” were categorized into the contemplation stage. Current smokers who answered “no” to both of these questions were allocated to the precontemplation stage. These questions have been used by other researchers to assign respondents to their smoking stage of change.

On the basis of the women’s responses to questions about occupation, women and their partners were ascribed to social class groups (Office of Population Censuses and Surveys, 1991). Each family was allocated a social class on the basis of the highest SES of the woman or her partner.

The study was approved by the local National Health Service research ethics committees.

**Analysis Strategy**

Research investigating relationships between smoking in pregnancy, FHLC, folic, and supplement intake is lacking, and this influenced the power calculation. Recruiting a large sample and assuming a small effect size should ensure the study had sufficient power (Cohen, 1992). In retrospect, large effect sizes were found (10%–20% differences on most outcome measures), so the sample provided power of over .99. It was therefore considered appropriate to accept a significance level of α = .05, despite carrying out multiple comparisons.

The data were analyzed using the Statistical Package for Social Scientists (SPSS; Norsis, 1983) to generate descriptive statistics and to examine associations between variables. The hypotheses were that positive health-related behavior would be related to other positive health-related behavior, and a similar pattern would emerge for negative health-related behavior. Thus the data analysis strategy was to carry out chi-square analyses and analyses of variance to look at differences between groups defined by smoking status and also by demographic factors (grouped where appropriate) to examine possible confounding factors.

**Results**

The questionnaire was completed by 1,203 pregnant women with an age range of 15 to 44 years (M = 28 years). Gestation ranged from 6 to 41 weeks (M = 22 weeks). Thirty-two percent of the women were in the 1st trimester, 26% in the 2nd trimester, and 42% in the 3rd trimester. Table 1 shows the socioeconomic profile of the sample.

Low levels of alcohol use were reported, with 67% stating that they consumed no alcohol, 14% consuming around 1 unit per week, 16% consuming 2 to 5 units, and 3% consuming over 5 units. The maximum number of units consumed per week was 12. Of the women in their 1st trimester, 27% were drinking alcohol compared with 35% in the 2nd and 34% in the 3rd trimester. Twenty percent were current smokers, 33% were ex-smokers, and 47% were never smokers. Of those in their 1st trimester, 20% were current smokers; the comparable figures for Trimesters 2 and 3 were 19% and 18%. Fourteen percent of the sample reported that they had quit smoking for their current pregnancy. Of the current smokers, 44% were precontemplative, 15% were in the contemplation stage, and 41% were in the preparation stage.

Current smokers were more likely to be unmarried, be living with a smoker, be of lower SES, have high external FHLC scores, and have finished education by 16 years of age. They were less likely to have increased folic acid intake or to be taking iron and vitamin supplements (Table 2) or to believe that increased folic acid is important for babies’ development, χ²(1, N = 1,185) = 3.43, p = .03.

Analysis to determine differences within the smoking population on the basis of number of cigarettes smoked per day was not significant for any variable. The distribution of smoking intensity is shown in Figure 1. Examination of the data across trimesters revealed only one significant difference, in that women were more likely to be taking iron and vitamin supplements in the 3rd trimester (55%) than in the 1st (29%) or 2nd (33%) trimesters, χ²(2, N = 1,190) = 70.56, p < .001.

**Stage of Change in Relation to Smoking**

Precontemplators were more likely to have finished education early, χ²(8, N = 582) = 64.95, p < .001; have no formal quali-
Table 2

Differences Between Smokers and Nonsmokers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Smokers (%)</th>
<th>Nonsmokers (%)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>35**</td>
<td>67</td>
<td>1,196</td>
</tr>
<tr>
<td>Living with a smoker</td>
<td>79**</td>
<td>29</td>
<td>1,196</td>
</tr>
<tr>
<td>Lower SES (4 and 5)</td>
<td>45**</td>
<td>16</td>
<td>1,187</td>
</tr>
<tr>
<td>Primarily external FHLC</td>
<td>49*</td>
<td>33</td>
<td>1,166</td>
</tr>
<tr>
<td>Educated &lt; 16 years</td>
<td>73**</td>
<td>38</td>
<td>1,194</td>
</tr>
<tr>
<td>Increased folic acid</td>
<td>71**</td>
<td>89</td>
<td>1,185</td>
</tr>
<tr>
<td>Taking iron and vitamin supplements</td>
<td>33*</td>
<td>44</td>
<td>1,186</td>
</tr>
</tbody>
</table>

Note. SES = socioeconomic status; FHLC = fetal health locus of control.

*p < .05. **p < .001.

Analysis of covariance was carried out to further examine differences between current smokers and nonsmokers on their internal FHLC scores. Variables that proved significant in the chi-square analyses were entered as covariates. The analysis of covariance showed that after accounting for these possible confounding variables, current smokers and nonsmokers still differed significantly on their internal FHLC scores, $F(1, 1132) = 5.93, p = .01$, and the only significant covariate was years of education, $F(1, 1132) = 3.72, p = .05$.

Figure 2 shows the mean total internal FHLC scores across the stages of change and demonstrates an overall trend toward an increase in mean internal scores. A one-way analysis of variance revealed that the differences were significant, $F(5, 1176) = 2.40, p = .03$, suggesting that women further along the cycle of change have higher internal FHLC scores.

