Teenage childbirth and young adult criminal convictions: A quasi-experimental study of criminal outcomes for teenage mothers

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Abstract

Purpose—Teenage childbirth is associated with poor psychosocial outcomes for teen mothers. One example is that teen mothers have higher rates of antisocial behavior. The extant research has not been able to determine if teenage motherhood is independently associated with criminal behavior, or if the association is due to selection factors associated with both teenage childbirth and criminal behavior.

Methods—We used longitudinal data from Swedish national registers and sibling-comparisons (both full- and half-siblings) to identify the extent to which there is an independent association between teenage childbirth and mothers' likelihood of criminal conviction between ages 20-30, or if the association is confounded by familial (including genetic or environmental) factors that make sisters similar.

Results—Women who began childbearing as teenagers were more likely to be convicted of a crime in young adulthood compared to women who delayed childbearing. When sisters were compared, the association between teenage childbirth and criminal convictions disappeared. Multivariate behavior genetic analyses suggest genetic and shared environmental account for the association.

Conclusions—The statistical association between teenage childbirth and early adulthood criminal convictions is confounded by genetic and shared environmental factors that influence both the likelihood of teenage childbirth and risk of early adulthood criminal conviction.

Keywords

Teenage mothers; teenage childbirth; criminality

Teenage motherhood is associated with a variety of poor social, economic and psychological outcomes for young mothers once they reach adulthood (Coley & Chase-Lansdale, 1998; Coyne & D'Onofrio, 2012). Most studies have focused on adulthood economic and

educational outcomes for teen mothers (Coley & Chase-Lansdale, 1998), and less is known about adulthood patterns of antisocial behavior. Longitudinal studies have found higher rates of teen childbirth among young women with childhood and adolescent antisocial behavior problems (Woodward, Fergusson, & Horwood, 2001; Zoccolillo, Paquette, Azar, Cote, & Tremblay, 2004), but few studies have explored the association between teenage motherhood and antisocial behavior in young adulthood (Fergusson & Woodward, 1999) or rigorously tested whether the association is a consequence of teenage childbirth or the selection factors that precede teenage childbirth.

The overlap in risk factors associated with teenage childbirth and adolescent antisocial behavior suggests that etiological models used to explain the developmental trajectory of antisocial behavior may also predict teenage childbirth (Ellis et al., 2003; Woodward & Fergusson, 1999; Woodward, et al., 2001). The association between teenage childbirth and other risky adolescent behavior (i.e., delinquency) is also consistent with problem behavior theory (Jessor, 1992; Jessor & Jessor, 1977; Miller-Johnson et al., 1999). Central to this theory is the idea that engaging in one type of problem behavior (e.g., delinquency) increases the likelihood that an individual will engage in other forms of problem behaviors (e.g., risky sexual behavior) (Jessor & Jessor, 1977). Peer relationships, particularly romantic and sexual relationships are thought to be of particular importance in the development of adolescent delinquency—older boyfriends can introduce adolescent girls into more deviant and older peer groups, contributing to the girls' antisocial behavior (Stattin, Ken, Mahoney, Persson, & Magnusson, 2005). Therefore, teenage pregnancy and childbearing may be the consequences of engaging in risky sexual behavior and other delinquent behaviors with deviant peers.

