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Smoking during pregnancy in association with maternal emotional well-being

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ABSTRACT

Objective: The aim of the study was to investigate psychosocial predictors of smoking during pregnancy.

Materials and methods: It was a cross-sectional analysis of a prospective birth-cohort study. The participants were 514 mothers of full-term infants. Women completed questionnaires during hospital stay after delivery. Questionnaire included items on sociodemographic characteristics, planning and emotional acceptance of pregnancy, reproductive history, health-related behavior, emotional well-being, and relationships with a partner.

Results: Smoking during pregnancy was reported by 14.8% of the participants. Prenatal smoking was associated with secondary or lower education, maternal age less than 20 years, childbirth outside of marriage, history of elective abortion, unplanned pregnancy, lack of positive emotional acceptance of pregnancy by mother and father, emotional distress and alcohol consumption during pregnancy. Smoking during pregnancy remained significantly associated with prenatal alcohol consumption, previous elective abortion, and lack of positive emotional acceptance of pregnancy by mother even after adjustment for maternal age, education, and family structure.

Conclusions: Results support an idea of complexity of the relationships among smoking, alcohol use, and emotional well-being. Lack of positive emotional acceptance of pregnancy by mother and history of elective abortions can be considered as possible associates of

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smoking during pregnancy and suggest that strengthening of positive attitudes toward motherhood could add to lower smoking rates among pregnant women.

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1. Introduction

Smoking during pregnancy is one of the most important and modifiable risk factors associated with adverse perinatal outcomes. Exposure to cigarette smoking leads to an increased risk of miscarriage, reduced fetal growth, low birth-weight, perinatal death, premature birth, preeclampsia, placental complication, impaired infant's lung function, respiratory illness, cancer, impaired growth, and development of behavioral problems [1]. It is estimated that smoking is responsible for about 15% of all preterm births, 20%–30% of all infants' low birth weight, and a 150% increase in overall perinatal mortality [2].

Despite well-established risks and the fact that pregnancy might be considered as an effective motivator for smoking cessation, tobacco smoking during pregnancy is relatively common and is increasing among young females [3,4]. Its demographic, social, and psychological determinants have been widely studied and various risk factors have been established. Evidence shows that women of younger age, of low social status, with a large number of children, having deficient prenatal care, and living without a partner or with a smoking partner, are more likely to smoke during pregnancy than other women [5].

Additionally, exposure to physical or sexual violence [6], delinquency in the past [7], personal stress, living in complicated personal situation [8], and low social support [9] can also be associated with persistence of smoking during pregnancy. Prenatal smoking was found to be linked with following psychiatric diagnoses: generalized anxiety disorder, bipolar disorder, oppositional disorder, drug abuse or dependence, and attention deficit-hyperactivity disorder [10]. A prospective cohort study of 7000 women in the United Kingdom showed that smoking cessation was associated with reduced depression symptoms, and this supports a complexity of relationship between depression and smoking with evidence for both possible directions of causation [11]. However, some studies report inconsistent findings: one recent study showed strong prenatal smoking association with low social support, but not with maternal depressive symptoms or stressful events [12]. Some studies indicate that prenatal smoking is associated with unintended pregnancy [13], early or single motherhood [14], and lack of antenatal care and non-attendance of antenatal classes [15]. However, there is still a lack of studies on associations of women's reproductive characteristics and prenatal smoking.

More comprehensive investigation of prenatal smoking in the context of reproductive history, current pregnancy planning and acceptance, as well as emotional well-being is important for better understanding of predictors of smoking

during pregnancy. For better understanding of smoking-related factors and outcomes during and after pregnancy there is a necessity to focus on smoking women not only with high risk, but also with relatively low health risk, such as mothers with full-term infants. Possibly, in case of full-term delivery, consequences of smoking might be less expressed or evident, and though less obvious but still essential. Our study aimed to investigate psychosocial predictors of smoking during pregnancy.

