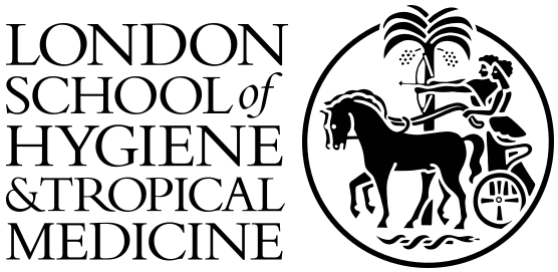

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"Does gravidity influence smoking behaviour in pregnancy? A comparison of multigravid and primigravid women from a population-based UK study using data from the National Women's Health Study."

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Summary

This study used the data from a retrospective cross-sectional survey to describe the prevalence of smoking in pregnancy in a large UK sample, over more than 20 years of pregnancies. The main objective was to determine whether women in their second or subsequent pregnancy are more or less likely to change their smoking behaviour compared to primigravidas.

The participants were 7506 ever-pregnant women, from 7702 who answered the second stage of a survey of reproductive history in 2001-2002, sent to 10,828 women, aged 18-55 on the UK electoral register. These women gave detailed information on their last pregnancy. The main outcome measure was self-reported cigarette consumption in the first trimester of pregnancy.

19% (1417/7506) women in this sample smoked in the first trimester of the reported pregnancy. The data showed that there had been a decrease over the last 20 years in smoking prevalence, but this trend was not statistically significant after adjustment for confounding (P_{trend} =0.07). There was evidence that multigravid women were more likely to smoke in their pregnancies than were primigravidas (adjusted OR=1.24, 95%CI 1.01 to 1.53), with a highly significant trend with increasing pregnancy order (P_{trend}<0.0001). Over time, women who reported smoking before pregnancy (n=1926), showed a decreasing trend in continuing to smoke the same amount after recognising their pregnancies (P_{trend}<0.0001). After adjustment, multigravid smokers were almost 75% more likely than primigravid smokers to continue to smoke with no change in consumption (adjusted OR=1.74, 95%CI 1.32 to 2.28), with a clear trend found with increasing pregnancy order (P_{trend}=0.001).

In this UK population-based study, multigravidas were more likely to smoke in pregnancy than women pregnant for the first time. If already a smoker, they were much less likely to cut down their smoking once they found out they were pregnant, regardless of age. This suggests that a great deal of the burden of morbidity associated with smoking in pregnancy is in the multigravid group.

Introduction

The negative effects of smoking during pregnancy are well known[1]. As well as the direct impact on families of increased perinatal (and sometimes maternal) morbidity and mortality, smoking during pregnancy places an extra burden on the Health Service. The Government's "Smoking Kills" white paper[2] reports that the associated costs amount to three to six times the cost of smoking cessation interventions. Multiparous women will also affect the health of their existing children if they smoke during a new pregnancy.

The white paper includes a long-term target to reduce the number of pregnant women who smoke from the 23% baseline found in the Infant Feeding Survey (IFS) of 1995[3] to 15% by the year 2010. If successful, this will have a particular impact on families of lower socio-economic status (SES), as a higher proportion of women in these groups smoke. The Government has called the reduction of the number of pregnant women smoking a "key intervention" for reducing health inequalities.[4]

Coleman's review[5] asserts that around 10% of pregnant women who smoke will stop when they realise they are pregnant, and that 6 or 7% more can be encouraged to stop with appropriate intervention. He advises that GPs and midwives should identify motivated women and refer them for individual intensive intervention delivered by specialists, but who are these women?

We need to know more about the needs of different groups within the population of pregnant smokers, who the "motivated" women might be and who might need particular help to become motivated. Some links are well-established, such as that between SES or having a partner who smokes and the likelihood that a woman will smoke through her pregnancy.[6 7] However, other groups' smoking patterns may also differ and knowing more about these could help to target smoking cessation resources more effectively.

Surveys undertaken in Britain[3 6 7] have not distinguished between women in their first or subsequent pregnancies. However, there is evidence from studies in other countries that these women may have different rates of smoking. Primigravidas in both a Spanish[8] and an American study[9] were more likely to give up than their multigravid counterparts; and more multiparous smokers in a Swedish study[10] continued smoking than did primiparas.

The aims of this study were twofold: to assess the prevalence of smoking in the pregnancies of this cross-section of women; and to determine the extent to which women smokers change their smoking behaviour when they become pregnant. In particular, we investigated whether women embarking on a second or subsequent pregnancy are more or less likely to change their smoking behaviour compared to primigravidas.

