Periconceptional smoking: an exploratory study of determinants of change in smoking behavior among women in the fertile age range

F. W. Siero¹,5, M. T. van Diem², R. Voorrips³ and M. C. Willemsen⁴

Abstract

How can women who are not yet pregnant be motivated to stop smoking before they become pregnant? Epidemiological studies have suggested that periconceptional smoking and smoking during the first trimester of the pregnancy may lead to congenital abnormalities. To motivate women to stop smoking before pregnancy, more insight is needed into the differences between ‘smoking’ women who want to have children and those who do not.

A sample of 931 women (65% response rate) aged 15–45 years returned a questionnaire with questions about their smoking behavior, wish to have children, risk perceptions, attitude to smoking, personal efficacy and stage of readiness to change. In spite of some positive outcomes (e.g. negative attitude to smoking, relatively high risk perceptions of the relationship between congenital anomalies and smoking), one cannot automatically assume that these women will stop smoking before they get pregnant. (1) Beliefs, attitude and readiness to change were not well integrated and grounded cognitively. (2) Women who smoked were pessimistic about their ability to quit. Future campaigns need to ‘invite’ women to associate and to integrate risk information about the relationship between smoking and congenital abnormalities with other cognitions (attitude, intention). It is also important to instruct women in how to stop smoking and to remain non-smokers.

Introduction

In the Netherlands, the total prevalence of smoking among women is 40% (Smit and Kromhout, 1998). Cigarette smoking during pregnancy is harmful for the baby. Despite this, about 74% of smoking women continue to smoke during pregnancy (Verkerk and van Noord-Zaadstra, 1991). About 33% of these pregnant smokers have a low educational level and 22% have a high educational background (Statistics Netherlands, 2001).

Apart from general health risks such as cancer and coronary heart disease, cigarette smoking during pregnancy increases the risk of specific complications such as spontaneous abortion, ectopic pregnancy, premature birth, low birth weight, and, in early life, leads to a higher incidence of broncho-pulmonary disease and cot death (Fredricsson and Gilljam, 1992; Werler, 1997). Smoking during pregnancy may also be related to disorders in the psychological development of the child such as behavioral disorders, hyperactivity and depression (Wakschlag et al., 1997).

The causal relation between smoking and congenital malformations remains unclear (CDC/National Center For Chronic Disease Prevention and Health Promotion, 2002). Several epidemiological
studies, however, do suggest a relationship between smoking and a number of structural congenital abnormalities, such as oral clefts (Khoury et al., 1989; Kallen, 1997; Wyszynski et al., 1997; Chung et al., 2000), deformities of the foot (Alderman et al., 1991; Reefhuis et al., 1998; Honein et al., 2000), craniosinostosis (Alderman et al., 1994; Kallen, 1999; Honein and Rasmussen, 2000), renal abnormalities (Li et al., 1996), limb reduction defects (Kallen, 1997; Reefhuis et al., 1998) and cardiovascular defects (Kallen, 1999). The majority of these congenital anomalies originate early in the first trimester of pregnancy. In this period, women are not yet aware that they are pregnant. Most women who quit smoking during pregnancy out of concern for the health of their baby do so around the third month of pregnancy. Therefore, in view of the general negative effects of smoking on fetal health, and although the causal relation between smoking and congenital anomalies is unclear, it seems appropriate to motivate women to stop smoking before they get pregnant rather than when they are already pregnant. Most women who quit smoking during pregnancy out of concern for the health of their baby do so around the third month of pregnancy. Therefore, in view of the general negative effects of smoking on fetal health, and although the causal relation between smoking and congenital anomalies is unclear, it seems appropriate to motivate women to stop smoking before they get pregnant rather than when they are already pregnant. To motivate women to stop smoking before pregnancy, more insight is needed into the differences between smoking and non-smoking women. In addition, within these groups, the differences between those who want to have children and those who do not need further exploration. Do they differ in their views of the consequences of smoking before and during pregnancy? Do they have different views of the maternal and fetal health risks? Information about these differences can lead to a fuller understanding of the determinants that lead to a change in smoking behavior in women who want to become pregnant.