Teenage mothers engage in higher rates of antisocial behavior during childhood and early adolescence (Woodward & Fergusson, 1999), but little is known about the patterns of antisocial behavior among these young mothers as they mature into early adulthood. Teenage childbirth may represent a female-specific manifestation of adolescent antisocial behavior that is the unintended consequence of engaging in risky sexual behavior, substance use, and other antisocial behaviors. Studies using male samples of juvenile delinquents have identified life transitions or turning points (i.e., marriage, job stability) that are associated with continuities and discontinuities in antisocial behavior (Sampson & Laub, 2003; Sampson & Laub, 2005). For young men, both delinquent and non-delinquent controls, marriage was associated with a desistance from antisocial behavior (Sampson & Laub, 2003). Few studies have explored turning points in female trajectories of antisocial behavior, but there is some evidence that women's criminal desistance can be linked to the birth of a child (Giordano, Cernkovich, & Rudolph, 2002). Although childbirth itself may not be a turning point, the internalization of expectations related to childrearing may lead young mothers view their antisocial behavior as incompatible with raising a child (Giordano, et al., 2002). Teenage childbirth might also exert an independent, developmentally disruptive effect on teenage mothers by introducing social and economic stressors that increase the likelihood of early adulthood criminal convictions. Alternatively, the statistical association between teenage childbirth and early adulthood criminal convictions could be confounded by selection factors, including environmental and genetic (shared genetic liability) confounds that influence both the likelihood that a young woman gives birth as a teenager and that she is convicted of a crime in young adulthood.

The current study used longitudinal, multi-generational data from Swedish national registers to explore the magnitude of the association between teenage motherhood and young adulthood criminal convictions. Quasi-experimental comparisons of full and half siblings were used to test whether or not selection factors, including genetic and environmental confounds, account for the association between maternal age at first birth (MAFB) and

women's criminal convictions. If there is a specific effect of teenage childbirth on young adulthood criminal convictions we would expect sisters who first gave birth as teenagers to be more likely to be convicted of a crime than their sisters who delayed childbearing. In contrast, if the association between teenage childbirth and young adult criminal convictions is confounded by genetic or environmental selection factors shared by sisters in a family, then we would expect sisters discordant for age at first birth to have a similar likelihood of criminal conviction during young adulthood.

Methods

Sample

Prospective data were merged from Swedish population registers for women born from 1970 to 1979, including detailed census information, demographic and pregnancy information, highest level of education, and criminal convictions. The registers are maintained by Swedish government agencies. The Multi-Generation Register (MGR), kept by Statistics Sweden, contains each individual's unique identifier and allows researchers to link all children to their biological mothers and fathers (based on maternal reports) and identify all siblings and offspring of siblings (cousins). The database also includes the date of birth for all individuals. The National Crime Register (NCR) (Fazel & Grann, 2006) includes information about all criminal convictions of those aged 15 (the age of criminal responsibility) and older since 1960. The register provides detailed information about the timing, nature and number of all offenses that led to court convictions. The Education Register (ER) (Statistics Sweden, 2004) contains information on the highest level of completed formal education. The total sample included 356,750 mothers and a sample of 706,494 offspring with 87,434 sisters (81,636 full sisters and 5,798 maternal half sisters) and 49,534 cousins (47,362 full cousins and 2,172 half cousins). There were 4,373 sister pairs discordant for teenage first birth (3,737 discordant full-sister pairs; 636 discordant half-sister pairs) in the sample.

Measures

Predictor—Mother's age at first birth (MAFB) was calculated as a binary and continuous variable, and the same models were run with each form of MAFB as a predictor. The binary variable categorizes MAFB as *teenage first birth* if the age at first birth was between 13-19 years old and *adult first birth* if the age at first birth was at least 20 years old. The average rate of teenage childbirth in this sample between 1970 and 1979 was 5.4% (N=19,351) of all first live births, consistent with other reports (Danielsson, Rogala, & Sundstrom, 2001; Darroch, Singh, & Frost, 2001). The continuous MAFB variable was re-centered at 27, the mean age of first birth in the full sample, and divided by 2 in order to estimate the change in risk for a two-year increase in maternal age at first birth. These transformations provided more interpretable and meaningful estimates of the effect of MAFB on mothers' risk of criminal conviction.