Methods

Using data from the National Women's Health Study (NWHS),[11] a cross-sectional survey of women's reproductive histories undertaken in 2001-2002, we looked at patterns of smoking during the first twelve weeks of pregnancy.

The NWHS used the UK electoral register as the sampling frame, sending a postal questionnaire to approximately 61,000 randomly chosen women believed to be 55 years old or younger, using an algorithm which assigned probable age based on first name. This algorithm used empirical data from birth certificates of the 20th century, such that certain names were judged to be more likely to be over 55 (e.g. Elsie) or under (e.g. Kylie). This was further refined by looking at the other names in the household and at how long a woman had lived at an address after registering to vote.

Maximum age was restricted to 55 years old to maximise the number of women responding who had started their reproductive careers and to minimise the length of time since women's last pregnancy. The pregnancies reported were conceived from before 1980 until 2002, the earliest reported pregnancy being in 1965, with 13% of all reported pregnancies before 1980 and three quarters since 1985 (74%).

The aim of the NWHS was to gather a large unbiased dataset that could be used to investigate the prevalence of miscarriage and infertility, as well as risk factors for these and other adverse outcomes of pregnancy. The survey consisted of two stages: Stage One was a one-page screening questionnaire and 26,050 (46%) of these were returned by the addressee. Some of these respondents had never attempted to have children or were ineligible: for example because the women were over 55 years. This left 13,035 women in the dataset who had ever tried to have children.

The average age at survey for the NWHS was around 40 years old, with average ages at first birth very similar to national data (see below) which might indicate that non-

responders tended to be younger women who had not yet started their reproductive careers. Little other information was available on non-responders as the sample was from the electoral register.

The emotive and intimate subject matter of this survey meant that the response rate was not expected to be high. However, to try to verify that the results would be generalisable, the data were examined against national statistics for England and Wales 1980 – 2001 (with data for 2002 estimated from 2001). Births in the survey from 1980 – 2002 were used in this comparison to establish whether the births reported were a representative sample of births in the population, and thus that the women were representative of the general population in terms of their reproductive histories.

The national data provided maternal age at first birth, as well as stillbirth and multiple delivery rates by maternal age. These two latter key reproductive indicators were then used to produce standardised registered stillbirth ratios (SRSR) and standardised multiple delivery rates (SMDR). The results of these analyses showed no statistical differences existed between the national data and the survey data.

Maternal age at first birth was very similar in both datasets, with no evidence to suggest any biases. Average age at first birth was slightly higher in the national data as it only included births within marriage whereas the NWHS included all births.

Stage Two consisted of a more detailed questionnaire sent to 10,828 women who had reported ever being pregnant or ever trying to conceive, and who had agreed to be contacted again. 7702 women (71%) completed this detailed questionnaire[11] which asked for much more information about the woman herself and the pregnancies she had had, including detailed questions about behaviour, lifestyle and socio-demographic characteristics of the women in the three months prior to, and the first trimester of their last pregnancy. The woman's last pregnancy was chosen in order to minimise recall bias and is referred to as the index pregnancy. Women whose most recent pregnancy ended in a termination for any reason were excluded from all analyses.

Two main analyses were carried for this current study: a descriptive analysis to determine the prevalence of smoking during the first 12 weeks of pregnancy in this sample, regardless of pregnancy outcome; and an analysis to explore which women

smokers changed their smoking behaviour (cut down or stopped) in the first 12 weeks of pregnancy.

This second analysis excluded never-smokers or those who gave up well before they became pregnant (i.e. they reported not smoking at all in the three months before pregnancy), leaving only women reporting smoking in the three months before conception (n=2509/7506, 27%). Among these, women whose pregnancies lasted 12 weeks or less (n=133/2059, 7%) were also excluded, as these women may not have had "time" to change their smoking behaviour or may have been more likely to misreport their smoking. This left 1926 women in the analysis.

The outcome of interest was cigarette consumption in the first trimester, grouped as "never smoked", "stopped", "smoked <5 cigarettes a day", "5-10", "10-20" and ">20". Women who smoked before pregnancy were then grouped according to whether their reported consumption stayed the same, increased, reduced or stopped completely in the first 12 weeks. Women who moved from one category to a lower one were considered to have "reduced" their consumption.

The main factor of interest was gravidity. This was treated both as an ordered categorical variable and, separately, as a binary variable comparing women in their first pregnancy (primigravidas) to all women reporting a second or subsequent pregnancy (multigravidas). All the information used for the analyses related to the first 12 weeks of the index pregnancy.

