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Smoking trajectories during the perinatal period and their risk factors: the nationally representative French ELFE birth cohort study.

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ABSTRACT

Background

In France, rates of perinatal smoking are among the highest worldwide, however perinatal smoking trajectories and associated factors have still not been adequately researched.

Methods

Among women participating in the French nationally representative ELFE birth cohort (n=15,540), perinatal smoking trajectories were estimated using group-based modelling. Associated characteristics were studied using multinomial logistic regression.

Results

Four trajectories were identified: non-smokers (59%), quitters (20%), persistent moderate (12%) and persistent heavy (9%) smokers. Older age, being native French, low socioeconomic position, persistent psychological difficulties and alcohol use in pregnancy, lack of social support, partner's smoking, mistimed pregnancy, and child formula feeding at birth were associated with persistent heavy smoking. Most of these factors were also associated, but to a lesser extent, with persistent moderate smoking, except for age and migrant status which had opposite effects. Women who successfully lost weight prior to pregnancy had higher levels of quitting smoking.

Conclusion

Women's long-term smoking trajectories vary with initial tobacco consumption level but also in relation to socio-demographic, psychological, behavioral, and partner characteristics. Health professionals in contact with pregnant smokers should address perceived risks and benefits of smoking, including partner's smoking and weight-gain concerns.

Keywords: smoking trajectories, maternal smoking, smoking determinants.

INTRODUCTION

In most high-income countries, women's smoking rates are now comparable to men's, and the number of female smokers continues to increase worldwide [1]. In France around 28% of women smoke regularly [1], and around 17% continue to smoke while pregnant [2]. This contributes to a high burden of smoking-related ill health, since maternal smoking is associated with a multitude of poor perinatal and long-term outcomes among mothers and their children [3–5].

Many smokers attempt to quit or decrease their level of smoking during pregnancy, making pregnancy a propitious window for smoking cessation [6]. However, a significant portion of women who quit relapse shortly after their child's birth [7]. A key factor influencing women's likelihood of quitting smoking in pregnancy is their pre-pregnancy level of tobacco use and nicotine dependence [8]. Other factors, including socio-demographic characteristics such as low socioeconomic status (SES), and partner's support have also been shown to play a role [9].

To date, only few studies modelled maternal smoking trajectories using prospective data and relying on statistical techniques that make it possible to identify distinct longitudinal patterns of smoking [11–13]. Moreover, studies that implemented such analyses either solely examined women with low SES, or did not take into account relevant determinants such as pre-pregnancy smoking level, and partner's characteristics and smoking status. Further, some variables such as migrant status, unintended pregnancy and a history of weight-loss dieting which have previously been linked with smoking behavior among women [13–15], have never been examined as predictors of smoking trajectories during the perinatal period. Another factor not studied in relation to perinatal smoking trajectories is infant feeding method at birth, which nonetheless has been previously associated with postpartum smoking behavior [16]. Identifying smoking trajectories and their determinants is key in improving the timing, duration and components of anti-smoking interventions, especially in France where rates of perinatal smoking are among the highest in the world [1].

In the present study, based on the French nationally representative ELFE cohort, we endeavored to identify longitudinal trajectories of maternal smoking from preconception through the postnatal period as well as associated maternal and partner characteristics.

METHODS

Participants and data collection

ELFE (Etude Longitudinale Française depuis l'Enfance) is an ongoing multidisciplinary [17], nationally representative birth cohort study which originally included 18,275 infants (17,988 mothers) born in France in 2011.

Newborns were recruited under a random sampling design in 320 (out of 349 initially selected) maternity wards and will be followed until adulthood. Eligible births were single or twin, at or above 33 weeks of gestation. Mothers had to be 18 years old or older, not planning to move out of metropolitan France in the following 3 years, and capable of giving informed consent in French, English, Arabic, or Turkish.

Wave one of data collection was conducted via face-to-face interviews by midwives at the maternity ward. Additionally, participating women completed a self-reported questionnaire on dietary practice during pregnancy including alcohol consumption. The second wave of data collection was carried out two months after the child's birth, through telephone interviews with the mother and father. In this analysis, we only included participants with available data at the two-month follow-up (response rate=86.4%, n=15,540 mothers). Compared to non-respondents (n=2,448), respondents were more likely to be at least 30 years of age (58% vs. 45%), to have French citizenship (90% vs. 69%), to hold a high school diploma (64% vs. 34%), and were less likely to be unemployed (5% vs 8%).