2. Materials and methods

2.1. Subjects

This study is a part of an ongoing prospective birth-cohort study, started in 2009. The analysis is cross-sectional, including only baseline data on mothers. The study participants were uniparous mothers who gave birth to full-term newborns (≥ 37 weeks of gestation) in the Hospital of the Lithuanian University of Health Sciences Kaunas Clinics. The psychosocial data about prenatal period were collected on the 2nd–3rd day following delivery. The questionnaires were given to women during their stay at hospital with the request to answer them on their own convenience. Data from 548 mothers were obtained, 34 questionnaires were dismissed due to lack of essential information, and therefore in total 514 women were included in current analysis.

2.2. Measurements

The participants completed the prenatal environment questionnaire, which was developed by authors. The questionnaire covered several groups of questions like demographics, reproductive history, planning of and emotional reactions toward current pregnancy, emotional experiences and relationship with the husband or partner, and substance use. In total, 16 items were included in current analysis.

Outcome of interest. Antenatal tobacco use was evaluated using the question: “Did you smoke cigarettes during pregnancy?” The possible answers were “not at all,” “several times during the whole pregnancy,” “once or several times a month,” “once or several times a week,” and “every day.” For logistic regression analysis the outcome was dichotomized: women who reported no smoking during pregnancy were categorized as nonsmokers, all other were defined as smokers.

Exposure variables (possible predictors). The demographic factors were assessed using questions about mother's age, mother's and father's education, and family structure.

Planning and acceptance of pregnancy. For evaluation of pregnancy planning, the participants were asked whether

the pregnancy was planned. The mother's acceptance of pregnancy was evaluated by items about emotional reaction toward conception (positive, negative, ambivalent) and intentions of elective abortion (had or did not have intentions for abortion). Positive emotions together with positive intentions toward pregnancy were categorized as positive acceptance of pregnancy. Negative or ambivalent emotions toward conception and/or considered intentions of abortion were categorized as lack of positive acceptance. Similarly, father's positive acceptance of pregnancy was evaluated by mother if he had positive emotions toward pregnancy and did not suggest an elective abortion.

Reproductive history was evaluated with items on parity, previous miscarriages, ectopic pregnancies, or elective abortions.

Prenatal emotional well-being of mother. Emotional distress during pregnancy was rated by questions on how often during pregnancy they have experienced emotions such as irritability, bad temper, feeling low, and feeling nervous. Mothers were given the possibility to choose one of five statements for each emotion: "almost daily," "more often than once a week," "almost every week," "almost every month," and "rare or never." To evaluate stressful and traumatic experience during pregnancy, women were asked whether they had or not experienced any stressful or traumatic events during pregnancy. The quality of relationships with husband or partner was evaluated by mothers on the Likert scale from "very bad relationship" (1 point) to "very good relationship" (5 points).

Alcohol consumption during pregnancy was evaluated by question "Did you consume alcohol during the pregnancy?" and dichotomized (yes/no).

2.3. Statistical analysis

Statistical procedures were conducted using SPSS for Windows 17.0 software package. Descriptive statistics was applied for distribution of respondents' smoking status, demographic characteristics, previous and current pregnancy as well as emotional well-being variables. Univariate logistic regression was used to analyze the associations between smoking during pregnancy and possible risk factors (Model 1). Multivariate logistic regression analysis was then performed for adjustment of odds ratios (OR) for demographic covariates: mother's age, education, and family structure (Model 2). The results of logistic regression are presented as OR and 95% confidence intervals (CI).

2.4. Ethical considerations

The original study was conducted with approval of the Kaunas Regional Biomedical Research Ethics Committee (No. P1-143/2007). Signed informed consent was obtained from every participant.

3. Results

The study results showed that the majority of study participants (85.2%) reported no tobacco smoking during pregnancy, 4.9% reported regular (everyday) smoking, and 9.9% occasional

Table 1 – Smoking during pregnancy and sociodemographic indicators among mothers of full-term infants.