Outcomes—The mother's history of any criminal conviction between age 20 and 30 was used as the outcome variable. Criminal convictions were derived from the National Crime Register and include four types of criminal convictions: (1) violent crimes, defined according to the Swedish Penal Code (SPC) as attempted or completed murder, manslaughter, or filicide, assault, kidnapping, illegal restraint, illegal coercion or threats, robbery, threats or violence against an officer, arson, gross violation of a person's integrity, or harassment—this corresponds to a definition of violent offending used in earlier scientific reports from Sweden (Fazel, Långström, Hjern, Grann, & Lichtenstein, 2009; Långström, Grann, Ruchkin, Sjöstedt, & Fazel, 2008); (2) driving-related crimes committed while under the influence of alcohol or other substance; (3) narcotic drug offenses, as defined by the

Narcotic Drugs Criminal Act, which includes possession for personal use, supply and manufacture, and consumption; and, (4) nonviolent crimes, which will be indexed as all other crimes (i.e., not related to violent or drug-related offenses). In Sweden, age 15 is the age of criminal responsibility; therefore, no criminal offenses prior to age 15 are recorded in the Crime Register. The primary analyses conducted in this study focus on any criminal conviction in the young adult age range between 20 and 30 years old.

Covariates—Birth order, mother's year of birth, and father's age at mother's birth were included as covariates in all analytic models. Father's history of criminal conviction and highest level of education were included as covariates in all models. Educational attainment was indexed as low if their highest level of education was less than 10 years of compulsory primary and lower secondary education. In Sweden, grades 1-9 are compulsory and equivalent to elementary and middle school in the United States and many other developed countries. Dummy codes were created to compare (a) low educational attainment and (b) those with missing values to the high educational attainment group. A greater proportion of partners of mothers' who first gave birth as teenagers (24.9%) had low educational attainment as compared to the proportion partners of mothers who first gave birth as adults (8.6%). Partner's history of criminal conviction was based on record of any criminal offense in the National Crime Register through 2004. Similar to the pattern observed with educational attainment, a greater proportion of partners of teenage mothers (64.9%) had a criminal conviction history as compared to partners of adult mothers (42.6%).

Analyses

Primary analyses—We tested the association between teenage first birth and criminal convictions between ages 20 and 30 using logistic regression models. All models statistically controlled for mother's birth order and demographic covariates of the father of the firstborn child, to account for measured selection effects. First, we tested the association between the teenage childbirth and young adult criminal convictions using population-wide comparisons of unrelated women (Model 1). Then we used fixed effects sibling-comparisons to identify if unmeasured familial background factors account for the statistical relationship between teenage MAFB and criminal convictions during young adulthood. Model 2 compared all sisters who were discordant for age at first birth, which controls for part of the genetic risk and all of the sociodemographic risk shared by siblings in a family. Model 3 and Model 4 compared maternal half- and full-sisters, respectively, who were discordant for the age at which they first gave birth.

The sibling-comparison design can be used to rule out potential genetic and environmental factors that confound the association between risk factors and outcomes. Comparing discordant siblings (e.g., a sister who gave birth as a teenager vs. a sister who gave birth as an adult) eliminates all the genetic and environmental influences that are shared by siblings in a nuclear family as possible explanations for the association between risk exposure and the outcome (D'Onofrio, Lahey, Turkheimer, & Lichtenstein, in press; Lahey & D'Onofrio, 2010; Rutter, Pickles, Murray, & Eaves, 2001; Tierney, Merikangas, & Risch, 1994). On average, full siblings share 50% of their genetic makeup. Sibling comparisons capitalize on this shared genetic relatedness to account for shared genetic confounds that might account for the association between a risk factor and outcome. When studies include sibling pairs who vary in their genetic relatedness (e.g., full- and maternal half-siblings), then multivariate behavior genetic analyses can more specifically examine genetic confounding. Because siblings share household environments if they are raised together, sibling-comparisons also account for potential measured or unmeasured environmental confounds shared by siblings that might account for associations between variables.