To our knowledge, no studies exist that specifically focus on non-pregnant women who want to have children in the near or distant future. There is, however, a substantial number of studies dealing with the determinants of smoking behavior during pregnancy, described in Ajzen’s Theory of Planned Behavior [beliefs, attitude, social norms, perceived efficacy, intention to change behavior (Ajzen, 1991, 2000)] and in the Transtheoretical Stages of Change model (Prochaska et al., 1992). These studies (Haug et al., 1994; Appleton and Pharoah, 1998; McBride et al., 1998; Bennett and Clatworthy, 1999; Bakker, 2002) demonstrate that the smoking behavior of people who are in close contact with the person (e.g. her partner) is an important determinant of smoking behavior during pregnancy. These studies also indicate that, among pregnant women, the health risks of smoking during pregnancy are either not sufficiently known or not taken sufficiently into account. In addition, pregnant as well as non-pregnant women equally lack the intention to stop smoking despite the consequences of smoking for themselves and their babies [e.g. (Hutchison et al., 1996; Ruggiero et al., 2000)]. Finally, Godin et al. (Godin et al., 1992) reported in a study conducted among smoking and non-smoking pregnant women that intentions and behavior are mainly predicted by perceived control.

The Transtheoretical Stages of Change model (Prochaska et al., 1992) postulates behavioral change as a process in which people move from one stage of readiness to change to another. Although the number of stages varies, six stages are usually distinguished [e.g. (Dijkstra et al., 1998)] and defined as follows: ‘immotives’ are smokers who have no intention to stop smoking within the next 5 years, ‘precontemplators’ intend to stop smoking within the next 5 years, but not within 6 months, ‘contemplators’ are planning to stop smoking within the next 6 months, but not within the next month, ‘preparers’ are planning to stop smoking within the next month, ‘actors’ stopped smoking within the last 6 months and ‘maintainers’ stopped smoking more than 6 months ago.

Although much criticized (Etter and Sutton, 2002), the Prochaska model has been used extensively in studies of smoking and pregnancy. In these studies (Crittenden et al., 1994; De Vries and Backbier, 1994; Bane et al., 1999), the determinants of behavioral change [Theory of Planned Behavior (Ajzen 1991, 2000)] and the stages of change of the Prochaska model were combined, resulting in interventions tailored to the subject’s stage of behavioral change. Bane et al. (Bane et al., 1999), for example, demonstrate that pregnant women in the ‘precontemplation’, ‘contemplation’ and ‘preparation’ stages are more
sensitive to pregnancy-related advantages than those in the ‘action’ and ‘maintenance’ stages (e.g. ‘it is too hard for me to quit while pregnant’). Also, a negative social norm was considered less important by women in the ‘precontemplation’ phase than by those in the following stages of readiness to change. In this study, we did not apply a tailored intervention, but used stage of change as a dependent variable on the basis of the Prochaska model, i.e. to conceive behavioral change as a process in which people move from one stage of readiness to change to another.

From studies using interventions based on the Prochaska model, as well as those based on other theories (Haug et al., 1994; Solomon et al., 1996; McBride et al., 1999; Hajek et al., 2001; Bakker, 2002) and from a meta-analysis (Walsh and Redman, 1993), it is clear that influencing smoking behavior with the goal of causing people to stop smoking permanently is extremely complicated, even among pregnant women. There are indications, however, that interventions to change smoking behavior during the first trimester of pregnancy are more successful (Hutchison et al., 1996; Solomon et al., 1996).

In this study, we addressed the question of how women who are not yet pregnant can be motivated to stop smoking before they become pregnant. In view of the negative effects of smoking in relation to pregnancy, one would expect the majority of women to stop smoking before or during pregnancy. Pregnancy is a period in which important changes in life take place and in which women are likely to be more susceptible to lifestyle changes aimed at benefiting their children. However, the high rate of smoking among pregnant women and the results of the above-mentioned studies illustrate the complexity of the problem and the modest effectiveness of smoking cessation programmes. On the one hand, it is conceivable that women are not aware of a likely relationship between smoking and congenital abnormalities or other disorders. Giving information about these serious outcomes may be sufficient reason for women to stop smoking (at least temporarily). On the other hand, there are a number of aspects of changing periconceptional smoking behavior which make a successful intervention difficult to realize. First, for most women, especially if they have never been pregnant, pregnancy is an experience that is difficult to imagine and something in the distant future. Therefore, the negative effects of smoking on the baby are possibly not salient and probably underestimated [cf. (Trope and Liberman, 2000)]. Second, distant future outcomes are generally subject to a process of discounting. This means that the further removed in time the negative pregnancy outcome is, the less likely women will find the probability of a negative pregnancy outcome (Shelley, 1994). This type of problem may cause women who are not pregnant to underestimate the health risks of smoking for themselves and their babies even more than women who are already pregnant. In this study, we explored the differences in the core variables from Ajzen’s Theory of Planned Behavior in women in the fertile age range, distinguished by smoking status and by their wish to get pregnant or not. We also explored these core differences between women in different stages of readiness to change.