Demographic variables	Total N (%)	Smokers N (%)	OR (95% CI)
<i>Maternal age (years)</i>			
15–19	24 (4.7)	10 (41.7)	4.30 (1.79–10.32)**
20–29	295 (57.5)	42 (14.2)	1.00
≥30	194 (37.8)	24 (12.4)	0.85 (0.50–1.46)
<i>Family structure</i>			
Marriage	411 (80.1)	38 (9.2)	1.00
Cohabitation	87 (17.0)	31 (35.6)	5.43 (3.13–9.43)**
Single	15 (2.9)	6 (40.0)	6.54 (2.21–19.38)**
<i>Maternal education</i>			
Secondary or lower	187 (36.7)	58 (31.0)	8.09 (4.45–14.43)**
Higher (college or university)	323 (63.3)	17 (5.3)	1.00

** $P < 0.01$.

smoking (several times during the whole time of pregnancy or once/several times smoking during a week). In total, smoking during pregnancy was reported by 14.8% of the full-term infants' mothers enrolled into the study.

The analysis of demographic variables revealed that the majority of responders were aged 20–29 years (58%), were married (80%), and had higher education (63%). The comparisons of smoking prevalence among mothers with different demographic characteristics are presented in Table 1. The univariate logistic analysis showed that secondary or lower education (OR = 8.1), maternal age less than 20 years (OR = 4.3), cohabitation (OR = 5.4) and living alone (OR = 6.5) were significantly associated with an increased likelihood of smoking during pregnancy ($P < 0.05$) (Table 1).

The univariate analysis revealed that smoking during pregnancy was significantly ($P < 0.05$) associated with previous elective abortions, non-planned pregnancy, lack of mother's and father's positive acceptance of pregnancy, often experienced irritability and bad temper, and alcohol consumption during pregnancy (Table 2). After adjustment for demographic covariates, the history of elective abortions, lack of mother's positive acceptance of pregnancy and alcohol consumption during pregnancy remained statistically significant. Specifically, prenatal alcohol consumption increased the odds of prenatal smoking by more than 8 times; previous elective abortions, by more than 4 times, and lack of mother's positive acceptance of pregnancy, by 2 times (Table 2), independently from other variables in the model.

4. Discussion

Our study showed that prenatal smoking was strongly associated with such demographic characteristics as low maternal education, young age, and pregnancy outside marriage. These findings prove an importance of sociodemographic indicators in prediction of smoking among women. Very similar results were found in a large study conducted in the United States. It showed that subgroups of increased risk of smoking were white, unmarried and low educated women,

Table 2 – Predictors of smoking during pregnancy among mothers of full-term newborns.

Predictor	Tobacco smoking during pregnancy			
	Total N (%)	Smokers N (%)	OR (95% CI) Model 1 ^a	OR (95% CI) Model 2 ^b
<i>Previous miscarriages or ectopic pregnancies</i>				
No	414 (80.5)	59 (14.3)	1.00	1.00
Yes	100 (19.5)	17 (17.0)	1.23 (0.68–2.22)	0.93(0.47–1.83)
<i>Previous elective abortions</i>				
No	430 (87.2)	49 (11.4)	1.00	1.00
Yes	63 (12.8)	24 (38.1)	4.79 (2.66–8.62)***	4.62 (2.26–9.44)***
<i>Other children</i>				
Yes	249 (48.6)	39 (15.7)	1.00	1.00
No	263 (51.4)	36 (13.7)	0.85 (0.52–1.39)	0.65 (0.35–1.21)
<i>Pregnancy planned</i>				
Yes	336 (68.3)	39 (11.6)	1.00	1.00
No	156 (31.7)	32 (20.5)	1.97 (1.17–3.28)*	0.91 (0.49–1.69)
<i>Mother's positive acceptance of pregnancy</i>				
Yes	404 (79.5)	49 (12.1)	1.00	1.00
No	104 (20.7)	26 (25.0)	2.42 (1.41–4.12)**	2.00 (1.08–3.68)*
<i>Father's positive acceptance of pregnancy</i>				
Yes	431 (88.5)	53 (12.3)	1.00	1.00
No	56 (11.5)	14 (25.0)	2.38 (1.22–4.65)*	1.77 (0.82–3.83)
<i>Feeling low</i>				
Every week or more often	49 (9.9)	12 (24.5)	1.97 (0.98–3.99)	1.38 (0.62–3.08)
Rarely or never	446 (90.1)	63 (14.1)	1.00	1.00
<i>Irritability, bad temper</i>				
Every week or more often	72 (14.6)	19 (26.4)	2.44 (1.35–4.44)**	1.36 (0.69–2.70)
Rarely or never	422 (85.4)	54 (12.8)	1.00	1.00
<i>Feeling nervous</i>				
Every week or more often	74 (14.9)	16 (21.6)	1.77 (0.95–3.28)	1.45 (0.72–2.95)
Rarely or never	422 (85.1)	57 (13.5)	1.00	1.00
<i>Stressful and traumatic experience during pregnancy</i>				
No	407 (80.6)	56 (13.8)	1.00	1.00
Yes	98 (19.4)	19 (19.4)	1.51 (0.85–2.68)	1.88 (0.98–3.63)
<i>Couple relationships during pregnancy</i>				
Good or very good	305 (59.3)	39 (12.8)	1.00	1.00
Average or bad	209 (40.7)	37 (17.7)	1.47 (0.90–2.39)	1.11 (0.63–1.94)
<i>Prenatal alcohol consumption</i>				
No	301 (59.6)	26 (8.6)	1.00	1.00
Yes	204 (40.4)	43 (21.1)	2.83 (1.67–4.77)***	8.21 (4.14–16.27)***