Sibling comparisons can be used to test hypotheses about the association between teenage childbirth and teenage mothers' early-adulthood criminal convictions. Figure 1 includes the expected patterns of results for different types of association between the risk factor (e.g., teenage first birth) and the outcome (e.g., mothers' criminal convictions between ages 20 and 30). The results in Figure 1 are hypothetical results from analyses comparing women who had their first child as a teenager (13-19 years old at first birth) and women who had their first child as an adult (at least 20 years old at first birth). The odds ratios represent the risk for teenage mothers using different comparison groups. In pattern A, the results suggest a specific effect of teenage childbirth accounts for the independent association between teenage childbirth and teenage mothers' criminal convictions because the association between MAFB and criminal conviction persists in every comparison group. Importantly, the association persists after controlling for genetic and environmental factors shared by full siblings. In pattern B, the results suggest the statistical association between MAFB and criminal convictions may be accounted for by genetic confounds because the magnitude of the association is smaller in sister comparisons that control for more genetic risk (i.e., the association is somewhat reduced when comparing half sisters and even further reduced when comparing full sisters). In pattern C, the results suggest that environmental confounds account for the association between MAFB and criminal convictions. The confounding factors would be environmental because the magnitude of the association is reduced in all sibling comparisons, regardless of degree of genetic relatedness.

Bivariate family models—If the sibling comparison models suggested familial confounding, we then used bivariate behavior genetic models to estimate the extent to which these confounds were genetic or environmental. The analyses included both full and half sister pairs, which provided different degrees of genetic relatedness (full sisters, 0.5; half sisters, 0.25). The models estimate the variance due to additive genetic influences (A), common environmental influences shared by sisters in family (C), or nonshared environmental influences that differ between sisters (E), which also includes measurement error. We used bivariate Cholesky models to estimate the sources of covariation between teenage childbirth and early adulthood criminal convictions. The models were run using Mplus version 6.12 software (Muthén & Muthén, 2010) using methods recommended by Prescott (2004) for bivariate models using categorical data. We estimated thresholds for the categorical predictor and outcome. The values for $rA_{teenbirth}$ and rA_{crime} were fixed at 0.5 in full siblings and 0.25 in maternal half siblings. Values for $rC_{teenbirth}$ and rC_{crime} were fixed at 1.0 in all sibling pairs. Values for $rE_{teenbirth}$ and rE_{crime} were uncorrelated in all sibling pairs.

Sensitivity analyses—We conducted several sensitivity analyses to explore further the findings. First, we used a linear measure of MAFB to predict criminal convictions because statistical power of considering MAFB continuously. We conducted bidirectional case cross-over comparisons within discordant sister pairs to address potential sibling effects (e.g., one sister's childbirth influencing the childbearing or criminal behavior of her sister). Finally, we used bivariate family models in a sample of maternal cousins rather than sisters to account for potential cross-over sibling effects in the sister comparisons. The sibling-comparison design assumes that exposure for one sibling does not increase risk for the other sibling, however, it is possible that in a nuclear family one sister's teenage childbirth influences her sister's risk of criminal conviction. Studies have shown there are possible sibling effects associated with teenage childbearing—younger sisters of teenage mothers may become more aware of the hardships associated with parenting and change their behavior to avoid teenage childbirth (East & Kiernan, 2001; East, Slonim, Horn, Trinh, & Reyes, 2009). It is possible that delaying childbearing in response to a sister's teenage childbirth also functions to protect younger sisters from engaging in antisocial and criminal behavior during young

adulthood. Quantitative behavior genetic models with cousins reduce the risk of cross-over sibling effects while providing estimates of the genetic and environmental accounting for the correlation between teenage childbearing and young adult criminality.

Results

Descriptive statistics for all the measured variables can be found in Table 1. The within-pair Pearson correlation for age at first birth was higher for full sisters ($r = 0.33$) than maternal half sisters ($r = 0.18$). Similarly, the within-pair tetrachoric correlation for the measure outcome (criminal conviction between ages 20 and 30) was higher for full sisters ($r = 0.31$) than half sisters ($r = 0.26$). The full-sister–pair correlations were stronger than the half-sister–pair correlations ($p < 0.05$), suggesting genetic factors may influence variability in these behaviors.