The ELFE study received approval from France's consultative committee for information treatment for health research (Comité Consultatif sur le Traitement des Informations pour la Recherche en Santé: CCTIRS) and the national data protection authority (Commission National Informatique et Libertés: CNIL)

Tobacco characteristics

Maternal tobacco smoking was evaluated at 3 time-points: in study wave one, women were asked about smoking prior to pregnancy during the face to face interview, and in the last trimester of pregnancy, and at wave two they were asked about smoking at two months postpartum.

At each of the three time points, women reported the number of cigarettes smoked per day.

Factors potentially associated with tobacco smoking

Studied variables included known risk factors of women's smoking in the perinatal period, as well as variables which have not been previously studied but were previously linked with smoking behavior.

Women's *sociodemographic characteristics* included: migrant status (first generation, i.e. not French-born; second generation, i.e. French-born with at least parent not French-born; vs. native French), age (≤ 30 years vs. > 30 years), educational level ($<$, equal to, vs. $>$ high school degree), number of children including the ELFE child (two, three or more, vs. one) and residential area (Great Paris region, North, East, West, South-West, Centre-East, others, vs. Paris (Ile-de-France)). Additionally, women were asked whether they experienced financial problems during pregnancy (yes vs. no).

Women's health characteristics: women were asked if they experienced persistent psychological difficulties during pregnancy (yes vs. no)[18]. Additionally, they were asked about their weight and height as well as their history of weight-loss dieting prior to pregnancy; these two measures were combined into a single variable that represented a proxy for weight gain concerns: overweight (BMI \geq 25) but has never dieted, overweight and has previously dieted, normal (BMI $<$ 25) weight and has previously dieted, vs. normal weight but has never dieted.

Household financial characteristics: the household occupational grade was defined as the highest occupational category of either the mother or her partner (no occupation or low [e.g. clerk, manual worker], intermediate [e.g. middle-level manager, technician], vs. high [e.g. manager]). The employment status at the time of pregnancy of both the woman and her partner was also measured (unemployed, out of the job market vs employed).

Perinatal characteristics were ascertained by asking about alcohol use during pregnancy ($<$ once per month, \geq one per month vs. never), the timing of pregnancy (mistimed/unintended, vs. anticipated), and the infant's feeding method at birth (formula vs. any breast feeding).

Partner characteristics included partner support during pregnancy (yes, not living with a partner vs. no)[19], as well as paternal smoking (yes vs. no) which was collected directly from fathers 2 months post-partum (wave two).

The *type of maternity ward* was also described (public vs. private).

Statistical analyses

To identify distinct longitudinal trajectories of maternal smoking over the follow-up period, we used Group-Based Trajectory Modelling (GBTM) [20], applied using the PROC TRAJ macro in SAS [21]. This method, assuming a zero-inflated Poisson distribution, was based on mothers' number of daily cigarettes smoked at the data-points. The best fitting-model was selected empirically based on the Bayesian Information Criterion (BIC) and the average posterior probabilities of trajectory membership (>0.7 for all trajectory groups), after testing several models with an increasing number of trajectories and different forms (intercept, linear, and quadratic) for each trajectory.

Missing data on independent variables (all variables had up to 10% of missing values, except for partner's smoking with 20.3% missing values) were imputed using multiple imputation by chained equations under fully conditional specification and assuming missingness at random [22]. Ten imputed datasets were created. The imputation model included all the previously listed variables as well as trajectory groups. The imputed datasets were then used in all subsequent analyses.

Multinomial regression models were implemented to identify factors potentially associated with maternal smoking trajectories. The same model was run twice, with two different reference categories: 'non-smokers' and 'quitters'. Potentially associated factors that were also associated with trajectory class membership in bivariate analyses (chi-square test, $p < 0.20$) were included in the multivariable regression model with a random intercept corresponding to the maternity ward to take into account the hierarchical nature of the data.

All analyses were performed with SAS, version 9.4. Multivariable analyses were conducted separately for each imputed dataset and the results (OR, CI 95%) were pooled using the 'PROC MIANALYZE' procedure.