* P < 0.05.

** P < 0.01.

*** P < 0.001.

^a Univariate regression.

^b Multivariate regression, adjusted for maternal age, education, and family structure.

and these risks factors were same for pregnant and nonpregnant women [16].

Our study also revealed the associations of prenatal smoking with previous elective abortions, non-planned pregnancy, lack of positive acceptance of current pregnancy (both mother's and father's), emotional distress, and alcohol consumption during pregnancy. After adjustment for demographic variables, prenatal smoking remained significantly associated with prenatal alcohol use, elective abortions history, and lack of positive acceptance of pregnancy by mother. Furthermore, the strongest predictor of smoking during pregnancy was alcohol consumption,

which increased the likelihood of prenatal smoking more than 8 times after adjusting for demographic variables. The link between prenatal smoking and alcohol consumption is well documented in other studies [17–19]. Some authors emphasize that the use of both smoking and drinking during pregnancy is especially dangerous, as it has a synergistic effect higher than the sum of the effects of either smoking or drinking [20]. Both smoking and drinking is also associated with more difficult quitting than single substance use and this may be due to difficulties of formulating appropriate behavioral strategies or less concern about healthy behavior [21].

Our study highlighted the importance of emotional pregnancy acceptance in defining predictive factors of prenatal smoking. Results also emphasize importance to distinguish such factors as pregnancy planning and pregnancy acceptance. Lack of mother's positive acceptance of pregnancy increased the likelihood of prenatal smoking two times, while unplanned pregnancy was significantly associated with prenatal smoking only before adjustment for demographic variables. The importance of estimating not only intentions for pregnancy (whether wanted, mistimed, etc.), but the attitudes and feelings toward pregnancy were previously emphasized by some researchers [22]. However, there are more studies analyzing and indicating the associations between unintended pregnancies and risky behavior of pregnant women [13,19]. The results of our earlier report from birth-cohort study indicated that negative maternal and paternal emotional reactions toward conception increased the likelihood of difficult infant behavior, while unplanned pregnancy was not related with infant difficult behaviors [23]. It shows that pregnancy planning and emotional pregnancy acceptance after conception should be addressed as separate issues.

