



Aetiology of teenage childbearing: reasons for familial effects

Petra Otterblad Olausson^{1,2}, Paul Lichtenstein¹ and Sven Cnattingius¹

¹Department of Medical Epidemiology, Karolinska Institute

²Centre for Epidemiology, National Board of Health and Welfare, Stockholm, Sweden

The aims of the present study were to evaluate the contribution of the genetic and environmental factors to the risk of teenage childbearing, and to study whether life style, socio-economic conditions, and personality traits could explain possible familial effects. We linked two population-based registers: the Swedish Twin Register and the Swedish Medical Birth Register. The study covers female twin pairs born between 1953 and 1958, having their first infant before the age of 30 years ($n = 1885$). In order to separate familial effects from other environmental influences, and genetic effects from shared environmental effects, only complete twin pairs with known zygosity were included, in all 260 monozygotic and 370 dizygotic twin pairs. We used quantitative genetic analyses to evaluate the importance of genetic and environmental effects for liability to teenage childbearing. Logistic regression analyses were used to estimate the effects of life style, socio-economic situation, and personality on the probability of teenage childbearing, and to study whether psychosocial factors could explain possible familial effects. Fifty-nine percent (0–76%) of the variance in being a teenage mother was attributable to heritable factors; 0% (0–49%) was due to shared environmental factors; and 41% (23–67%) was explained by non-shared environmental factors. Thus, the data were consistent with the hypothesis that the familial aggregation of teenage childbearing is completely explained by genetic factors, although the alternative hypothesis that familial aggregation is entirely explained by shared environmental factors cannot be ruled out. Significant effects of smoking habits, housing conditions, and educational level were found in relation to liability to teenage childbearing. However, the familial effects on risk of teenage childbearing were not mediated through similarities in life style and socio-economic factors. When studying risk factors for teenage childbearing, it is recommended to include life style and socio-economic variables as well as information about family history of teenage childbearing. *Twin Research* (2000) 3, 23–27.

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Introduction

The increased risks of poor pregnancy outcome among teenagers compared with older mothers have primarily been attributed to poorer social circumstances and more limited prenatal care among teenagers.^{1,2} Compared with older mothers, teenage mothers are not only at increased risk of poor pregnancy outcome, but also reported to have a less favourable long-term prognosis: teenage mothers are more likely to be poorly educated, to have lower incomes, to have more unwanted births, and face greater marital instability.³

Teenage childbearing tends to run in families. Compared with daughters and sisters to mothers having their first child in adulthood, daughters and

sisters to teenage mothers are more likely to become teenage mothers themselves.^{4–7} One possible explanation for the familial tendency of teenage childbearing is that social or socio-cultural factors are important. The alternative explanation is that some heritable components (mediated for example by personality) are involved in the proneness. The distinction between environmental and heritable causes is important if counselling is warranted. However, in ordinary family studies it is not possible to distinguish between genetic and shared environmental effects in the aetiology of behaviour. Twin studies, on the other hand, can elucidate the causes for familial aggregation of a trait, in this case teenage childbearing.

In order to estimate the importance of genetic and environmental factors as predictors of teenage childbearing, we linked two nation-wide registers, the Swedish Twin Register and the Swedish Medical Birth Register. A second aim was to study whether factors related to life style, socio-economic situation, or personality could explain possible familial effects

Correspondence: Petra Otterblad Olausson, Department of Medical Epidemiology, Karolinska Institutet, PO Box 281, SE-171 77 Stockholm, Sweden. Tel: +46 8 728 61 29; Fax: +46 8 31 49 57; E-mail: petra.otterblad@mep.ki.se

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(genetic and shared environment) on teenage childbearing.

Materials and methods

We used the population-based Swedish Twin Register, including data on all twins born from 1926 to 1958, who were alive and living in Sweden in 1970,⁸ and the Swedish Medical Birth Register covering 99% of all births since 1973.⁹ Use of the unique national registration number assigned to each Swedish resident permitted linkage of individuals across these registers.

In 1973, a questionnaire was sent to all like-sex twin pairs where both individuals were alive. The questionnaire was used to assess zygosity, life style, socio-economic situation, and personality.¹⁰ The study population covers all female twins born from 1953 to 1958 who answered the questionnaire (91%) and first gave birth before the age of 30, recorded in the Medical Birth Register ($n = 1885$). The outcome variable studied was maternal age at first birth, defined as age in years at the time of delivery and arranged into two groups, 15–19 years and 20–29 years. For some respondents data on specific items were missing. For the quantitative genetic analyses, only complete twin pairs with known zygosity could be used. There were 260 monozygotic (MZ) female twin pairs and 370 dizygotic (DZ) twin pairs, of whom both twins had their first child before 30 years of age. When studying the relationship between life style, socio-economic indicators, personality, and maternal age at first birth, we avoided dependent observations by including only one twin from each complete twin pair and single child-bearers ($n = 1216$).

