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The effect of in utero exposure to alcohol, tobacco and cannabis on educational attainment in adolescence: findings from ALSPAC, a UK cohort study

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Objectives

Alcohol, tobacco and cannabis can cross the placenta, and could have long-lasting effects on the brain of the developing foetus. We examine whether exposure to these substances is associated with educational attainment in adolescence (Key Stage 4 [KS4], aged 16yrs), and consider whether any associations are due to an intrauterine causal mechanism.

Approach

We use two main approaches: (1) a comparison of the risks associated with maternal substance use during pregnancy with the risks associated with paternal substance use at the same time, and (2) Mendelian Randomisation (MR). The population-based sample are from the Avon Longitudinal Study of Parents and Children. Educational attainment at KS4 was determined through linkage to the National Pupil Database: capped score of eight best subjects (converted to percentage). Mothers and their partners reported use of substances during the mother's pregnancy via questionnaire. In observational complete-case analysis ($n=6018$), multilevel (child level 1, school level 2) linear models were used to examine the association between maternal and paternal substance use and KS4 attainment adjusted for potential confounders. In MR analysis, genetic markers associated with maternal alcohol (rs1229984) and tobacco (rs1051730) use were used to estimate the unconfounded effect of the exposures.

Results

Maternal substance use in pregnancy was common (72% reported any alcohol, 22% any tobacco, and 2% any cannabis) and socially patterned (tobacco associated with deprivation, moderate alcohol and light cannabis with higher maternal education). In adjusted observational analyses, children of mothers

who smoked had lower KS4 percentage scores (β -2.7, 95% CI -3.7 to -1.7) but a similar association was observed for paternal smoking (β -3.0, -3.8 to -2.2). Compared to children of non-drinkers in first trimester, children whose mothers drank ≥ 7 units per week had lower KS4 scores (β -4.6, -7.9 to -1.4), but children of lighter drinkers did not. The MR analyses were under-powered but provisional results suggest no association between maternal smoking and KS4 score, but that small amounts of alcohol could have a detrimental effect. Neither maternal nor paternal cannabis use was associated with educational attainment in observational analyses, but few mothers in our sample used cannabis regularly in pregnancy.

Conclusion

The negative association in observational analysis between maternal smoking in pregnancy and child KS4 attainment is likely due to residual confounding rather than an intrauterine mechanism. Conversely, residual confounding may be masking a negative association between lower levels of alcohol drinking and KS4 attainment in observational analysis.

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