

CONFIDENTIAL

Subject ref 9

"Smoking habits and birthweights in
two successive births in Sweden"

M-L Nordström and S Gnattingius

Early Human Development (1994), 37, 195-204

Numerous studies have demonstrated that mothers who smoke in pregnancy have babies with a lower birthweight than mothers who do not smoke in pregnancy. Although this association cannot be explained by differences between smokers and nonsmokers in respect of a whole range of studied confounding variables, it remains possible, in theory at least, that some or all of the birthweight difference may reflect differences in variables that have not been considered. After all smokers differ from nonsmokers in many respects.

This paper describes an alternative approach, used only by very few studies previously, in which changes in smoking habits between two pregnancies are related to differences in birthweight between the pregnancies. By studying differences within rather than between mothers, bias due to many potential confounding variables can be ruled out. Thus genetic factors will be the same at both pregnancies, as will factors reflecting life history up to the time the first pregnancy started. For many other attributes, e.g. diet, though some changes may occur,

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changes between pregnancies are likely to be smaller than differences between mothers. Confounding is only likely to arise from factors associated with changes in smoking - e.g. a mother may decide to embark on a healthy lifestyle generally and not only give up smoking but also give up drinking alcohol, and start taking regular exercise. However, in theory, studies investigating differences in birthweight between babies born to the same mother are capable of producing stronger evidence of a cause and effect relationship than the standard type of study looking at differences between babies born to different mothers.

The study considered here is of this type and is based on 57732 Nordic women aged 15-44 who gave birth to their first two infants in Sweden during the period 1983 to 1987. At least one of the infants' birthweights had to be available for the women to be included. Data were available from the birth register on the mothers' age at delivery, parity and smoking habits as well as on the infants' birthweight, gestational age and sex. Smoking habits were obtained at each pregnancy at the time of the first ante-natal visit, mothers being classified as nonsmokers, moderate smokers (up to nine cigarettes per day), heavy smokers (10 or more cigarettes per day), or smoking information missing. Data were also available on years of education by the end of 1987 and on time of infant death.

The analyses showed a number of clear relationships with birthweight:

- (i) Compared to women with age at first birth of 20-34, birthweight was reduced by around 50g for women aged 15-19 or 35-44 at first birth.

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- (ii) Compared to women with 12 or more years of education, women with nine years or less education or with length of education missing had lower birthweight infants, by around 100g. Women with 10 or 11 years education had intermediate birthweight.
- (iii) There was a clear tendency for second infants to be heavier than first infants, by about 130g.
- (iv) At each pregnancy, birthweights were lower if the mother smoked, by about 150 to 160g.

The fact that second birth infants were heavier than first birth infants complicated the comparison of women grouped according to changes in smoking habits. For this reason, analyses were generally based on differences in birthweight between the two pregnancies. As shown in Table 2 of the paper, these comparisons were generally consistent with a direct effect of smoking on birthweight. Thus the largest differences were seen in mothers switching from heavy to none and the smallest in mothers making the reverse switch, while the next largest differences were seen in mothers switching from moderate to none and the next smallest in mothers making the reverse switch. It was also notable, in Table 1 of the paper, that mothers who smoked in one pregnancy and not the other had quite similar birthweights in the pregnancy they did not smoke in to that of nonsmoking mothers. However mothers who smoked in both pregnancies had lower birthweights, by about 100g in each pregnancy, than mothers who smoked in that pregnancy but who did not smoke in the other. This appeared to relate to the fact that mothers who smoked in only one pregnancy tended to be more educated and be older than mothers who smoked in both pregnancies. An attempt to take into account the fact

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that the various groups of smoking mothers differed in other characteristics was made in Table 4, where results of a multiple regression analysis are presented. For convenience selected results are shown below for adjusted (from Table 4) and unadjusted (from Table 2) data:

<u>Change in smoking habits</u>	<u>Birthweight change</u> *	
	<u>Unadjusted</u>	<u>Adjusted</u>
Heavy → None	112	98
Moderate → None	45	39
Smoker → None	60	52
None → None	0	0
None → Smoker	-85	-75
None → Moderate	-76	-70
None → Heavy	-127	-97

(* Relative to none → none)

It can be seen that this adjustment has not had a very dramatic effect. A much smaller difference is seen between the estimated differences in birthweight due to smoking in this analysis (about 50-70g) than seen when a simple comparison of smokers and nonsmokers is made (about 150-160g). This suggests that quite a substantial difference in birthweight is due to factors other than smoking (although it is in theory possible that some of the difference between these two comparisons is due to a carry-over effect of smoking from the pregnancy in which the women smokes to the one in which she does not).

In summary, the results from this study seem to me both to reinforce the view that some of the relationship between smoking and birthweight is

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likely to be real, while indicating that a substantial part of it is due to the fact that mothers who smoke are more exposed to other risk factors for low birthweight than mothers who do not.

P N Lee

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