Potential confounding was explored using multivariable logistic regression for the following factors: age at conception, nausea, alcohol consumption, paternal smoking, traumatic or stressful events, education level, socio-economic status, year of conception and working status (full- or part-time, at home, or unemployed or a student). Potential interactions between gravidity and year of conception, and between gravidity and maternal age, were included in the models and assessed through likelihood ratio tests.

The smoking of women who had had some difficulty or negative outcome associated with pregnancy was examined in a separate analysis. We had data on a limited number of problems. For all women we had data on: time taken to conceive the pregnancy (where >12 months was considered "a problem" for these purposes) and

whether they had fertility treatment to conceive the pregnancy; and additionally for multigravidas: whether they had ever had pre-eclampsia, a miscarriage or a live birth.

Results

7508 (97%) of the women who completed the second stage questionnaire (n=7702) had ever been pregnant. Two of these women were excluded from this analysis as their forms contained almost no information about behaviour in their last pregnancy, giving a sample size of 7506 women.

80% (6035/7506) of women in this sample were multigravid (93% of whom had had a live birth) and 85% (5140/6035) of the multigravid group were 25 years old or over (Table 1). 74% (5538/7506) of all the index pregnancies were conceived since 1985.

Smoking prevalence among all women

Almost one in five women in this sample smoked in the first trimester of the index pregnancy (19%, 1417/7506, Table 1). This was significantly less than the 27% (2059/7506) who smoked before they were pregnant ($p<0.0001$, χ^2 test, 1df). Under 25 year-olds were the group most likely to smoke in pregnancy with a prevalence of 34% (456/1337), but again, this was far fewer than the 47% (623/1337) who smoked before pregnancy ($p<0.0001$, χ^2 test, 1df). There was some evidence that older mothers (aged 30 and over) smoked less in pregnancy compared to the largest 25-29 year-old age group, with strong evidence of a trend of decreasing prevalence with increasing maternal age ($P_{trend}<0.0001$, Table 2).

The data showed that there had been a decrease in smoking prevalence in the first trimester of pregnancy over time: from 25% (237/964) of women who conceived before 1980 down to 16% (189/1177) in 2000-2002 (Table 1). However, this trend over time disappeared after adjustment for confounding, with only those who conceived before 1980 showing some tendency towards more smoking (adjusted OR=1.19, 95%CI 0.95, 1.50; Table 2).

With all other factors accounted for, there was some evidence that women were more likely to smoke in the first trimester of second or subsequent pregnancies than in

their first (adjusted OR=1.24, 95%CI 1.01, 1.53; Table 2). Examining pregnancy order in more detail showed a strong trend in odds of smoking with increasing pregnancy order (P_{trend}<0.0001). Although women in their first or second pregnancy were similar with respect to smoking behaviour (adjusted OR for a second pregnancy=1.11, 95%CI 0.90, 1.38), women in their third, and especially their fourth pregnancy, were more likely to smoke (Figure 1). The relationship between smoking in pregnancy and pregnancy order was constant over time, adjustment for calendar period having little effect on the estimates.

Figure 1: Trends of ORs for women smoking in the first 12 weeks of pregnancy by pregnancy order

Among women who smoked before pregnancy

Among the women who reported smoking before pregnancy (n=1926), over half changed their smoking habits, with 17% (256/1542) of those who smoked more than 10 cigarettes a day cutting down to less than 5. However, 44% of smokers (841/1926) continued their smoking habit unchanged after becoming pregnant.

Women smokers under 25 years had the highest odds of continuing to smoke in pregnancy, compared to women aged 25-29 (adjusted OR=1.52, 95%CI 1.17, 1.98), but there was little evidence of any difference between the other age groups and no evidence of a trend (P_{trend}=0.919, Table 3).

Smokers conceiving before 1980 were most likely to continue their smoking habit with no reduction (adjusted OR=2.09, 95%CI 1.50, 2.91; Table 3). There was a generally decreasing trend over time in those continuing to smoke unchanged, women who conceived from 2000-2002 having a 30% lower odds of continuing to smoke the same amount than those in 1995-1999 (adjusted OR=0.71, 95%CI 0.50, 1.01; Table 3).

After adjustment, multigravid smokers were almost 75% more likely than a smoker starting her first pregnancy not to cut down or stop in pregnancy (adjusted OR=1.74, 95%CI 1.32, 2.28; Table 3), with a very clear trend found with increasing pregnancy order (P_{trend}=0.001, Figure 2).

Figure 2: Trends of ORs for smokers continuing to smoke with no reduction ("continuing") in the first 12 weeks of pregnancy by pregnancy order

These analyses were repeated including only those pregnancies that resulted in live births and produced virtually identical results. We found no evidence for interaction between gravidity and year of conception (likelihood ratio test (LRT), p=0.722) or between gravidity and maternal age (LRT, p=0.940).