Method

Participants and procedure

Recruiting of respondents was judged and accepted by the Psychological Ethical Commission of the Department of Psychology of the University of Groningen.

Between September 1999 and April 2001, a sample of 1448 women between the ages of 15 and 45 years received a questionnaire that could be returned in a prepaid envelope. They were recruited in several ways: (1) GPs were asked to send a letter to all women in the fertile age range in their practice informing them about the research project. Respondents were also recruited by telephone by one of the researchers (R. V.). (2) Women visiting local supermarkets were asked to participate in the study (R. V.). (3) The midwives of five independent midwives’ practices asked women in the first trimester of pregnancy to participate in the research.
project. (4) Specialists of the fertility clinic in
the outpatient department of the local University
Hospital asked women under their care to partici-
pate. Reminders were not sent nor were women
again approached by telephone. GPs, midwives and
supermarkets were selected throughout the northern
region of The Netherlands, using zip code and mean
income as an indicator of socioeconomic status
(SES). The aim was to select subregions with an
over-representation of respondents with a low SES,
because smoking is a major problem in these groups.

**Questionnaire**

**Demographic variables**
The respondents were asked questions about their
age, highest formal education, income and house-
hold characteristics.

**Smoking status**
By asking whether the respondent smoked (yes, no)
and about her individual smoking history (did you
ever smoke? yes, no), a smoking status indicator
consisting of three categories (never, former, cur-
ten) was formed.

**Status wish to have children**
Respondents were classified in one of three groups.
Group A (no wish) consisted of women who did not
want to get pregnant (anymore) and women who
could not get pregnant (anymore) because of medical
reasons. Group B (wish) consisted of women who
indicated that they might want to get pregnant
(again) in the future and of women who were actually
trying to become pregnant. Group C (pregnant)
consisted of women who were pregnant.

**Expectancy outcomes (beliefs)**
To assess the beliefs about the effects of peri-
conceptual smoking, the following eight items
[seven-point scale from (1) very unlikely to (7) very
likely] were used: smoking in this period increases
the risk of a child with a clubfoot, a child with an
oral cleft, a miscarriage, a low birth weight child
and cot death. Similar beliefs were assessed using
questions on fetal nicotine concentration being
higher than maternal nicotine concentrations, res-
iduals of cigarette smoke influencing the develop-
ment of the baby for more than 1 month after
maternal smoking cessation and broncho-pulmo-

nary disorders such as asthma or bronchitis being
more common in children of smoking parents. On
the basis of a principal component analysis these
eight beliefs were reduced to two varimax-rotated
factors: *congenital abnormality beliefs* (clubfoot,
oral clefts, miscarriage) and *other abnormality
beliefs* (low birth weight, cot death, nicotine con-
centrations of mother and baby, residues of smok-
ing, broncho-pulmonary disorders). Both factors
explained 54% of the variance in all items.

**Attitude**
Attitude towards smoking in the periconcepn-
tional period was measured using a composite of
five bipolar items (seven-point scale): bad–good,
unpleasant–pleasant, unwise–wise, unhealthy–
healthy, not understandable–understandable (Cron-
bach’s $\alpha = 0.80$).

**Personal efficacy**
Personal efficacy was measured as follows: ‘Imag-
ine that you want to become pregnant. You decide
to stop smoking in the period in which you are
trying to become pregnant and in the three months
after conception. Do you expect to be able to realize
that target?’ [seven-point scale from (1) very
unlikely to (7) very likely].

