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SMOKING RELAPSE ONE YEAR AFTER DELIVERY AMONG WOMEN WHO QUIT SMOKING DURING PREGNANCY

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Abstract
Objectives: The aim of the randomized trial was to evaluate the risk of smoking relapse one year after delivery among the women who quit smoking during pregnancy. **Materials and Methods:** The study was carried out in 2002 and 2003 and included the collection of data on smoking relapse within one year after delivery among 175 women who participated in the randomized smoking cessation trial and quit smoking during pregnancy. **Results:** About 50% of women who quit smoking during pregnancy relapsed into that habit within 12 months postpartum. The analysis of women who quit smoking before 14 weeks of pregnancy revealed a significantly higher risk of smoking relapse after delivery for women with the higher level of smoking addiction indicated by the Fagerström test (OR = 5.0; 95% CI: 1.5–16.2). Compared to the control group, spontaneous quitters who participated in intervention activities during pregnancy showed lower risk of smoking relapse within one year after giving birth (OR = 0.3; 95% CI: 0.1–0.9). In the group of women who quit smoking after 14 weeks of gestation, the risk of smoking relapse postpartum was significantly higher for those with the higher Fagerström test score (OR = 4.8; 95% CI: 1.6–14.1). The risk of smoking relapse 12 months after delivery was lower for spontaneous quitters who participated in the intervention during pregnancy and for women who quit smoking after participation in the intervention activities than for controls (OR = 0.03; 95% CI: 0.01–0.2, OR = 0.1; 95% CI: 0.03–0.6). **Conclusions:** Women who had higher score in the Fagerström test before quitting smoking had significantly higher risk of smoking relapse within 12 months after delivery. Anti-smoking intervention during pregnancy helps women to maintain smoking abstinence after delivery.

Key words:
Smoking relapse, Postpartum

INTRODUCTION

In Poland about 4 million children are involuntarily exposed to tobacco smoke at home [1]. Exposure to environmental tobacco smoke gives rise to an excessive risk of several diseases in infancy and childhood, including sudden infant death syndrome, upper and lower respiratory infections, asthma, and middle ear disease [2,3]. Converting smoking abstinence during pregnancy to long-term cessation is important not only because it protects women against severe health effects, like cancer or heart diseases, but it is also beneficial to their potential future pregnancies. Smoking abstinence after delivery reduces exposure of infants to environmental tobacco smoke and prevents them from related health risks. Women successful in quitting smoking may also persuade their smoking partner to give up the habit and help them maintain smoking absti-

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nence, or at least avoid smoking at home to eliminate the child's exposure.

It is encouraging that approximately 25–40% of pregnant women who smoke prior to pregnancy tend to quit smoking by the first prenatal visit [4,5]. A lot of studies dealing with smoking cessation interventions for pregnant women indicate that even minimal assistance can increase the cessation rate [6–9]. In the smoking cessation program, which preceded this study, quitting rate during pregnancy was 44.3% in the intervention group and 16.7% in controls (OR = 5.8; $p < 0.001$) [10]. Unfortunately, according to follow-up studies up to 60% of these women return to smoking within the first six months postpartum and 80–90% experience a smoking relapse 12 months after delivery [11,12].

The aim of the randomized trial was to evaluate the risk of smoking relapse within one year after delivery among women who quit smoking during pregnancy.

MATERIALS AND METHODS

Study design

The study was carried out in 2002 and 2003 and included the collection of data on smoking relapse within one year postpartum among the women who participated in the randomized smoking cessation trial and quit smoking during pregnancy. The trial was performed between December 1, 2000 and December 31, 2001, in public maternity centers in Łódź, central Poland, and focused on the effectiveness of the smoking cessation program for pregnant women [10].

Study population

Of the 386 women who participated in the trial during pregnancy, 182 declared quitting smoking before delivery (93 before and 89 after enrolment in the trial). Twelve months after delivery, we interviewed 175 (96%) women who quit smoking during pregnancy (53 women who quit smoking before participation in the intervention group, 64 women who quit smoking after participation in the intervention activities and 58 women of the control group). Seven women who participated in the study during pregnancy and declared quitting smoking were lost to follow-up because of changed address and excluded from the study.