RESULTS

As illustrated in **Figure 1**, we found that four groups constituted the best fit for the data:

- "Non-smokers" (59.4%, $n=9,226$) who did not smoke prior to pregnancy (including possible ex-smokers);
- "Quitters" (19.7%, $n=3,068$) who reported moderate smoking before pregnancy (mean=10.6, $sd=6$ cigarettes/day), stopped smoking during pregnancy and remained non-smokers two months postpartum;
- "Persistent moderate smokers" (11.5%, $n=1,790$) who reported moderate smoking before pregnancy (mean= 8.1, $sd=5$ cigarettes/day), continued to smoke during pregnancy (mean=1.5, $sd=2$ cigarettes/day) and increased their level of smoking two months postpartum (mean= 4.7, $sd=3$ cigarettes/day)
- "Persistent heavy smokers" (9.4%, $n=1,456$) who reported heavy smoking before pregnancy (mean=17.6, $sd=7$ cigarettes per day), and continued to smoke during and after pregnancy (respectively mean=8, $sd=5$ cigarettes per day in pregnancy and mean=11.7, $sd=5$, cigarettes per day postpartum).

The average posterior probability of belonging to each group ranged from 0.96 for persistent heavy smokers to 0.99 for quitters, confirming the model's overall goodness of fit [20].

Table 1 presents descriptive statistics of women included in the analysis. In bivariate analyses (not shown), all studied factors were significantly associated with smoking trajectories. **Table 2**

presents the results of multinomial multivariable regression analyses, in which non-smokers served as the reference category. Odds Ratios (OR) for factors significantly associated with persistent heavy smoking ranged from 1.22, (95% CI: 1.00 to 1.49) for employment status to 8.70, (95% CI: 7.39 to 10.20) for partner's tobacco use. These factors were: being native French, older than 30 years, low educational level, financial difficulties, low occupational grade, joblessness, psychological difficulties, alcohol use during pregnancy, mistimed pregnancy and formula feeding. Additionally, persistent heavy smoking was associated with partner's tobacco use, and low/ absent partner's support, as well as having delivered in a public maternity unit. Except for age, perceived financial problems, employment status, and maternity unit type, the same factors were also associated with persistent moderate smoking. However, associations were of a lesser magnitude, with ORs ranging from 1.26, (95% CI 1.05 to 1.50) for psychological difficulties to 6.64, (95% CI 5.74 to 7.68) for partner's tobacco use.

Additionally, persistent moderate smoking was also associated with pre-pregnancy weight, such that overweight women, whether they had a previous experience of dieting or not, were less likely to belong to this group than women who were of normal weight.

In secondary analyses in which 'quitters' served as the reference category (supplementary table S1), factors that significantly distinguished persistent moderate smokers included migrant status ($OR_{2nd\ generation / native\ French} = 1.27$ (95% CI: 1.05 to 1.54)).

DISCUSSION

Key results

Using data from a large nationally representative contemporary cohort study of women giving birth in France, we found four trajectories of maternal tobacco use in the perinatal period: non-smokers (59%), quitters (20%), moderate smokers who continued smoking (12%), and persistent heavy smokers (9%).

Our results show a graded association between women's likelihood and degree of smoking and several socio-demographic, health, behavioral and partner characteristics. Adding to prior research, we found that most characteristics associated with persistent heavy smoking are also associated with moderate smoking during pregnancy but to a lesser degree. Additionally, some characteristics have distinct associations; for example, first and second generation migrants are less likely to be heavy smokers, but second generation migrant women who smoke moderately are less likely to quit during pregnancy than native French women. Additionally, maternal age of 30 years or above is associated with persistent heavy smoking, but among moderate smokers older women are more likely to quit than young smokers. Further, prior weight-loss dieting is not

associated with heavy smoking, but predicts the likelihood of quitting during pregnancy among women who smoke moderately.

Interpretation

Migrant status

Native French women were more likely to smoke than second and especially first generation migrants. This may be explained by levels of acculturation; the prevalence of smoking among women in France is higher than in regions such as North and sub-Saharan Africa [23], which is where most of the first generation migrant women giving birth in France come from [14].

However, second generation women who smoked moderately were less likely to quit during pregnancy than the native French. This might reflect a combination of women's transition towards the risk behaviors of native French women, as well as stressors that are specific to women of migrant origin [24].

Social, demographic and economic characteristics

Younger women (>30 years) were less likely to be persistent heavy smokers than older women, which is consistent with other research [25]. In contrast, younger women were less likely to be in the 'quit smoking' group than to the non-smokers group. Older women who smoke for a long time and have high levels of nicotine dependence may be least motivated to quit smoking and, therefore, may deserve particular attention from health professionals [9].