**Subjective norm**
Subjective norm was assessed by measuring
normative belief and motivation to comply with
the following significant others: partner, best friend,
GP and colleague. To assess normative belief, we
asked the respondents to rate the view of each
significant other about ‘smoking in the period in
which you try to become pregnant and in the 3
months after conception’ on an evaluative di-
mension [seven-point scale from (–3) bad to (+3)
good]. Motivation to comply was measured by
asking the respondents to rate their motivation
to comply, taking into account the view of the
significant other (‘To what extent do you take into
account the significant other’s opinion”) on a seven-point scale from (1) to a low extent to (7) to a high extent. A measure of subjective norm was computed by multiplying each normative belief and the corresponding motivation to comply, and summing the products over the four referents (Ajzen, 1991).

Stage of readiness to change

Stage of readiness to change was measured using seven questions on smoking behavior. The respondents were divided into one of six stages of intention to change. Respondents who smoked cigarettes and who had no intention to stop smoking were assigned to the ‘immotives’ stage. Respondents were assigned to the ‘precontemplation’ stage if they intended to stop smoking within a period of 6 months and 5 years; to the ‘contemplation’ stage if they intended to stop smoking within 6 months, but not within 1 month; and to the ‘preparation’ stage if they intended to stop smoking within 1 month. Respondents who reported that they had stopped smoking within the last 5 months were assigned to the ‘action’ stage. Respondents who reported that they had stopped longer than 6 months before the beginning of the study were assigned to the ‘maintenance’ stage. Because of the small numbers of respondents in the ‘contemplation’ stage and the ‘preparation’ stage, these stages were combined into the ‘contemplation/preparation’ stage.

Results

Characteristics of participants

The questionnaire was sent to 1448 women; 916 women (63%) completed and returned the questionnaire (sources: GPs, 624; supermarket, 220; midwives practices, 49; fertility clinic, 38 women). Eight women who did not comply with the age criterion were excluded from the analysis. Almost one-third of the participants were smokers (31%). As intended, participants with low and average educational levels were over-represented (73%). The distribution of the participants over smoking status, educational level and age is displayed in Table I.

<table>
<thead>
<tr>
<th>Smoking status</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Former</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th>Smoking</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Status of wish to get pregnant</th>
<th>Smoking</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>no wish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pregnant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evidently, education is negatively related to smoking status \(\chi^2 (4, N = 916) = 50.8, P < 0.001\). The percentage of smokers among women with low and average educational levels \(n = 241\); 84% of all smokers) was much higher than the percentage of smokers among those with a high educational level \(n = 47\); 16%). Differentiated by age category (15–19, 20–24, 25–29, 30–34, 35–39 and 40–45), the percentages of smokers were nearly uniformly distributed, 28 \(n = 16\), 33 \(n = 34\), 34 \(n = 58\), 31 \(n = 73\), 31 \(n = 58\) and 31% \(n = 50\), respectively.

Women who did not wish to get pregnant and women who wished to get pregnant were almost equally divided over the three smoking groups (Table I). Apparently, a woman’s wish to become pregnant in itself does not have any impact on her smoking behavior. Pregnant women show a deviant pattern: the data suggest that they smoked less and stopped more than the women who were not pregnant.

Smoking status groups and wish to become pregnant: differences

The first question concerned the differences in the dependent variables between the three smoking status groups, and between the women who wished and who did not wish to become pregnant. The means for smoking status, wish to become pregnant
and the combination of both are depicted in Tables II and III. The F-tests are summarized in Table IV. The eight beliefs were reduced to two factor-analytic (standardized) components (see Method)—congenital abnormality beliefs (clubfoot, oral clefts, and miscarriage) and other abnormality beliefs (low birth weight, cot death, nicotine concentrations of mother and baby, residues of smoking, bronchopulmonary disorders).