Description of the intervention and control activities during pregnancy

The intervention program consisted of four midwife visits during pregnancy. During those visits, the women under study received continuous support according to the intervention formula based on written materials prepared by the Community Health Research Unit in Ottawa, which were translated and adopted to the Polish conditions [13]. The program addressed to smoking women began with information how to prepare themselves for quitting, and stressed the importance of making the decision and hanging on it. The women who had stopped smoking spontaneously before their first prenatal visit and agreed to participate in the intervention were informed by the midwife during the home visits how to avoid smoking and maintain smoking abstinence. The control units received standard, written information about the health risk of maternal smoking for the fetus. More detailed description of intervention activities was presented in the previous publication [10].

Interview

During the initial contact with the maternity center, all women completed a questionnaire, which sought information concerning the subject's demographic data and smoking profile (number of cigarettes smoked, years of smoking, partner's smoking, other household members' smoking, smoking in previous pregnancies if any, previous smoking cessation attempts). In the control group, the data on smoking habits were updated at 20 week of gestation, whereas in the intervention group any changes in the smoking profile were recorded during each midwife visit. Shortly after delivery, the midwives visited the women from the intervention and control groups in their homes. They inquired whether anything had changed in subjects' smoking status, e.g., maintaining abstinence, smoking relapses, quitting after the period of intervention. At the time-point of one year postpartum, the women completed the third questionnaire, updating information about their

smoking status. We did not verify self-reported smoking status by using biomarkers of exposure to tobacco smoke, and to check the reliability of that information we asked the women 12 months after delivery about quitting smoking during pregnancy. However, in the analysis of smoking relapse after delivery we included information about quitting smoking during pregnancy reported by the women during pregnancy and shortly after delivery.

Statistical analysis

We compared relapse into smoking between the study groups using a logistic regression model. A multivariate logistic model was used to adjust risk estimates for some potential confounders. Odds ratios (OR) were used to examine strength of association. We based our statistical inference on 95% confidence intervals (CI) for odds ratios. The analysis was carried out using STATA 8 statistical package [14].

RESULTS

Smoking relapse one year after delivery

Of the 175 women who quit smoking during pregnancy, 87 (50%) relapsed into the habit within 12 months post-

Table 1. Smoking relapse within one year after delivery

Variable	Relapse into smoking N = 87		Do not relapse into smoking N = 88		OR
	n	%	n	%	95% CI
Age (years)					
≤18	6	60.0	4	40.0	1.5 (0.4–5.6)
19–30	68	50.0	68	50.0	1
>30	13	44.8	16	55.2	0.8 (0.4–1.8)
Education					
primary or vocational	57	51.8	53	48.2	1
(8 or 11 years of education)	30	46.2	35	53.8	0.8 (0.4–1.5)
college or university					
(12 or 17 years of education)					
Marital status					
married	55	50.0	55	50.0	1
unmarried	32	49.2	33	50.8	1.0 (0.5–1.8)
Number of children					
1	49	48.0	53	52.0	1
2	25	52.1	23	47.9	1.2 (0.6–2.3)
>2	13	52.0	12	48.0	1.2 (0.5–2.8)
Duration of smoking (years)					
<5	36	46.8	41	53.2	1
5–10	43	55.8	34	44.2	1.4 (0.8–2.7)
>10	8	38.1	13	61.9	0.7 (0.3–1.9)
Smoking before pregnancy (cigarettes/day)					
<5	11	40.7	16	59.3	1
5–10	47	48.0	51	52.0	1.3 (0.6–3.2)
>10	29	58.0	21	42.0	2.0 (0.8–5.2)
Fagerström test (score)					
0–2	45	40.9	65	49.1	1
3–9	42	64.6	23	35.4	**2.6 (1.4–5.0)***
Husband or other household member smoking					
Yes	64	45.7	76	54.3	**0.4 (0.2–0.9)***
No	23	65.7	12	34.3	1
Quitting smoking during pregnancy (hbd)					
1–8	17	35.4	31	64.6	1
9–16	25	48.1	27	51.9	1.7 (0.8–3.8)
17–39	45	60.0	30	40.0	**2.7 (1.3–5.8)***
Intervention during pregnancy					
for spontaneous quitters	16	30.2	37	69.8	**0.3 (0.1–0.6)***
for smokers	36	56.3	28	43.7	0.8 (0.4–1.7)
Control	35	60.3	23	39.7	1

OR – odds ratio; 95% CI – 95% confidence interval; * Statistically significant.