Our results also conform that low SES, ascertained using low educational level, low occupational grade and perceived financial difficulties, is associated with women's persistent smoking during pregnancy [26]. Furthermore, we found that low SES predicts not only heavy smoking but also the persistence of smoking among women who were moderate smokers. The mechanisms behind these associations are probably complex and may involve low risk perception [27], psychological stress linked to social adversity [28,29], as well nicotine dependence.[30]

Weight-loss diet

Regardless of their BMI status, moderate smokers who underwent a weight-loss diet were more likely to quit during pregnancy, which may be indicative of motivation or confidence in the ability to control weight after quitting [31]. It could also be related to high perceived self-efficacy to successfully change health-related behavior.

Partner characteristics

Women whose partner is an active smoker have an elevated likelihood of persistent smoking throughout pregnancy and beyond [9]. This may be explained by easy access to cigarettes as well as frequent smoking-promoting social cues. Importantly, this implies that in order to encourage women's smoking cessation efforts in the perinatal period, partner's tobacco use should also be

taken into consideration. Additionally low partner support and single-parent status are associated with persistent smoking, possibly through low self-esteem, high stress and inadequate access to information [32], which can impede smoking cessation efforts.

Perinatal characteristics

In our study, women's persistent tobacco use was systematically associated with alcohol consumption. Alcohol use in pregnancy may be a marker of broader risk taking behavior, lack of self-care and a propensity for addiction [33]. We also found that smoking at moderate or high levels was disproportionately frequent among women who reported psychological difficulties in pregnancy. Heavy smokers have previously been found to have problems in adaptive functioning (psychological distress, low self-esteem, low sense of control) as well as interpersonal relations [34]. Further, depression and other psychological difficulties are known barriers to smoking cessations efforts [35].

These findings suggest that among pregnant women who smoke, health professionals may need to pay particular attention to co-occurring alcohol use and psychological difficulties and address these factors to improve women's chances of quitting.

Additionally, women who reported that their pregnancy was mistimed were more likely to continue smoking than those who did not. Mistimed/unintended pregnancy potentially has bearings on the mother's psychosocial well-being [36], and is associated with high-risk behaviors that include smoking [15] and inadequate use of antenatal care services [37]. From a public health perspective, efforts aiming to help women prevent unplanned pregnancies through widespread access to contraceptives could help reduce the number of babies exposed to maternal smoking and associated adverse pregnancy outcomes. We also found that women who did not breastfeed their infant were more likely to smoke than those who did. Mothers might not want to expose their infant to nicotine and other potentially toxic substances found in cigarettes that can be transmitted through breastmilk [38].

Limitations

This study has several limitations. First, tobacco use was measured using two different methods through maternal self-reports rather than objective measures and could be underreported, especially at maternity where it was measured during a face to face interview. Nevertheless, self-reported smoking levels have been found to be highly correlated with cotinine measures among pregnant women [39], suggesting that underreporting is limited. Second, follow-up was limited to 2 months postpartum. It is possible that some women relapse to smoking beyond that period, for instance after weaning their child, possibly modifying estimated smoking trajectories and associated factors. In France, breast feeding rates are low compared to other industrialized

countries (approximately 70% at birth) and median breast feeding duration is 17 weeks [40,41]. Thus, in our study, even among women who breastfed their child, most had finished by the time postpartum smoking was ascertained. Nevertheless, additional research with longer follow-up would help gain a better understanding of factors that influence postpartum smoking reuptake over the long-term. Third, our analyses may be influenced by selection bias resulting from attrition, particularly among mothers who smoked. This could've resulted in an underestimation of the association between factors such as low partner's support and socio-economic status and smoking trajectories, those factors being also associated with a higher attrition rates in our study. Still, the ELFE study is nationally representative at baseline and the levels of maternal tobacco use observed are comparable to other nationally representative estimates in women giving birth in France (24% and 18% in 2010 and 2014 respectively), which is reassuring as to the generalizability of our findings.

Conclusion, implications

Our study shows that women's smoking trajectories in the perinatal period in the general population vary with the degree of smoking level but also several socio-demographic, health and partner characteristics. In particular, women's migrant status, perception of timing of pregnancy and prior experience of weight loss dieting independently predict the likelihood of decreasing smoking consumption during the perinatal period. These groups of women deserve special attention from health professionals involved in pregnancy care and in the promotion of smoking cessation. In order to be effective and limit health risks for children, smoking cessation programs should include women's partners and be maintained postpartum, especially among the most vulnerable women. Socioeconomically disadvantaged heavy smokers might need longer, more individualized interventions than moderate smokers, including a combination of behavioral programs (behavioral counselling, health education, incentives, social support, etc.) that have been shown to substantially improve the likelihood of smoking cessation in pregnancy [42]. Additionally, these interventions should simultaneously target alcohol consumption. In particular, addressing women's weight gain concern could be a useful component of smoking cessation interventions. In moderate smokers, among whom levels of nicotine dependence are low, addressing women's motivation to smoke and the characteristics of their social environment appears especially important.