Several adverse outcomes studied were found to be associated with a reduction in the odds of continuing to smoke in the first trimester, however, the small numbers involved in analysis of smokers continuing meant that many of the confidence intervals were very wide and few robust effects were found (Table 4).

Discussion

Although younger women are more likely to smoke in pregnancy, multigravidas (who are generally over 25) make up the majority of pregnant women. They are more likely to smoke in pregnancy than women pregnant for the first time, and much more likely to continue to smoke with no change if already a smoker, regardless of age in both cases. In other words, primigravidas are more likely to give up, or at least cut down, when they find out they are pregnant. This suggests that a great deal of the burden of morbidity associated with smoking in pregnancy is in the multigravid group.

This study is an exploration of a recent survey of women providing an opportunity to examine the behaviour and lifestyle choices in pregnancy of a large representative sample of UK women. It presents information about what may contribute to a woman choosing to or being able to reduce her smoking in pregnancy. This study also provides an analysis of which smokers do not change their habits once they know they are pregnant, giving an insight into who is motivated or has the support to reduce their consumption, and who might need more intensive smoking cessation advice. These results argue for more targeting of older, multigravid women.

The data included many variables so it was possible to explore a great number of risk factors for smoking in pregnancy and examine them as potential confounders in the

models reported here. The associations found can be viewed with some confidence, due to the large sample size.

When relying on self-reported information there is always the possibility that women may not report their behaviour accurately, especially when the topics are emotive ones like pregnancy and smoking. Under-reporting of the level of cigarette consumption may be an issue: when one-off self-report is compared with blood or urine cotinine levels, under-reporting has consistently been found.[12-14]It is a possibility in this data, partly because it was collected retrospectively: a problem from which other surveys have suffered.[6 7] The HEA Survey[6] was administered while women were pregnant and they found an average of 27% of pregnant women smoking in pregnancy over their 9 surveys (compared 23% in the IFS survey[6 7]), and this went as high as 30% in 1999.

The NWHS questionnaires offered women pre-set categories (as opposed to an open-ended invitation to give their own figure) and although there are sound reasons for this design, people have a tendency to round their cigarette consumption down to the nearest 10 which could have led to further under-reporting[15]. This is especially likely to have had an impact on the analysis of who continued to smoke unchanged as two self-categorisations were used to compute the variable of who "cut down". Some women who felt they had made a real effort to cut down might have put themselves into two different categories, when in reality the reduction may have only been 2-3 cigarettes a day. Conversely, a woman who accurately reported smoking 18-19 cigarettes a day before pregnancy to 11-12 during, would not be seen to have reduced using these categories.

Women often fluctuate in their cigarette consumption during pregnancy as they try to stop or cut down and then relapse; because of this a retrospective "reconstruction" of pregnancy smoking history may well be the best measure, despite the difficulties outlined above.[16] Pickett's (2005) study of variations of smoking in pregnancy found that self-report may be a more accurate way of assessing women's smoking in pregnancy than cotinine levels – unless an impractical number of repeated cotinine measures are taken. They assert that researchers' suspicion of the validity of self-report is unwarranted, shown by the "substantial associations" they found between cotinine-assessed smoking status and self-reported number of cigarettes.

The implications for this study are that we should be able to view the women's self-reported cigarette consumption with some confidence, but that, if anything, the prevalence and level of smoking may be even higher than these data would suggest, and that our results are a conservative estimate of a pressing problem.

This was a retrospective cross-section of smoking behaviour that covered pregnancies going back over 20 years. We cannot assume that it fully represents current demographic or behaviour profiles.

However, the period from 1980 until 2000 showed little evidence for a clear trend towards reduced smoking in pregnancy. It may be that the profile of women who are pregnant has changed during this time too, and with these factors adjusted for, the effect of calendar period is less marked. Also, recall difficulties may lead women with pregnancies started over 20 years ago to tick the same boxes for before and during pregnancy, and because of this they appeared to continue smoking more.

However, Yawn's study[17] found that women had good recall for obstetric outcomes 10 to 15 years before including 99.5% of women being able to remember if they smoked, although that study did not ask how much they smoked. Kesmodel and Olsen[18] found that, over shorter time periods, recall of smoking was accurate independently of both time and the outcome of the pregnancy, with the suggestion of some over-reporting with longer time intervals.

Indeed, women who had pregnancies before 1980 were more likely to report being smokers and continuing to smoke, some possibly because felt they could be more honest. The General Household Survey (GHS)[15] suggests that women reporting more recent pregnancies might find it harder to be honest about their smoking: "…as smoking has become less acceptable as a social habit, some people may be less inclined to admit how much they smoke, or to admit to smoking at all".