The three smoking status groups (never, former, current) differed strongly on all dependent variables ($P < 0.001$ for all variables), with the exception of the beliefs about congenital abnormalities, for which the means were different with $P < 0.034$. These $F$-tests are depicted in Table IV and the means in Table II. Compared to the women who never smoked, the smokers (‘current’) showed the following differences. They were less pessimistic about the risk of the negative effects of smoking on a child (for congenital abnormality beliefs: $M_{\text{Never}} = 0.10$ versus $M_{\text{Current}} = -0.08$; for the other abnormality beliefs: $M_{\text{Never}} = 0.15$ versus $M_{\text{Current}} = -0.27$), their personal efficacy towards smoking cessation was lower ($M_{\text{Never}} = 6.84$ versus $M_{\text{Current}} = 4.70$), the attitude towards periconceptional smoking was less negative ($M_{\text{Never}} = 1.19$ versus $M_{\text{Current}} = 2.07$) and they experienced less social pressure to stop smoking ($M_{\text{Never}} = -14.43$ versus $M_{\text{Current}} = -9.92$). The women who stopped smoking (‘former’) were situated between those who never smoked and the ‘current smokers’ in their answers.

Women who wished to get pregnant, those who did not wish to get pregnant and pregnant women differed strongly on the abnormality beliefs, personal efficacy, smoking attitude and social norms (see Table II). They did not differ significantly on the beliefs about other abnormalities. The $F$-tests are depicted in Table IV. Compared with the women who did not want to get pregnant and the pregnant

<table>
<thead>
<tr>
<th>Status of wish to get pregnant</th>
<th>Smoking</th>
<th>Beliefs (congenital abnormality)</th>
<th>Beliefs (other)</th>
<th>Personal efficacy</th>
<th>Smoking attitude</th>
<th>Social norm</th>
</tr>
</thead>
<tbody>
<tr>
<td>No wish</td>
<td>$M$</td>
<td>$-0.25^a$</td>
<td>$-0.07$</td>
<td>$5.99^a$</td>
<td>$1.58^a$</td>
<td>$-11.91^a$</td>
</tr>
<tr>
<td></td>
<td>$SD$</td>
<td>$0.97$</td>
<td>$1.00$</td>
<td>$1.81$</td>
<td>$0.89$</td>
<td>$5.90$</td>
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<td>381</td>
<td>388</td>
<td>356</td>
<td>379</td>
</tr>
<tr>
<td>Wish</td>
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<td>$0.24^{ab}$</td>
<td>$0.05$</td>
<td>$6.29^{ab}$</td>
<td>$1.43^{ab}$</td>
<td>$-13.64^{ab}$</td>
</tr>
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<td></td>
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<td>$0.98$</td>
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<td>$0.72$</td>
<td>$5.21$</td>
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<td></td>
<td>$n$</td>
<td>412</td>
<td>412</td>
<td>415</td>
<td>399</td>
<td>391</td>
</tr>
<tr>
<td>Pregnant</td>
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<td>$0.03^b$</td>
<td>$0.09$</td>
<td>$5.81^b$</td>
<td>$1.68^b$</td>
<td>$-11.91^b$</td>
</tr>
<tr>
<td></td>
<td>$SD$</td>
<td>$0.95$</td>
<td>$1.02$</td>
<td>$2.13$</td>
<td>$0.97$</td>
<td>$5.90$</td>
</tr>
<tr>
<td></td>
<td>$n$</td>
<td>98</td>
<td>98</td>
<td>98</td>
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<td>98</td>
</tr>
<tr>
<td>Never</td>
<td>$M$</td>
<td>$0.10$</td>
<td>$0.15$</td>
<td>$6.84$</td>
<td>$1.19$</td>
<td>$-14.43$</td>
</tr>
<tr>
<td></td>
<td>$SD$</td>
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<td>$0.85$</td>
<td>$0.82$</td>
<td>$0.47$</td>
<td>$4.66$</td>
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<td></td>
<td>$n$</td>
<td>340</td>
<td>340</td>
<td>345</td>
<td>334</td>
<td>326</td>
</tr>
<tr>
<td>Former</td>
<td>$M$</td>
<td>$-0.02$</td>
<td>$0.09$</td>
<td>$6.65$</td>
<td>$1.39$</td>
<td>$-13.58$</td>
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<tr>
<td></td>
<td>$SD$</td>
<td>$0.97$</td>
<td>$1.05$</td>
<td>$1.12$</td>
<td>$0.66$</td>
<td>$5.00$</td>
</tr>
<tr>
<td></td>
<td>$n$</td>
<td>268</td>
<td>268</td>
<td>272</td>
<td>253</td>
<td>265</td>
</tr>
<tr>
<td>Current</td>
<td>$M$</td>
<td>$-0.08$</td>
<td>$-0.27$</td>
<td>$4.70$</td>
<td>$2.07$</td>
<td>$-9.92$</td>
</tr>
<tr>
<td></td>
<td>$SD$</td>
<td>$1.02$</td>
<td>$1.06$</td>
<td>$2.14$</td>
<td>$1.03$</td>
<td>$6.15$</td>
</tr>
<tr>
<td></td>
<td>$n$</td>
<td>283</td>
<td>283</td>
<td>284</td>
<td>261</td>
<td>277</td>
</tr>
</tbody>
</table>