Smoking (and alcohol use) could be a form of 'self-medication' among pregnant women experiencing low SES, psychological difficulties and low social support, therefore anti-smoking interventions should be part of a more comprehensive system assisting disadvantaged women.

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DISCLOSURE STATEMENT

All authors have no conflicts of interest to disclose.

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Figure legend

Figure 1: Women's perinatal smoking trajectories (ELFE study, n=15540, 2011)

TABLES

Socio-demographic characteristics (n, %)			Household economic situation (n, %)		
Migrant status	Native French	11987 (77.1%)	Household occupational grade	High	1702 (11.0%)
	2 nd generation	1882 (12.1%)		Intermediate	3167 (20.4%)
	1st generation	1542 (9.9%)		Low	9684 (62.3%)
		None		987 (6.40%)	
Age	>30 years	6465 (41.6%)	Mother's employment status	Working	12558 (80.8%)
	≤ 30 years	9006 (58.0%)		Out of the job market	1801 (11.6%)
Number of children	One	7192 (46.3%)		Unemployed	819 (5.3%)
	≥Two	8348 (53.7%)			
Educational level	< High school	2578 (16.6%)	Father's employment status	Working	14024 (90.2%)
	High school	3068 (19.7%)		Out of the job market	469 (3.0%)
	≥High school	9894 (63.7%)		Unemployed	619 (4.0%)
Residential area	Paris	3038 (19.5%)	Partner's characteristics (n, %)		
	Great Paris region	2614 (16.8%)	Tobacco use	Yes	4365 (28.1%)
	North	1345 (8.70%)		No	8026 (51.6%)
	East	1546 (9.90%)	Social support during pregnancy	Yes	13483 (86.8%)
	West	2229 (14.3%)		No/seldom	1212 (7.80%)
	South-West	1249 (8.00%)		Not in a couple	698 (4.50%)
	Centre-East	1737 (11.2%)	Perinatal characteristics (n, %)		
	Others	1762 (11.3%)	Mistimed pregnancy	No	13581 (87.4%)
		Yes		1791 (11.5%)	
Health characteristics (n, %)					
Psychological difficulties during pregnancy	No	13459 (86.6%)	Alcohol use during pregnancy	No	12626 (81.2%)
	Yes	1927 (12.4%)		<once per month	2230 (14.4%)
Lifetime weight-loss diet	No (Normal BMI)	7843 (50.5%)		≥once per month	609 (3.90%)
	Yes (Normal BMI)	2286 (14.7%)	Child feeding method at birth	Breast feeding	11470 (73.8%)
	No (Overweight)	1720 (11.1%)		Formula	4048 (26.0%)
	Yes (Overweight)	1993 (12.8%)	Maternity type	Private	5301 (34.1%)
		Public		10139 (65.2%)	

Table 1: Characteristics of women participating in the French ELFE study (non-imputed table, n=15,540, n, %). Missing values were included in the percentage calculation.

Table 2: Factors associated with smoking trajectories (ELFE study, n=15,540, 2011): multivariable multinomial analysis (OR, 95% CI)