Zygosity was determined by the following question: 'Were you, as children, as alike as two peas in a pod?' Monozygosity assessed through that item has been evaluated serologically, and the sensitivity was estimated at 99%, and the specificity at 92%.¹¹ The questionnaire included several items regarding alcohol intake, which were used to calculate the absolute alcohol intake in grams per month. Alcohol intake was grouped into none, 1–250, 251–500, and 501 grams or more per month. Excessive alcohol drinking was assessed by one question: 'Do you, occasionally, drink more than five bottles of beer, or more than one bottle of wine, or more than half a bottle of liquor on the same occasion?' Current cigarette smokers were those who gave a positive answer to the question 'Do you smoke cigarettes at present?' Because a relatively large proportion were smokers at that time (38%), we also used a question concerning the age when the respondents began to smoke regularly. The variable was classified:

13 years or younger, and 14 years or older, together with those who stated they never had been daily smokers. As an indicator of socio-economic situation, we used one question about housing conditions, which was classified into flat (rental), co-operative apartment, terrace house, and own house. We also asked whether the respondents had education beyond elementary school or not. Scales regarding neuroticism and introversion–extraversion dimensions of personality (range 0–9), created from several questions, were also analysed.¹²

Analyses

In order to disentangle genetic and environmental effects for liability to teenage childbearing, quantitative genetic analyses were used. Similarities in monozygotic and dizygotic twin pairs provide information about genetic and environmental effects. In quantitative genetic analysis, the phenotype is assumed to be the sum of the effects of the genotype and the environment.¹³ The importance of genetic effects is indicated by a greater similarity among monozygotic than among dizygotic pairs. Shared environmental effects reflect twin similarity that is not explained by genetic effects, whereas non-shared environmental effects are evidenced by within-pair differences. By comparing observed phenotypic covariance between twins of different zygosity, we could estimate the proportion of variance accounted for by genetic, shared environmental and non-shared environmental effects, respectively. Variance estimates for genetic and environmental effects were obtained by entering two by two contingency tables of maternal age status (15–19, 20–29 years) in twin pairs (twin 1 vs twin 2), stratified by zygosity status into a structural model fitting program.¹⁴

To study the association between each independent variable and maternal age at delivery, odds ratios (OR) with 95% confidence intervals (CI) were estimated by logistic regression analysis. The odds ratios were adjusted by maternal year of birth, as maternal birth cohorts were associated with the independent variables as well as with age at first delivery. Effects of neuroticism and introversion–extraversion were analysed as odds ratios for change in interquartile range for the scales.

In order to analyse whether life style and socio-economic factors could explain the possible familial influence on teenage childbearing, we used logistic regression analyses. We computed the odds ratio of the familial effects on risk of teenage childbearing, as well as odds ratios of the familial effects adjusted for the significant psychosocial predictors of teenage childbearing.¹⁵

Table 1 Estimates of genetic and environmental effects for low maternal age at first birth (15–19 years) from structural equation model fitting. Female twin pairs born 1953–1958 who both gave birth in Sweden 1973–1987

Model	Explained variance (95% confidence limits)			Fit of model			
	Heredity	Shared environment	Non-shared environment	χ^2	Df	P value	AIC
Model 1	0.59 (0.00–0.76)	0.00 (0.00–0.49)	0.41 (0.23–0.67)	2.2	3	0.5	–3.754
Model 2	0.59 (0.37–0.77)	–	0.41 (0.23–0.67)	2.2	4	0.7	–5.754
Model 3	–	0.42 (0.24–0.57)	0.58 (0.43–0.76)	5.2	4	0.3	–2.765
Model 4	–	–	1.00 (1.00–1.00)	25.4 (0.23–0.67)	5	<0.0001	15.367

Results

The quantitative genetic analyses regarding maternal age at first birth are presented in Table 1. In the full model (model 1), the analyses indicate that 59% (95% CI 0–76%) of the variance in being a teenage mother is attributable to heritable factors, whereas the shared environmental effects were estimated to zero. Non-shared environmental factors are significant and 41% (95% CI 23–67%) of the variance in being a teenage mother is attributable to the non-shared environment. Even if the genetic parameter estimate was not statistically significant, the estimate of the familial effects were significant, evaluated by comparing a model including all parameters (model 1) with a reduced model excluding parameters estimating familial effects (model 4). The differences in χ^2 for the reduced model (χ^2 25.4, df 5) minus the full model (χ^2 2.2, df 3) was highly significant (χ^2 23.2, df 2, $P < 0.001$). The data thus show a significant familial aggregation of teenage childbearing, which is completely explained by genetic factors, although it cannot be excluded that shared environmental factors are responsible, since the genetic parameter is not statistically significant.