Conversely, women whose pregnancies started in 2000-2002 were less likely to keep smoking at the same level and this may reflect better recall or could be a real response to recent health education messages, as reflected also by the crude drop in smoking prevalence in pregnancy found over time.

There may be some difference in recall for primigravidas and multigravidas, as women who have only had one pregnancy are likely to remember the details of their

behaviour better than those who have had two or more pregnancies, in which they may have behaved differently.

Pregnant women form one of the UK government's "priority groups" for smoking cessation services. However, with limited resources available it remains important for all clinicians to be aware of which pregnant women are more at risk of continuing to smoke. They need to target certain groups of pregnant women and this study found some evidence of smoking in groups that may sometimes be overlooked. Women who have already had a normal pregnancy may see less of their health professionals than primigravidas, but in terms of smoking the former need more, not less, contact with antenatal carers and might particularly benefit from intensive advice if they have smoked in a previous pregnancy.

Primigravidas may generally be more cautious during their first experience of pregnancy than women who have previously delivered a child, as well as having more contact with health professionals. They may also respond more to antismoking advice.[19] Women who have smoked in a previous pregnancy are likely to be set in this behaviour pattern,[10 20] especially if they smoked in their previous pregnancies with no negative consequences.

It is multigravid women, who may have smoked through a pregnancy before, that this study suggests might be most in need of interventions, and yet this group may be the most resistant. It remains a challenge to smoking cessation services with limited resources to target these women, and maintain support for them through pregnancy. More research and ongoing monitoring is needed to provide them with the best service.

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Table 1: Selected characteristics of women with different smoking behaviours in pregnancy

Study population N=7506	Smoked in the first 12 weeks of pregnancy, n (%)	Gave up in the first 12 weeks of pregnancy, n (%) [a]	Did not smoke in pregnancy [b], n (%)	Totals, n (%)	Smoking data missing, n (%)
Pregnancy order					
1st	307 (21)	167 (12)	967 (67)	1441 (100)	30 (2)
2nd	517 (17)	226 (7)	2390 (76)	3133 (100)	24 (0.8)
3rd	327 (19)	137 (8)	1238 (73)	1702 (100)	19 (1)
4th	194 (25)	67 (9)	529 (67)	790 (100)	4 (0.5)
5th or more	72 (20)	32 (9)	256 (71)	360 (100)	3 (0.8)
2nd or subsequent	*1110 (19)*	*462 (8)*	*4413 (74)*	*5985 (100)*	*50 (0.8)*
Mother's age					
<25 yrs	456 (34)	153 (11)	728 (55)	1337 (100)	34 (3)
25-29 yrs	475 (18)	247 (9)	1964 (73)	2686 (100)	22 (0.8)
30-34 yrs	341 (15)	161 (7)	1829 (79)	2331 (100)	22 (0.9)
35-39 yrs	119 (13)	61 (7)	735 (80)	915 (100)	2 (0.2)
≥ 40	26 (17)	7 (5)	124 (79)	157 (100)	0 (0)
Year of conception					
<1980	237 (25)	93 (10)	634 (66)	964 (100)	13 (1)
1980-1984	180 (20)	87 (9)	657 (71)	924 (100)	15 (2)
1985-1989	207 (20)	78 (8)	755 (73)	1040 (100)	9 (1)
1990-1994	240 (19)	88 (7)	960 (75)	1288 (100)	9 (1)
1995-1999	364 (18)	166 (8)	1503 (74)	2033 (100)	17 (1)
2000-2002	189 (16)	117 (10)	871 (74)	1177 (100)	17 (1)
Total, n (%)	1417 (19)	629 (9)	5380 (73)	7426 (100)	80 (1)

[a] these women reported giving up when they found out they were pregnant

[b] or in the 3 months prior to conception

Table 2: Who smokes in pregnancy?

Pregnancy order, age and calendar period of conception of women who smoked in the first 12 weeks of pregnancy