partum. No statistically significant differences in smoking relapse one year after delivery were noted with respect to the women's age, level of education, marital status, number of children, years of smoking, and number of cigarettes smoked per day before pregnancy (Table 1). Around 65% of the women who scored more than 2 points in the Fagerström test relapsed into smoking, whereas 41% of the women with the result lower than 3 points returned to the habit (OR = 2.6; 95% CI: 1.4–5.0). The women whose spouses were smokers had lower risk for smoking relapse within one year after delivery than those with non-smoking partners (OR = 0.4; 95% CI: 0.2–0.9). In the group of women who relapsed into smoking, 35% quit smoking before 9 weeks of pregnancy, 48% between 9–16 weeks and 60% after 16 weeks of pregnancy. The risk of smoking relapse postpartum was significantly higher for women who quit the habit after 16 weeks of pregnancy than for those who stopped smoking before 9 weeks of gestation (OR = 2.7; 95% CI: 1.3–5.8). There was about 3-fold lower risk of smoking relapse one year after delivery among spontaneous quitters who participated in intervention activities during pregnancy than in controls (OR = 0.3; 95% CI: 0.1–0.6). No statistically significant differences in smoking relapse one year postpartum were found between women who quit smoking due to participation in the intervention program and the control group (OR = 0.8; 95% CI: 0.4–1.7).

Multivariate analysis of smoking relapse after delivery by the time of quitting smoking during pregnancy

We included all variables that were statistically significant in a univariate model into multivariate model. The analysis was carried out in two strata: for women who quit smoking at and before 14 weeks of pregnancy and for those who did it after 14 weeks of gestation (Table 2).

The women who quit smoking before 14 weeks of pregnancy with higher level of smoking addiction (Fagerström test 3–9) had five times higher risk of smoking relapse one

Table 2. Multivariate analysis of smoking relapse after delivery by the time of quitting smoking during pregnancy

Variable	Relapse into smoking		Do not relapse into smoking		OR
	n	%	n	%	95% CI
Quit smoking before 14 weeks of pregnancy					
Fagerström test					
0–2	19	31.7	41	68.3	1
3–9	15	51.7	14	48.3	**5.0 (1.5–16.2)***
Husband or other household member smoking					
Yes	24	33.8	47	66.2	**0.2 (0.07–0.8)***
No	10	55.6	8	44.4	1
Intervention during pregnancy					
for spontaneous quitters	13	31.0	29	69.0	**0.3 (0.1–0.9)***
for smokers	5	45.5	6	54.5	0.5 (0.1–2.6)
Control	16	44.4	20	55.6	1
Quit smoking after 14 weeks of pregnancy					
Fagerström test					
0–2	26	52.0	24	48.0	1
3–9	27	75.0	9	25.0	**4.8 (1.6–14.1)***
Husband or other household member smoking					
Yes	40	58.0	29	42.0	0.8 (0.2–3.4)
No	13	76.5	4	23.5	1
Intervention during pregnancy					
for spontaneous quitters	3	27.3	8	72.7	**0.03 (0.01–0.2)***
for smokers	31	58.5	22	41.5	**0.1 (0.03–0.6)***
Control	19	86.4	3	13.6	1

OR – odds ratio; 95% CI – 95% confidence interval; * Statistically significant.

year after delivery than those with the Fagerström test score lower than 3 points (OR = 5.0; 95% CI: 1.5–16.2). The risk of smoking relapse within 12 months postpartum was significantly lower for spontaneous quitters who participated in intervention activities during pregnancy than for controls (OR = 0.3; 95% CI: 0.1–0.9). The women who quit smoking due to participation in the intervention program had lower risk of smoking relapse than controls, but the difference was not statistically significant because of a small number of women in the intervention group (OR = 0.5; 95% CI: 0.1–2.6). The risk of smoking relapse within one year after delivery was also significantly lower for women whose husband or other household members was smoker than for those whose spouses did not smoke (OR = 0.2; 95% CI: 0,1–0.8).

There were statistically significant differences in the level of smoking addiction and participation in intervention during pregnancy in the women who quit smoking after 14 weeks of pregnancy. The risk of smoking relapse after delivery was significantly higher for the women with the higher Fagerström test score (OR = 4.8; 95% CI: 1.6–14.1). One year after delivery, more than 86% of controls relapsed into smoking, only 27% of spontaneous quitters who participated in the intervention activities during pregnancy, and 59% of the women who quit smoking due to participation in these activities (spontaneous quitters vs. controls OR = 0.03; 95% CI: 0.01–0.2, smokers vs. controls OR = 0.1; 95% CI: 0.1 0.03–0.6). No statistically significant differences in smoking relapse one year after delivery were noted between women whose spouses were smokers and those whose spouses did not smoke (OR = 0.8; 95% CI: 0.2–3.4).