Range: outcome efficacy, smoking attitude: 1 to 7; social norms $-21$ to $+21$; beliefs (abnormality) and beliefs (other) are standardized variables.

For status of wish to get pregnant: means with an equal superscript differ by column at the $P < 0.05$ level.
women, those who did want to get pregnant were more pessimistic about the risk of negative effects on the child (for abnormality beliefs: $M_{Wish} = 0.24$ versus $M_{No wish} = −0.25$ and $M_{Pregnant} = 0.03$; for the other beliefs, the differences are not significant: $M_{Wish} = 0.05$, $M_{No wish} = −0.07$, $M_{Pregnant} = 0.09$), they perceived themselves as better able to stop smoking ($M_{Wish} = 6.29$ versus $M_{No wish} = 5.99$ and $M_{Pregnant} = 5.81$), the attitude towards periconceptional smoking was relatively more negative than that of those who were not planning to get pregnant.
(MWish = 1.43 versus MNo wish = 1.60 and MPregnant = 1.68) and they experienced more social pressure to stop smoking (MWish = −13.64 versus MNo wish = −11.91 and MPregnant = −11.91).

Are the differences between the three groups of women (women who wished to get pregnant, women who did not wish to get pregnant, and the pregnant women) the same for each of the three smoking groups? There are interactions for the congenital abnormality beliefs (marginally: P < 0.10), the beliefs about other abnormalities (P < 0.037), personal efficacy (P < 0.001), smoking attitude (P < 0.005) and social norm (P < 0.009).

The simple mean tests and means in Table III show that the contrast between women who wished to become pregnant and both other groups (women who did not wish to become pregnant and pregnant women) appeared particularly within the group of smokers. In this group especially, the women who wished to become pregnant showed, compared with both other groups, a more negative pattern of responses in favor of smoking. They were more pessimistic about congenital abnormalities as an effect of smoking, more optimistic about their ability to stop smoking, less positive about smoking and experiencing stronger social pressure. Strikingly, within the group of smokers, the pregnant women consistently showed a more positive pattern of responses in favor of smoking than the group of women who did not wish to get pregnant. They were very pessimistic about their ability to stop smoking, were relatively less negative about smoking and reported the least social pressure (see Table III).

Surprisingly, the negative beliefs of the smoking women who wanted to become pregnant were not reflected in their attitudes towards periconceptional smoking. A regression analysis on the data collected from all women revealed a modest relationship between attitude and beliefs. The beliefs explained 12% of the variance in attitude (see Table V). In particular, beliefs about miscarriage, a low birth weight, the effects of smoke residues on the development of the child and broncho-pulmonary disorders were related to smoking attitude. However, the attitude towards smoking did not seem to

<table>
<thead>
<tr>
<th>Beliefs about probability of consequences</th>
<th>β</th>
<th>t</th>
<th>P</th>
<th>RXY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of smoking detectable 1 month after cessation</td>
<td>−0.13</td>
<td>−3.7</td>
<td>0.005</td>
<td>−0.24</td>
</tr>
<tr>
<td>Miscarriage</td>
<td>−0.11</td>
<td>−2.9</td>
<td>0.004</td>
<td>−0.24</td>
</tr>
<tr>
<td>Higher incidence of broncho-pulmonary disease in children of smoking parents</td>
<td>−0.10</td>
<td>−2.8</td>
<td>0.005</td>
<td>−0.24</td>
</tr>
<tr>
<td>Low birth weight child</td>
<td>−0.12</td>
<td>−3.2</td>
<td>0.001</td>
<td>−0.23</td>
</tr>
<tr>
<td>Higher fetal than maternal nicotine levels</td>
<td>−0.05</td>
<td>−1.5</td>
<td>0.140</td>
<td>−0.19</td>
</tr>
<tr>
<td>Cot death</td>
<td>−0.01</td>
<td>−0.2</td>
<td>0.809</td>
<td>−0.16</td>
</tr>
<tr>
<td>Oral clefts</td>
<td>−0.01</td>
<td>−0.2</td>
<td>0.831</td>
<td>−0.15</td>
</tr>
<tr>
<td>Club foot</td>
<td>−0.06</td>
<td>−1.0</td>
<td>0.305</td>
<td>−0.15</td>
</tr>
</tbody>
</table>