Primary analyses

The odds ratios with corresponding 95% CIs for MAFB are shown in Figure 2. In Model 1, teenage childbirth was associated with an increased likelihood of adulthood criminal conviction between 20 and 30 years old ($b_{population-wide}$=0.89; OR$_{population-wide}$=2.43, $95\% CI$=2.29-2.58). Specifically, the odds of a criminal conviction between ages 20 and 30 were 2.43 times higher for teenage mothers than mothers who delayed childbearing until adulthood. Model 2 compared sisters who were discordant for teenage first birth (comparing women who gave birth as a teenager versus their sisters who delayed childbirth) and showed that teenage childbirth was not associated with early adulthood criminal convictions; sisters who gave birth as teenagers were no more likely to be convicted of a crime between ages 20 and 30 than their sisters who delayed childbirth until adulthood ($b_{all sisters}$=0.02; OR$_{all sisters}$=1.01 $95\% CI$=0.83-1.25). Model 3 compared half sisters and the results indicated there is no increased risk of early adulthood criminal convictions for half sisters who give birth as teenagers ($b_{half sisters}$=0.04; OR$_{half sisters}$=1.04 $95\% CI$=0.62-1.75). The results from the full-sister comparisons in Model 4 showed a similar pattern, consistent with the hypothesis that teenage childbirth is not associated with early adulthood criminal convictions after controlling for genetic and environmental confounds shared by full sisters in a family ($b_{full sisters}$=0.01; OR$_{full-sister}$=1.01, $95\% CI$=0.80-1.26). The results from the primary analyses suggest that sisters have similar risk for criminal convictions during early adulthood. The magnitude of the association decreased in the full-sibling comparisons suggesting that genetic confounds may account for the association between teenage childbirth and early adulthood criminal convictions.

Bivariate family models

Bivariate family models were used to estimate the degree to which the covariation between teenage childbirth and early adulthood criminal convictions was due to genetic (A), shared environmental (C), and/or nonshared environmental (E) factors. The total correlation (r_{total}) and the contributions of A (a_{cov}^2), C (c_{cov}^2) and E (e_{cov}^2) for bivariate sibling can be found in Table 2. The cross-sibling cross-trait correlations were larger among full siblings than among half siblings, which suggests that genetic factors may contribute to the association between teenage childbirth and early adulthood criminal convictions.

The sibling bivariate family models in Table 2 showed significant and moderate correlations between teenage childbirth and early adulthood criminal convictions among siblings. For criminal convictions between ages 20 and 30, nonshared environmental influences did not account for much of the covariation between teenage childbirth and early adulthood criminal convictions, which is not consistent with an independent association. Genetic influences

accounted for 31% and shared environmental influences accounted for 67% of the total correlation between teenage childbirth and criminal convictions in early adulthood.

Sensitivity analyses

Sensitivity analyses using the same four models to predict criminal convictions between ages 20 and 30 using a continuous measure of MAFB to maximize statistical power provided commensurate findings (results provided upon request). These results suggest that delaying childbirth is not associated with odds of criminal convictions during young adulthood. In the population-wide comparisons (Model 1), every two-year increase in maternal age at first birth predicted a 13% decrease in the odds of criminal conviction between ages 20 and 30 for mothers population-wide ($b_{unrelated}$=−0.16; OR=0.85 *95%CI*=0.84-0.85). Model 2 compared sisters who began childbearing at different ages, and MAFB did not predict early adulthood criminal convictions ($b_{all\ sisters}$=*0.0001*; OR$_{all\ sisters}$=1.00 *95%CI*=0.97-1.04). In Model 3, MAFB was not associated with early adulthood criminal convictions ($b_{half\ sisters}$=−0.01; OR$_{half\ sisters}$=0.99 *95%CI*=0.88-1.11). Model 4 compared full sisters, controlling for all genetic and environmental confounds that make full sisters similar. Again, MAFB was not associated with early adulthood criminal convictions ($b_{full\ sisters}$=−0.003; OR$_{full-sister}$=1.00, *95%CI*=0.97-1.04).