The association between independent variables and teenage childbearing are presented as odds ratios adjusted for maternal birth cohort with 95% confidence intervals (Table 2). Fifteen percent of the women were teenage childbearers. In 1973, teenage mothers more often lived in rented flats compared with women 20–29 years old at first birth (46% vs 40%), and only 23% of teenage mothers had attended schools beyond elementary stage compared with 43% of the older mothers. Fifty-one percent of the teenage mothers were current smokers in 1973, compared with 36% of the women age 20–29 years at first birth, and teenage mothers also more often reported to have started smoking regularly at an early age, (21% among teenage childbearers and 9% among older mothers). The differences in smoking habits, housing conditions and educational level between teenage mothers and older mothers were

Table 2 Adjusted^a odds ratios with 95% confidence intervals (CI) for the association between life style factors, socio-economic indicators, personality, and teenage childbearing

Psychosocial indicator	Odds ratio ^a	95% CI
Housing condition		
Owned house or flat	1.0	
Rented flat	1.7	1.2–2.3
Missing 9%		
Schools beyond elementary school		
Yes	1.0	
No	2.0	1.3–3.0
Missing 1%		
Current cigarette smoker		
No	1.0	
Yes	2.3	1.7–3.2
Missing <1%		
Age ≤13 when regularly smoking cigarettes		
No	1.0	
Yes	2.2	1.5–3.4
Missing 1%		
Absolute alcohol intake/month (grams)		
None	1.0	
1–250	1.4	0.9–2.0
251–500	1.2	0.5–2.6
501–	1.8	0.5–6.8
Missing 24%		
Excessive alcohol drinking ^b		
No	1.0	
Yes	1.3	0.7–2.4
Missing 2%		
Neuroticism	1.0	0.9–1.2
Missing <1%		
Introversion–extraversion	1.04	0.9–1.2
Missing <1%		

^aBivariate logistic regression analyses adjusted for maternal birth cohort.

^bMore than five bottles of beer, one bottle of wine, or more than a half bottle of spirits on the same occasion.

statistically significant. Teenage mothers tended to drink more alcohol and also to drink more excessively than older mothers, but these differences did not reach statistical significance. We found no

Table 3 Odds ratios with 95% confidence intervals (CI) of being a teenage mother in relation to familial factors

	Crude odds ratio	95% CI	Adjusted ^a odds ratio	95% CI
Familial effects	4.2	2.8–6.3	3.1	2.0–4.9

^aAdjusted for smoking habits, housing conditions and educational level.

differences in mean and quartile values on neuroticism and introversion–extraversion scores between those who became teenage mothers and those who became mothers as adults (Table 2).

We estimated the importance of the psychosocial variables that were significantly associated with increase in risk of teenage childbearing in Table 2, as determinants for the familial effects. When adjusting for the psychosocial factors, the familial effects of teenage childbearing were somewhat attenuated but remained statistically significant (Table 3). The psychosocial factors, as measured in this study, did not explain the familial tendency of teenage childbearing.

Discussion

In accordance with previous observations,^{4–7} we found a familial aggregation for teenage childbearing. The present study had the advantage of also offering the possibility to separate the familial component into a genetic and an environmental part. The data were consistent with the hypothesis that the familial aggregation of teenage childbearing is explained by genetic factors, although we cannot completely rule out that the familial effects are due to shared environmental factors.

There are several reports describing genetic influences on behaviour. Smoking habits and alcohol consumption are affected by genetic factors,^{16–18} and genetic sources are important for achieved socio-economic position.¹⁹ In a second step we therefore tried to evaluate whether the familial effects could be mediated through psychosocial factors, which in this study as well as in previous studies,² have shown to be important risk factors for teenage childbearing. We found no evidence for familial effects on teenage childbearing to be associated with similarities in life style and socio-economic position.

Other factors that could have been of importance for the mediation of familial effects were personality traits. Although the measures of personality included (neuroticism and introversion–extraversion scores) were not related to the probability of becoming a teenage mother, there may be other aspects of personality that are more relevant for the prediction of teenage childbirth. It has previously

been stated that psychosocial constellations, such as hostility in the parents' marriage, alienation from the mother, or a seductive father–daughter relationship, predispose teenagers to unwanted pregnancy.²⁰

Life style and socio-economic factors were related to low maternal age at first birth, and these results are in accordance with other reports.^{2,6–7} The social environment and life style during adolescence may predict teenage childbearing independent of family background factors, indicating that risk environments are independently contributing to susceptibility to become a teenage mother. Other environmental factors predicting teenage childbearing could be living in deprived areas, having low educational aspirations, being unemployed or having friends with risk-prone life styles.

One limitation in the present study was that we were unable to include information on onset of menarche and age at first sexual intercourse. Genetic influences on variability of onset of menarche are strong and well-documented,²¹ and it has also been reported that early onset of menarche is associated with early sexual intercourse.²² Another disadvantage was that we could only analyse the probability of becoming a teenage mother. Since a great part of teenage pregnancies are unintended, it would have been preferable also to evaluate the tendency to become pregnant.

We conclude that there is evidence of familial effects on the liability to teenage childbearing. When analysing risk factors for teenage childbearing, it is therefore recommended to include not only socio-economic and life style-related variables, but also information about family history of teenage childbirth.

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