	Women smoking in pregnancy [a]				
	Smoked in the first 12 weeks, n (%row)	Crude OR [b] [95%CI]	P value	Adjusted OR [c] [95%CI]	P_{trend}
Pregnancy order			<0.0001		<0.0001
1st	307 (21)	1 [d]		**1** [d]	
2nd	517 (17)	0.73 [0.62, 0.85]		**1.11 [0.90, 1.38]**	
3rd	327 (19)	0.88 [0.74, 1.05]		**1.34 [1.05, 1.71]**	
4th	194 (25)	1.20 [0.98, 1.48]		**1.98 [1.49, 2.64]**	
5th or more	72 (20)	0.92 [0.69, 1.23]		**1.57 [1.06, 2.33]**	
2nd or subsequent	*1110 (19)*	*0.84 [0.73, 0.97]*	*<0.0001*	***1.24 [1.01, 1.53]***	-
Mother's age			<0.0001		<0.0001
<25 yrs	456 (34)	2.41 [2.07, 2.80]		1.68 [1.39, 2.03]	
25-29 yrs	475 (18)	1 [d]		1 [d]	
30-34 yrs	341 (15)	0.80 [0.69, 0.93]		0.92 [0.77, 1.11]	
35-39 yrs	119 (13)	0.70 [0.56, 0.86]		0.77 [0.60, 1.00]	
≥ 40	26 (17)	0.92 [0.60, 1.42]		0.74 [0.43, 1.29]	
Year of conception			<0.0001		0.065
<1980	237 (25)	1.49 [1.24, 1.80]		1.19 [0.95, 1.50]	
1980-1984	180 (20)	1.11 [0.91, 1.35]		1.03 [0.81, 1.32]	
1985-1989	207 (20)	1.14 [0.94, 1.38]		1.15 [0.92, 1.44]	
1990-1994	240 (19)	1.05 [0.88, 1.26]		1.02 [0.82, 1.26]	
1995-1999	364 (18)	1 [d]		1 [d]	
2000-2002	189 (16)	0.88 [0.72, 1.06]		0.94 [0.75, 1.17]	

[a] excluding those with missing smoking information, n=80 (1%)

[b] ORs comparing women who smoked in pregnancy with those who never smoked or stopped in the first 12 weeks

[c] adjusted for pregnancy order, mother's age, nausea, alcohol consumption, father's smoking, number of traumatic events, SES and working status

[d] reference group

Table 3: Which smokers continue into pregnancy with no change to their habit?

Pregnancy order, age and calendar period of conception of women who smoked before pregnancy

	Of those who smoked before pregnancy (n=1926):				
	Continued unchanged, n (% row)	Crude OR [a] [95%CI]	P value	Adjusted OR [b] [95%CI]	P_{trend}
Pregnancy order			<0.0001		0.001
1st	150 (34)	1 [c]		**1** [c]	
2nd	344 (48)	1.78 [1.39, 2.28]		**1.74 [1.31, 2.34]**	
3rd	183 (42)	1.42 [1.08, 1.87]		**1.48 [1.07, 2.06]**	
4th	129 (54)	2.24 [1.63, 3.09]		**2.28 [1.55, 3.34]**	
5th or more	35 (46)	1.65 [1.01, 2.70]		**1.88 [1.08, 3.28]**	
2nd or subsequent	*691 (47)*	*1.73 [1.38, 2.16]*	*<0.0001*	***1.74 [1.32, 2.28]***	
Mother's age			0.0001		0.919
<25 yrs	302 (53)	1.67 [1.33, 2.08]		1.52 [1.17, 1.98]	
25-29 yrs	275 (40)	1 [c]		1 [c]	
30-34 yrs	188 (41)	1.03 [0.81, 1.23]		1.34 [1.02, 1.76]	
35-39 yrs	66 (42)	1.09 [0.77, 1.30]		1.41 [0.96, 2.07]	
≥ 40	10 (45)	1.23 [0.50, 1.98]		1.52 [0.52, 4.43]	
Year of conception			<0.0001		<0.0001
<1980	195 (61)	2.33 [1.75, 3.10]		2.09 [1.50, 2.91]	
1980-1984	115 (45)	1.22 [0.90, 1.66]		1.10 [0.78, 1.55]	
1985-1989	123 (46)	1.31 [0.97, 1.77]		1.23 [0.88, 1.71]	
1990-1994	131 (43)	1.13 [0.85, 1.50]		1.04 [0.76, 1.43]	
1995-1999	200 (40)	1 [c]		1 [c]	
2000-2002	77 (31)	0.67 [0.49, 0.93]		0.71 [0.50, 1.01]	

[a] ORs comparing smokers who continued with no reduction in pregnancy (n=841) with those who stopped or cut down (excluding women who never smoked, n=5380 (73%) and/or whose last pregnancy lasted ≤12 weeks, n=442 (6%))

[b] adjusted for pregnancy order, mother's age, nausea, alcohol consumption, father's smoking, SES and calendar period

[c] reference group

Table 4: Do women who have previous problems in pregnancy change their smoking habits?