We conducted sensitivity analyses to test whether or not young woman's teen childbirth influenced her sister's childbearing and criminal behavior. In the sample of discordant sisters, the bidirectional case cross-over comparisons indicate the cross-sister correlation between teenage childbirth and criminal conviction was small for both older sister's (the firstborn) teen childbirth and young sister's (the second-born) criminal conviction (r = −0.09, SE=0.04) and young sister's (the second-born) teen childbirth and older sister's (the firstborn) criminal conviction (r = −0.01, SE =0.04). These results suggest an inverse association between an older sister's teenage childbirth and her younger sister's risk of early adulthood criminal conviction, but the magnitude was small. Both correlations are small in magnitude and the large standard errors (SE = 0.04) limit their interpretability. To account for a potential sister cross-over effects we conducted a set of bivariate family models using a sample of maternal cousins. The cross-cousin cross-trait correlations were larger among full cousins (r = 0.07) than half cousins (r = −0.13), again, suggesting that genetic influences may contribute to the association between teenage childbirth and early adulthood criminal convictions. The results of the bivariate family models in the cousin sample were commensurate with the bivariate family models in the sibling sample. The results suggest a modest correlation between teenage childbirth and early adulthood criminal convictions (r_{total} =0.15), and genetic influences account for 18% of the covariation.

Discussion

The results of the discordant sibling-comparisons suggest that women who begin childbearing earlier are no more likely to be convicted of a crime during early adulthood than their sisters who delay childbearing. Compared to the population-wide estimates, the magnitude of the association is smaller among full sisters than among half sisters, which suggests that the association between teenage childbirth and criminality may be due to genetic confounding or environmental selection factors that make siblings similar. The results from the bivariate family models support this interpretation. The covariation between teenage childbirth and early adulthood criminality was due to common genetic and environmental influences that increase the likelihood of teenage childbirth and the risk of criminal conviction in early adulthood.

These results have potential implications for intervention and prevention programs targeting at-risk young women. Although teenage childbirth may not be a causal risk factor for early

adulthood criminal conviction, the shared genetic factors that increase the likelihood of both teenage childbirth and criminal conviction suggest that some young women may be at risk for adverse outcomes during adolescence and early adulthood. Interventions that can target at-risk teenage women should address risk factors that increase both the likelihood of teenage childbirth and criminal behavior.

Limitations

There are limitations to the current study that are important to consider and can inform future research. First, future research is needed to explore proximal risk factors (e.g., impulsivity, early pubertal maturation) that may influence the likelihood of teenage childbirth and subsequent criminality in early adulthood.

Second, discordant sibling-comparison designs assume that one sibling's exposure to the environmental risk does not influence the unexposed sibling (Lahey & D'Onofrio, 2010). Sibling comparisons may overlook the unique characteristics of sisters of teenage mothers-- experiencing a sister's teenage childbearing might influence their decision to delay or encourage earlier childbearing (East & Jacobson, 2000). In our sensitivity analyses, sibling cross-over effects did not appear to influence the pattern of association between teenage childbirth and early adulthood criminal convictions. Future research is needed, however, to explore how experiencing a sister's teenage childbirth might influence younger sisters' childbearing and antisocial behavior.

Third, we relied on official records of criminal convictions, which may underestimate the true level of criminal behavior among women. The overall prevalence of criminal convictions is higher among males than females, which may reflect true differences in rates of crime or reflect differences in law enforcement approaches to male and female offenders (Chesney-Lind & Belknap, 2004). Moreover, females may tend to engage in other forms of antisocial behavior (e.g., relational aggression), which is not well captured when only official records of criminal convictions are considered (Fontaine, Carbonneau, Vitaro, Barker, & Tremblay, 2009). Future studies using multi-informant approaches, including self-reports of diverse forms of antisocial behavior, may obtain more accurate estimates of the range of antisocial behavior that occurs after childbirth.