		Non-smokers n=9226	Quitters n=3068 OR (CI 95%)	Persistent moderate smokers n=1790 OR (CI 95%)	Persistent heavy smokers n=1456 OR (CI 95%)
Migrant Status	French	reference	1	1	1
	2nd generation		0.73 (0.63- 0.83)	0.93 (0.78- 1.10)	0.67 (0.55- 0.82)
	1st generation		0.26 (0.22- 0.32)	0.31 (0.24- 0.40)	0.11 (0.08- 0.16)
Mother's age	>30 years	reference	1	1	1
	<30 years		0.76 (0.69- 0.84)	1.00 (0.88- 1.13)	0.83 (0.72- 0.96)
Educational level	>High school	reference	1	1	1
	< High school		1.31 (1.14- 1.51)	1.97 (1.68- 2.32)	3.91 (3.27- 4.69)
	High school		1.21 (1.07- 1.37)	1.68 (1.45- 1.94)	2.44 (2.05- 2.89)
Number of children	≥Two	reference	1	1	1
	One		1.28 (1.16- 1.40)	1.08 (0.96- 1.22)	1.09 (0.95- 1.25)
Residential area	Paris	reference	1	1	1
	Great Paris Region		1.19 (0.99- 1.43)	0.97 (0.79- 1.19)	1.05 (0.83- 1.33)
	North		0.97 (0.76- 1.23)	0.96 (0.75- 1.23)	1.08 (0.82- 1.43)
	East		1.06 (0.85- 1.33)	0.97 (0.76- 1.23)	1.29 (0.98- 1.69)
	West		1.32 (1.09- 1.61)	1.12 (0.91- 1.39)	1.15 (0.90- 1.49)
	South-West		1.32 (1.05- 1.66)	1.14 (0.89- 1.46)	1.17 (0.87- 1.57)
	Centre-East		1.11 (0.90- 1.37)	1.05 (0.84- 1.33)	1.02 (0.76- 1.36)
Psychological difficulties	Others		1.23 (1.00- 1.51)	1.13 (0.91- 1.41)	1.17 (0.90- 1.52)
	No	reference	1	1	1
	Yes		1.20 (1.06- 1.37)	1.26 (1.05- 1.50)	1.32 (1.09- 1.61)
Lifetime weight-loss diet	No (Normal BMI)	reference	1	1	1
	Yes (Normal BMI)		1.39 (1.23- 1.57)	1.01 (0.85- 1.20)	1.10 (0.89- 1.35)
	No (Overweight)		0.91 (0.79- 1.06)	0.76 (0.60- 0.97)	0.96 (0.78- 1.19)
	Yes (Overweight)		1.24 (1.09- 1.41)	0.72 (0.58- 0.88)	0.91 (0.73- 1.12)
Occupational grade	High professional	reference	1	1	1
	Intermediate		1.05 (0.90- 1.23)	1.19 (0.93- 1.53)	2.45 (1.52- 3.96)
	Low professional		1.19 (1.03- 1.38)	1.49 (1.18- 1.90)	3.49 (2.20- 5.56)
	No occupation		1.04 (0.77- 1.41)	1.49 (1.03- 2.16)	3.38 (1.95- 5.87)
Perceived financial problem	No	reference	1	1	1
	Yes		1.07 (0.98- 1.17)	1.07 (0.95- 1.20)	1.44 (1.26- 1.66)
Mother's	Working	reference	1	1	1

employment status	Out of the job market		0.76 (0.65- 0.91)	0.96 (0.79- 1.15)	1.22 (1.00- 1.49)
	Unemployed		1.19 (0.97- 1.45)	1.21 (0.95- 1.54)	1.67 (1.30- 2.13)
Partner's employment status	Working	reference	1	1	1
	Out of the job market		0.95 (0.72- 1.24)	0.86 (0.63- 1.18)	0.94 (0.68- 1.31)
	Unemployed		0.99 (0.77- 1.27)	0.90 (0.68- 1.18)	1.10 (0.84- 1.45)
Alcohol use during pregnancy	No	reference	1	1	1
	<once per month		1.29 (1.15- 1.45)	1.44 (1.23- 1.68)	1.41 (1.17- 1.71)
	≥once per month		1.58 (1.27- 1.96)	2.14 (1.64- 2.79)	3.13 (2.33- 4.2)
Mistimed pregnancy	Yes	reference	1	1	1
	No		1.09 (0.95- 1.26)	1.31 (1.11- 1.55)	1.64 (1.37- 1.95)
Child feeding method at birth	Breast feeding	reference	1	1	1
	Formula		0.88 (0.80- 0.98)	1.47 (1.30- 1.66)	2.05 (1.79- 2.35)
Partner's tobacco use	No	reference	1	1	1
	Yes		1.67 (1.52- 1.84)	6.64 (5.74- 7.68)	8.70 (7.39- 10.20)
Partner's support during pregnancy	Yes	reference	1	1	1
	No/seldom		0.95(0.81- 1.12)	1.24 (1.02- 1.50)	1.24(0.99- 1.54)
	Not in a couple		0.90(0.69- 1.18)	1.37 (0.98- 1.92)	2.32(1.69- 3.19)
Maternity type	Private	reference	1	1	1
	Public		0.95 (0.84- 1.06)	0.94 (0.83- 1.07)	1.22 (1.05- 1.41)