R = 0.36; R² = 0.13; F(8, 844) = 15.8, P < 0.001.

be based on beliefs about congenital abnormalities as an effect of smoking. This is particularly important with respect to the smokers who wanted to become pregnant. They were more pessimistic about congenital abnormalities as an effect of smoking, but did not base their negative attitude on this category of beliefs.

### Stage of readiness to change

Interestingly, all variables except the beliefs about the congenital abnormalities were related to the stage of readiness to change. The means in Table VI show that the women in the ‘action’ group and the ‘maintenance’ group were more pessimistic about the risk of negative consequences for the child (other abnormality beliefs), were more negative about periconceptional smoking, perceived themselves as better able to stop smoking and experienced more social pressure to stop smoking. The differences between the five readiness-to-change groups show a linear trend: for beliefs about the other abnormalities, this is F(1, 535) = 7.5, P < 0.006, for personal efficacy F(1, 540) = 116.2, P < 0.001, for smoking attitude F(1, 497) = 42.0, P < 0.001 and for social norm F(1, 529) = 59.1, P < 0.001. For attitude and for personal efficacy the quadratic trend is also
significant: $F(1, 497) = 7.1, P < 0.008$ for attitude and $F(1, 540) = 4.6, P < 0.032$) for personal efficacy. Contrary to the linear pattern, the ‘contemplators/preparers’ (intention to stop within 6 and 1 month, respectively) were more positive towards smoking and more pessimistic about their ability to stop smoking. Actually, their responses correspond strongly to the responses of the respondents in the ‘immotive’ stage.

The stage of readiness to change is also strongly related to personal efficacy. A forward regression analysis (see Table VII) revealed that this variable has the most common and unique variance with stage of readiness to change. Despite the significant differences between the five readiness-to-change groups on other abnormality beliefs, attitude, personal efficacy and social norm, only personal efficacy explained a substantial portion of the variance in stages of readiness to change ($R^2_{\text{change}} = 0.20; \beta = 0.35$). Obviously, the univariate relationship between attitude and social norms, and stages of readiness to change is partly based on the
common variance of both variables with personal efficacy. Personal efficacy correlates 0.53 with attitude and −0.43 with social norm.

Discussion

In this study, we addressed the question of how women who are not yet pregnant can be motivated to stop smoking before becoming pregnant. To answer this question, we compared smokers who wished to get pregnant, who did not wish to get pregnant (anymore) and those in the first trimester of pregnancy. At first sight, our results appear to be positive and encouraging. All participating women had a negative attitude towards smoking. They believed that the risk of having a child with a congenital anomaly was higher when the mother smoked and they experienced greater pressure from persons in their social environment (especially from their partners) to stop smoking. The non-pregnant women also thought they would be able to stop smoking when they wanted to become pregnant.

Encouraging as all this may be, about 75% of the women continue to smoke during pregnancy. These women reported a very low personal efficacy (this study) and, in view of the rather slim positive results so far of smoking cessation programmes among pregnant women (Lumley et al., 2000), one cannot automatically assume that women will stop smoking before becoming pregnant.