Conclusion

In population-wide comparisons, teenage motherhood is associated with increased risk of criminal convictions. This statistical association, however, is not consistent with a causal association; it is confounded by genetic and shared environmental factors that influence both the likelihood of teenage childbirth and risk of early adulthood criminal conviction.

Acknowledgments

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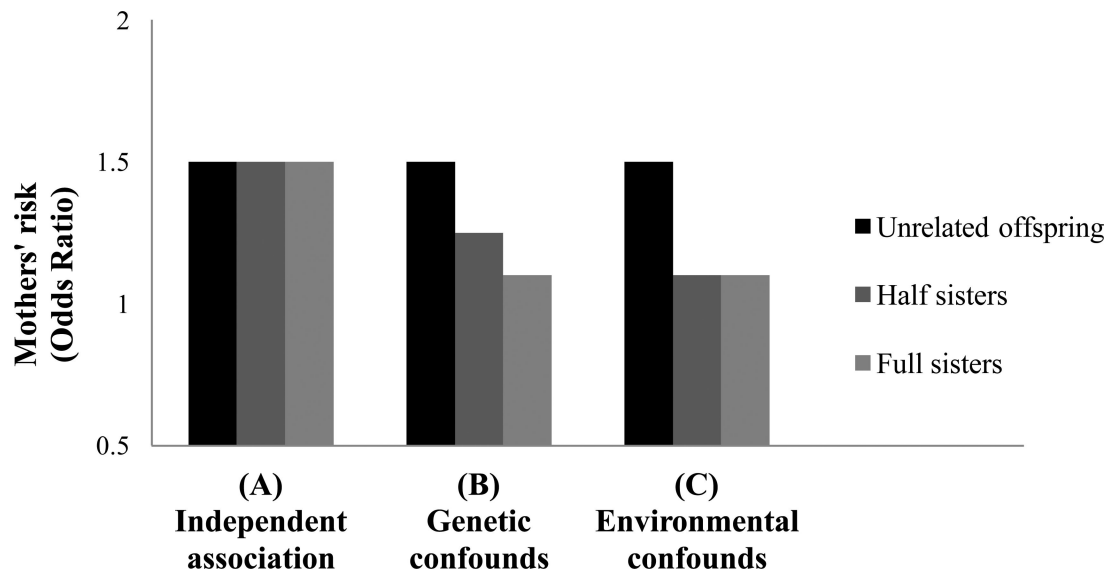
Figure 1.
Hypothetical pattern of results consistent with (A) independent association, (B) a statistical association confounded by genetic factors, and (C) a statistical association confounded by environmental factors.
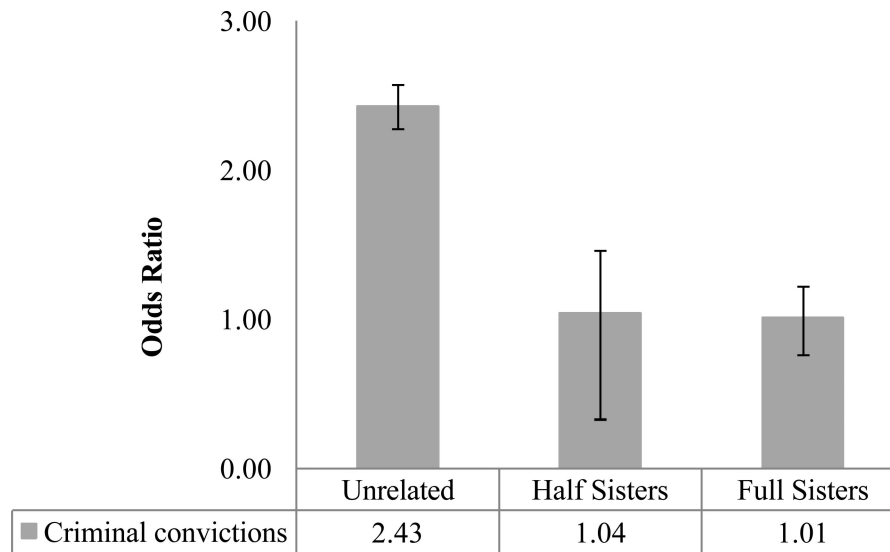
Figure 2.
Odds ratios with 95% CIs for logistic regressions with a binary measure of MAFB (teenage versus adult first birth) as a predictor of offspring criminal convictions.