The link between prenatal smoking and previous elective abortions was also established in our study. Women who were smoking during pregnancy reported previous elective abortions more often. The existing data on elective abortion outcomes for women are controversial. A systematic review on long-term mental health outcomes showed that evidence of psychological distress after intended abortion is unclear [24]. Authors of another review conclude that the most consistent predictor of mental disorders after abortion remains preexisting disorders [25]. However, a recently published review of research about abortion and mental health revealed a moderate to highly increased risk of mental health problems after abortion: 81% increased risk of mental health problems, especially of substance misuse and suicidal behavior [26]. A longitudinal study of youth showed that induced abortion can be associated with increased risk of use of nicotine, alcohol, cannabis and other illegal drugs [27]. Some existing studies revealed that if compared with women who gave birth, women who have had an induced abortion were significantly more likely to use alcohol and other drugs during their next pregnancy [28]. The association between previous induced abortions and smoking during later pregnancies has several implications. It can indicate a group of pregnant women with more prevalent risk behaviors, especially among those with low education and living outside of marriage. These results emphasize the relevance to screen abortion history in order to distinguish women with increased risk for smoking during pregnancy. However, the fact that participants of our study were lower risk mothers and that adjustment was made for demographic variables suggest that relationships between prenatal smoking and previous abortions may be considered not only due to the disadvantaged sociodemographic environment, but due to psychological factors as well. Though the results suggest that previous elective abortions may have implications for future pregnancies and can be considered as a possible risk factor for smoking during subsequent pregnancies, the underlying mechanisms are still not clear and should be analyzed more comprehensively in future research.

Some studies show that smoking between women is a growing public health problem in Lithuania: the number of daily smokers among women in Lithuania was 14.9% in 2008 and has doubled from 1994 to 2008 [29]. The data of our study and comparison with official national medical data reveal the possibility of underestimation of true prevalence of smoking during pregnancy. The medical data of births show that 4.5% women reported smoking during pregnancy in 2010 in Lithuania [30]. While in our study 14.8% of mothers of full-term infants reported tobacco smoking, and 4.9% reported everyday smoking during pregnancy. It is also important to take into consideration that 6.2% of mothers did not indicate their smoking status at all. There is a high possibility that some of these women were smokers. Other studies also indicate that pregnant smokers often deny smoking to health professionals, partners and colleagues and use private smoking places out of public view to reduce the chances of detection [8].

Thus, the study also has some limitations. In our study smoking habits were only self-reported and not compared with objective data, such as CO or cotinine measurement. Some studies show that reliance on self-report while identifying pregnant smokers can underestimate the number of pregnant smokers [31], though other studies indicate that self-reported tobacco use is also a valid measure [32,33]. In our study occasional smokers (52 women) and regular smokers (26 women) were included in the same group named "smokers" because of limited size of these two groups. However, at larger scale it would be reasonable to analyze possible differences and similarities between occasional and regular prenatal smokers.

Other limitation is that the data about emotional acceptance of pregnancy, emotional distress or relationships with husband were collected retrospectively after birth and therefore could be influenced by recall bias. It may be that the answers to these questions could be different if collected on earlier time point during pregnancy. Some studies show that there is only moderate agreement between retrospective and prospective evaluation of prenatal maternal emotional wellbeing [34].

Some implications for further research should be mentioned. Our study emphasized that several factors related to women's life-style and emotional well-being contribute to the prenatal smoking risk independently of sociodemographic variables. However these associations could not be fully explained by our study results and requires further comprehensive examination. Study suggests that more attention is needed for internal psychological factors, which could more deeply explain possible mechanisms underlying these associations, e.g. impulse control, addictiveness or coping strategies. We also assume that various life situations, such as getting unplanned pregnant, having problematic relationships with a husband/partner, are also signs of difficult emotional situation of pregnant women. Although the life situations are usually not easy changeable, we hypothesize that helping women to deal with emotional distress through social support or professional psychological help could improve emotional well-being as well as increase motivation and success at smoking cessation during pregnancy. The examination of this hypothesis could be valuable trend in future interventional studies of prenatal smoking cessation.

5. Conclusions

Our study revealed the importance of maternal prenatal emotional distress for risk of smoking during pregnancy. Results support an idea of complexity of the relationships among smoking, alcohol use, and emotional well-being. Lack of positive emotional acceptance of pregnancy by mother and history of elective abortions can be considered as possible associates of smoking during pregnancy and suggest that strengthening of positive attitudes toward motherhood could add to lower smoking rates among pregnant women.

Conflict of interest

The authors declare that there is no conflict of interest.

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