Women who wish to become pregnant are more aware of the risks of smoking in the periconceptional period than those who do not want to get pregnant and those who are already pregnant. However, their attitude towards smoking and, to a lesser degree, their readiness to change smoking behavior appear to be ‘cognitively’ isolated—not connected to the beliefs about the consequences of smoking [weak versus strong attitudes (Jaccard et al., 1995). In fact, all the belief variables together only explain 12% of the variance in the attitude towards periconceptional smoking. The perceived risk of congenital abnormalities does not contribute at all to the variance in attitude, and only a weak relationship could be detected between attitude and some beliefs such as ‘influence of smoking detectable in maternal blood’, miscarriage, broncho-pulmonary disorders and low birth weight. Apparently, the perceived risks of smoking on fetal health do not automatically result in a negative attitude towards smoking. Also, the readiness to change behavior does not seem to be related to the perceived risks of smoking in early pregnancy. In fact, neither directly nor indirectly through attitude could a relationship be detected between readiness to change behavior and beliefs about smoking in the periconceptional period. Consequently, providing information on the risks of smoking on fetal health does not automatically result in changes in attitude and readiness to change behavior. In order to have a strong impact on attitude, intention and behavior, knowledge about the consequences of smoking in early pregnancy must first be sufficiently cognitively integrated with attitude and intention to stop smoking.

The addictive character of smoking makes achieving a change of behavior an extremely complicated matter. Despite the fundamental biological and emotional bond between a mother and her developing baby, many women continue to smoke in pregnancy (Windsor et al., 1998). Apparently, the fetal health risks do not outweigh the strength of the addiction. In this study, pregnant women who smoked showed a negative profile for smoking cessation on the three fundamental determinants (attitude, social norm and personal efficacy) of Ajzen’s change of behavior model. These scores on personal efficacy, in particular, were much lower compared to the scores of non-pregnant women who smoked. In the stepwise regression model (Table VII), it is demonstrated that self-efficacy is the only factor which predicts the stage of readiness to change. Therefore, to achieve a change in smoking behavior, emphasis should be on strengthening self-efficacy.

There are some possible weaknesses in this study. We aimed at and succeeded in recruiting women with low and medium educational levels (low SES). Consequently, the results of this study may not be applicable to women with a higher educational level. However, the smoking rate
among women with a lower educational level is much higher than among those with a higher education. Therefore, an intervention can be expected to be of greater benefit in the groups with a low educational level. Contrary to the intended over-representation of women with a low educational level, younger women (15–19 years) were unintentionally under-represented [6.2% in this study, 15% of women in the 15–45 years category in the general population (Statistics Netherlands, 2000). Clearly this group is extremely important because they are at the beginning of their reproductive lives. In this study, the percentage of smokers in this age category was 28%. Since national figures show a much higher percentage of smokers among young women, the women in our study are not representative of this age group in the general population. Another possible weakness in this study is the assessment of personal efficacy in non-smokers in particular. It is difficult for this group to contemplate a change of smoking behavior. This is a point of concern when smokers and non-smokers are compared. However, in this study we only compare the mean efficacy scores of pregnant and non-pregnant women who all smoked.

Smoking cessation campaigns are often unsuccessful in achieving a lasting result (Lumley et al., 2000). Until now there was little reason for optimism about the effects of a smoking cessation intervention in the category of smokers, consisting of women who wish to become pregnant in the near or distant future. However, in this study, we found some information specifically relevant to this group. A woman with the intention of becoming pregnant at some point in time not only does harm to her own health, but also harms her child’s health. It is difficult to understand that this knowledge does not effect her in some way and does not motivate her to reflect on her smoking behavior. In this study, this was demonstrated by the fact that the majority of women had a negative attitude towards smoking in the periconceptional period. This negative attitude, however, is no guarantee of a change in intention to change behavior. In the development of a smoking cessation intervention, emphasis should, therefore, be put on enhancing knowledge about the relationship between smoking and congenital abnormalities. In addition, knowledge must be combined with other elements such as enhancing self-control (how will I be able to do it) and support from the social environment (partner). The information will have to be offered in such a way that women will actively process and integrate the information, and, at a later stage, will be able to connect this with cognitive elements such as attitude and beliefs. Also, embedding this particular smoking problem in a much larger general health campaign may help to develop a consciousness among people that pregnancy, health and children are interconnected, and a healthy way of life in which there is no place for smoking. In view of our finding of a strong relationship between self-efficacy and readiness to change behavior, it is extremely important to show women how attempts to stop smoking can lead to success and can be maintained beyond pregnancy.

References


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