Time spent trying to conceive, fertility treatment, pre-eclampsia, miscarriage and live birth related to continuing to smoke in the first 12 weeks of pregnancy. Excluding those who never smoked, n=5380 (72.5%) and/or whose last pregnancy lasted ≤12 weeks, n=442 (5.9%)

	n(%) who continued smoking [a]	Crude OR [95%CI]	P value	Adjusted OR [b] [95%CI]
Problems conceiving the index pregnancy				
(Previous smokers, gestation >12 weeks, n=1904)				
Time spent trying to conceive [c]			0.0353	
<12 mths (planned)	365 (40.6)	1[d]		1[d]
>12 mths (planned)	53 (41.7)	1.05 [0.72-1.53]		1.30 [0.86-1.96]
Unplanned	315 (47.1)	1.30 [1.06-1.59]		1.24 [0.99-1.57]
Fertility treatment			0.0877	
No	832 (44.4)	1[d]		1[d]
Yes	8 (28.6)	0.50 [0.22-1.14]		0.84 [0.35-2.03]
Problems in previous pregnancies				
(Previous smokers reporting 2nd or subsequent pregnancy, gestation >12weeks, n=1464)				
Previous pre-eclampsia			0.0149	
No	688 (47.5)	1[d]		1[d]
Yes	2 (15.4)	0.20 [0.04-0.91]		0.24 [0.05-1.12]
Previous miscarriage			0.0193	
No	562 (48.7)	1[d]		1[d]
Yes	128 (41.3)	0.74 [0.57-0.95]		0.81 [0.61-1.07]
Ever had a live birth			0.1519	
No	50 (41.0)	1[d]		1[d]
Yes	640 (47.7)	1.31 [0.90-1.92]		1.22 [0.80-1.85]

[a] excluding missing smoking information, n=22 (1.2%)

[b] adjusted for mother's age, nausea, alcohol consumption, father's smoking and SES

- time spent trying to conceive and fertility treatment: additionally adjusted for pregnancy order

[c] excludes those who answered "don't know" n=894 (11.9%)

[d] reference group

Figure 1: Trends of ORs for women smoking in the first 12 weeks of pregnancy by pregnancy order

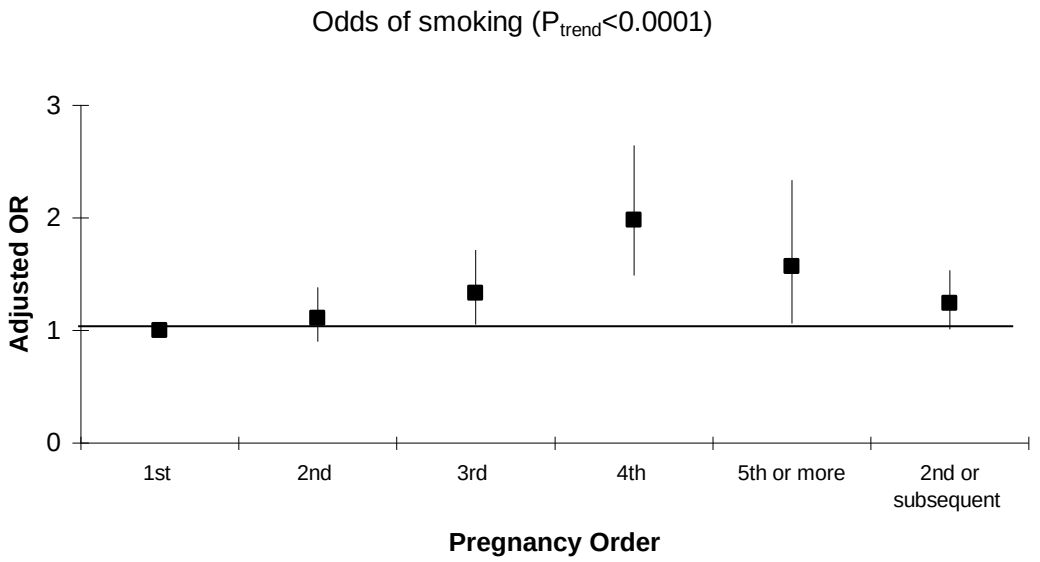
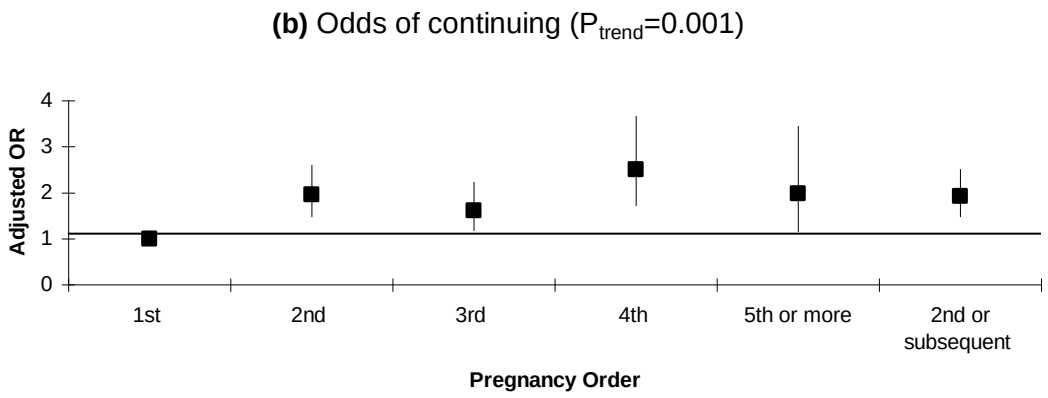