DISCUSSION

Study population

The analysis of smoking relapse one year after delivery was performed in 96% of the women who had participated in the randomized smoking cessation trial and quit smoking during pregnancy. In the control group we decided to combine spontaneous quitters and women who quit smoking after participation in the study because of small population of those women. Both populations of women from the control group quit smoking by themselves and they differ with respect to the weeks of pregnancy at quitting smoking so we carried out the analysis in two strata.

Smoking relapse after delivery

In this study, 50% of the women who quit smoking during pregnancy relapsed into the habit within 12 months after delivery. Other researches indicate even higher percentage of women who return to smoking within one year postpartum (80–90%) [11,12]. That difference can be explained by the fact that in Poland the population of smoking women includes occasional smokers who may have less problems with quitting smoking during pregnancy, which was confirmed in our previous paper [10]. Those women maintain smoking abstinence after delivery longer than those strongly addicted to tobacco. This is confirmed by the Fagerström test, used to measure physical dependence on nicotine. In our study, only few women were scored higher than six points in the test, which indicated physical addiction.

Social and psychological changes such as decreased motivation and social pressure to maintain abstinence, stress associated with caring for a newborn, exposure to high-risk situations that may have been avoided during pregnancy, and cessation of breast-feeding may contribute to the high relapse rates seen among postpartum women [15–18].

In the group of women who quit smoking before 14 weeks of pregnancy, those with the higher Fagerström test score relapsed into smoking more frequently than those with the lower score (OR = 5.0; 95% CI: 1.5–16.2). The same result was found in women who quit smoking after 14 weeks of pregnancy. Women with stronger nicotine-dependence may experience more problems with keeping smoking abstinence after delivery if they are less motivated after than during pregnancy.

The risk of smoking relapse within 12 months postpartum was significantly lower in spontaneous quitters who participated in intervention activities during pregnancy than in controls. The intervention program for those women concentrated on keeping smoking abstinence not only during pregnancy but also after delivery. The control

centers received standard written information about the health risk of maternal smoking for the fetus and child, whereas women without any advice have more problems with maintaining smoking abstinence after giving birth. The women who quit smoking due to participation in the intervention program had lower risk of smoking relapse than controls, but the difference was not statistically significant because of a small number of women in the intervention group.

The women who quit smoking before 14 weeks of pregnancy and whose husband or other household members was smoker had lower risk of smoking relapse within 12 months after delivery than women whose spouses did not smoke (OR = 0.2; 95% CI: 0,07–0.8). Other researches indicate that smoking among family members is a risk factor of smoking relapse after delivery. One possible explanation of this result is the differential misclassification of the smoking status. In the group of women whose spouses were smokers the consistency of information about quitting smoking during pregnancy obtained from the women during pregnancy and 12 months after delivery was 87% and for the women whose household member did not smoke this consistency was 79% (data not presented in the results). Based on that information we can presume that women whose husbands were non-smokers because of social pressure were more inclined to report quitting smoking although they did not do that than women whose spouses were smokers. In the group of women whose spouses did not smoke high percentage of women who relapsed into smoking 12 months after delivery can be the result of misclassification of smoking status during pregnancy. The other suggestion could be that in our study women who quit smoking contrary to their husband's smoking were more strongly convinced about the danger of environmental tobacco smoke exposure to the fetus and child and maintained smoking abstinence after delivery for sake of their child health. On the other hand, the women whose husbands did not smoke might quit that habit on spouses' suggestions and social pressure, but not because on their own conviction and were more inclined to relapse into smoking after delivery. We cannot exclude that the observed effect could be confounded by other factors not included in the analyses.

The analysis of women who quit smoking after 14 weeks of pregnancy showed that over 86% of women from the control group relapsed into smoking one year after delivery. Smoking within that time declared only 27% of spontaneous quitters who participated in intervention activities during pregnancy and 59% of the women who quit smoking due to participation in intervention activities. High percentage of women in the study group who relapsed into smoking may result from misclassification. Those women might have declared quitting smoking during pregnancy, but in fact they failed to do so and after delivery they reported smoking. This misclassification can be differential because the intervention group had more frequent or stronger contacts with midwife during pregnancy than the control group, and thus the information about quitting smoking seems to be more reliable. As a result the observed relationship may be stronger than the real one.

CONCLUSIONS

The women with the higher score in the Fagerström test, used to measure physical dependence on nicotine, had significantly higher risk of smoking relapse after delivery. Anti-smoking intervention during pregnancy helps women to maintain smoking abstinence after delivery.

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