Discussion

The results of this survey of over 1,200 pregnant women indicate that 20% were current smokers and almost half of these were in the precontemplative stage. Current smokers were less likely to participate in positive antenatal behavior (increasing folic acid intake, taking vitamin and iron supplements). So, in addition to the health-compromising effects of smoking, the babies of pregnant smokers may be placed at a further disadvantage in utero. Current smokers were less likely to increase their folic acid intake (important in preventing neural tube defects) and less likely to believe that folic acid is important for fetal development. Pregnant smokers in this study were also less likely to be taking iron and vitamin supplements.

The current position is that iron and vitamin supplementation should only be recommended in cases of low hemoglobin or serum iron. There is clear evidence indicating that pregnant smokers are deficient in iron. Piasek, Blanusa, Kostial, and Laskey (2001) and Paszkowski and Sikorski (1994) found that term placentas of smokers have lower levels of iron compared with those of nonsmokers. Studies of the nutrient intake of pregnant women found that smokers’ diets contained significantly less thiamin, riboflavin, vitamin C, carotinoids, and iron than nonsmokers’ diets (Mathews,
Yudkin, Smith, & Neil, 2000; Trygg et al., 1995). A study of over 15,000 births suggested that regular use of vitamins and minerals may reduce the risk of fetal death associated with smoking (Wu, Buck, & Mendola, 1998). Because pregnant smokers have poorer diets during pregnancy, vitamin and iron supplementation is especially important in this group.

The finding that pregnant smokers were less likely to increase folic acid, vitamin, and iron intake suggests that babies born of mothers who smoke during pregnancy experience a relatively impoverished environment in utero. Moreover, these infants are likely to be exposed to household tobacco, which is associated with sudden infant death syndrome (Blair et al., 1996; Wisborg, Kesmodel, Henriksen, Olsen, & Secher, 2000) and health problems during infancy and childhood such as respiratory tract infections, asthma, impaired lung function, and persistent middle ear effusion (Black, 1984; Fergusson & Horwood, 1985; Gilliland et al., 2000; Martinez, Cline, & Burrows, 1992). We therefore argue that maternal smoking may represent a downward spiral of impoverished environments for infants and children.

Haslam and Draper (2000) demonstrated that pregnant women further along the cycle of change are more convinced about the health risks of smoking during pregnancy. In line with that finding, in the present study, women further along the cycle of change tended to have higher Internal FHLC scores. Additionally, it was found that precontemplative smokers were less likely to increase their folic acid, vitamin, and iron intake during pregnancy and had higher External FHLC scores. Thus, women in the first stage of change are most resistant to engaging in positive health behavior during pregnancy and less likely to feel personal responsibility for the health of their unborn infant. We suggest that interventions need to target the beliefs and behavior of precontemplative smokers and their partners.

This study found low levels of alcohol consumption. Although a third consumed alcohol, half of those limited their consumption to one unit per week. Even lower levels of alcohol consumption (only 5% consuming alcohol) were reported in a U.S. study of over 7,000 pregnant women (Pirie, Lando, Curry, McBride, & Grothaus, 2000). Women seem to accept that drinking alcohol can be hazardous to fetal development, and they modify their behavior accordingly. The health-promotion messages regarding smoking are apparently less well acted on.

Smoking during pregnancy is an important and avoidable cause of fetal and infant mortality and morbidity. This study has shown that pregnant smokers (particularly precontemplators) are less likely to increase folic acid, vitamin, and iron intake during pregnancy. Hence, babies born of women who smoke experience not only exposure to tobacco but may also be placed at a nutritional disadvantage. This impoverished environment in utero coupled with the impact of household tobacco exposure in childhood may well account for the observed fetal and infant mortality and childhood morbidity rates associated with parental smoking.

Implications for Future Research and Practice

This survey was cross-sectional, and future longitudinal study is likely to further elucidate the relationship between smoking, other health-related behavior, and beliefs as well as revealing changes in behavior. Longitudinal work might also address whether cutoff points for stages of change should be modified to reflect the time-limited nature of pregnancy. A high priority for research
should be the development of effective antenatal smoking cessation materials and motivational counseling techniques to equip health workers with the tools to reduce maternal smoking. Such interventions will need to inform women, encourage them to consider their health beliefs, and target them according to the recipient’s readiness to change (Haslam, 2000). The results of this study also highlight the need to advise smokers (especially pre-contemplators) about adequate nutrition in pregnancy as well as encouraging them to stop smoking.

**Limitations**

Although this study covered hospitals in the south of England and the Midlands, United Kingdom, no claims for a representative sample are made. Smoking was assessed by self-report, and future investigations could usefully use biochemical verification of smoking status. It is acknowledged that other factors (not covered in this study) are also important in continuing maternal smoking, such as social support and duration of previous smoking.

**Conclusion**

This survey, based on a large sample drawn from three different areas in the United Kingdom, shows that pregnant smokers (particularly those in the precontemplative stage) are less likely to engage in important health-related behavior during pregnancy and less likely to feel responsible for the health of their infant. This suggests that the infants of pregnant smokers may be placed at a nutritional disadvantage in utero. Hence, pregnant smokers need to be better informed about the dangers of smoking and given advice on nutrition during pregnancy.

**References**