Figure 2: Trends of ORs for smokers continuing to smoke with no reduction ("continuing") in the first 12 weeks of pregnancy by pregnancy order



References

1. Lumley J, Oliver SS, Chamberlain C, Oakley L. Interventions for promoting smoking cessation during pregnancy. *Cochrane Database Systematic Review* 2004(4):CD001055.
2. Department of Health. *Smoking Kills - A White Paper on Tobacco*: London: The Stationery Office, 1998.
3. Foster K, Lader D, Cheesborough S. *Infant Feeding 1995: Office for National Statistics*: London: The Stationery Office, 1997.
4. Department of Health. *Statistics on smoking: England, 2003*: London, Department of Health (Statistical Bulletin 2003/21), 2003.
5. Coleman T. Special groups of smokers. *British Medical Journal* 2004;328(7439):575-577.
6. Owen L, Penn G. *Smoking and pregnancy: a survey of knowledge, attitudes and behaviour, 1992-9*: London: Health Education Authority, 1999.
7. BRMB International. *Infant Feeding Survey 2000*: London: The Stationery Office, 2002.
8. Pichini S, Puig C, Garcia-Algar O, Pacifici R, Figueroa C, Vall O, et al. Neonatal effects of smoking habit during pregnancy and sociodemographic determinants in Barcelona, Spain. *Medicina Clinica* 2002;118(2):53-56.
9. Quinn VP, Mullen PD, Ershoff DH. Women who stop smoking spontaneously prior to prenatal care and predictors of relapse before delivery. *Addictive Behaviors* 1991;16(1-2):29-40.
10. Hakansson A, Lendahls L, Petersson C. Which women stop smoking? A population-based study of 403 pregnant smokers. *Acta Obstetrica et Gynecologica Scandinavica* 1999;78(3):217-24.
11. Maconochie N, Doyle P, Prior S. The National Women's Health Study: assembly and description of a population-based reproductive cohort. *BMC Public Health* 2004;4(1):35.
12. Moore L, Campbell R, Whelan A, Mills N, Lupton P, Misselbrook E, et al. Self help smoking cessation in pregnancy: cluster randomised controlled trial. *British Medical Journal* 2002;325:1383.
13. Lawrence T, Aveyard P, Croghan E. What happens to women's self-reported cigarette consumption and urinary cotinine levels in pregnancy? *Addiction* 2003;98(9):1315-20.
14. Jedrychowski W, Whyatt RM, Cooper TB, Flak E, Perera FP. Exposure misclassification error in studies on prenatal effects of tobacco smoking in pregnancy and the birth weight of children. *Journal of Exposure Analysis and Environmental Epidemiology* 1998;8(3):347-57.
15. Office for National Statistics. *Living in Britain: Results from the 2001 General Household Survey*: London: The Stationary Office, 2002.
16. Pickett KE, Rathouz PJ, Kasza K, Wakschlag LS, Wright R. Self-reported smoking, cotinine levels, and patterns of smoking in pregnancy. *Paediatric and Perinatal Epidemiology* 2005;19(5):368-76.
17. Yawn BP, Suman VJ, Jacobsen SJ. Maternal recall of distant pregnancy events. *Journal of Clinical Epidemiology* 1998;51(5):399-405.
18. Kesmodel U, Olsen SF. Smoking habits among pregnant Danish women: reliability of information recorded after delivery. *Journal of Epidemiology and Community Health* 1999;53(4):239-242.
19. MacArthur C, Newton JR, Knox EG. Effect of anti-smoking health education on infant size at birth: a randomized controlled trial. *British Journal of Obstetrics and Gynaecology* 1987;94(4):295-300.
20. Dietz PM, Adams MM, Rochat RW, Mathis MP. Prenatal smoking in two consecutive pregnancies: Georgia, 1989-1992. *Maternal and Child Health Journal* 1997;1(1):43-51.