Table 1

Sample characteristics in a national registry-linkage study of maternal outcomes associated with teenage childbearing for teenage and adult mothers born in Sweden 1970-1979

	All Mothers		Teen Mothers		Adult Mothers	
Variable	**N**	**(M)%**	**N**	**(M)%**	**N**	**(M)%**
Mean maternal age at first birth						
Mothers	356,750	27.3	19,351	18.7	337,399	27.9
Early adulthood outcomes						
Criminal conviction between ages 20-30	13,909	3.9%	2,039	10.5%	11,870	3.52%
Criminal conviction between ages 15-30	31,381	8.8%	3,942	20.4%	27,439	8.13%
Maternal educational achievement						
Less than 10 years of education (ref)	22,283	6.25%	5,439	28.1%	16,844	5.0%
At least 10 years of education	334,325	93.71%	13,863	71.6%	320,462	95.0%
Missing education level	142	0.04%	49	0.3%	93	0.0%
Individual-level covariates						
Birth order						
1st born (ref)	266325	74.7%	13482	69.7%	252843	74.9%
2nd born	81,762	22.9%	4,982	25.7%	76780	22.8%
3rd born or greater	8663	2.4% (30.1)	887	4.6% (23.1)	7776	2.3% (30.5)
Father's age at mother's first birth						
Mean age						
< 20 years old	4,876	1.31%	3,621	13.26%	1,255	0.37%
20-24 years old	50,769	13.65%	10,782	39.47%	39,987	11.60%
25-29 years old (ref)	121,449	32.65%	3,527	12.91%	125,217	36.33%
30-35 years old	118,035	31.73%	736	2.69%	117,299	34.03%
> 35 years old	55,405	14.89%	256	0.94%	55,149	16.00%
Missing father's age	6,216	1.67%	429	1.57%	5,787	1.68%
Father's educational achievement						
Less than 10 years of education (ref)	33,788	9.5%	4,820	24.9%	28,968	8.6%
At least 10 years of education	315,118	88.3%	13,994	72.3%	301,124	89.2%
Missing education level	7,844	2.2%	537	2.8%	7,307	2.2%
Maternal lifetime criminal history	34,434	9.65%	4,466	23.1%	29,968	8.88%
Father lifetime criminal history	125,046	35.0%	12,558	64.9%	112,488	33.34%

Table 2

Bivariate family model of covariation between teenage childbirth and early adulthood criminality

Outcome	r_{total}	a_{cov}^2	c_{cov}^2	e_{cov}^2	A(%)	C(%)	E(%)
Criminal conviction ages 20-30 (r_H =0.13[*], r_F =0.18[*])	0.21[*]	0.06	0.14	0.01	31%	67%	2%

Note: A, additive genetic influence; C, shared environmental influence; E, nonshared environmental influence; F, full siblings; H, half siblings.

Relative contributions of A, C, and E to total correlation (r_{total}) represented by a_{cov}^2, c_{cov}^2, and e_{cov}^2. Cross-sibling cross-trait correlations among full and half sibling pairs indicated by r_F and r_H, respectively.

[*] p <0.05.