



The association between birth by caesarean section at term and offspring cognitive and academic performance: A birth cohort study

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Background: Caesarean section is associated with an increased risk of adverse health outcomes for both mothers and offspring. The evidence for an association between caesarean section and reduced offspring cognitive and academic performance has been inconsistent, with considerable limitations. This study was to compared cognitive and academic performance in childhood and early adulthood, in offspring delivered by caesarean section with those delivered vaginally at term.

Materials and methods: Data on 4,327 mothers and offspring from the Mater University of Queensland Study of Pregnancy (MUSP) were analysed. Offspring cognitive performance was measured by the Picture Peabody Vocabulary Test-Revised (PPVT-R) at ages five and 21, and the Raven’s Standard Progressive Matrices at age 14. Academic achievement was assessed using the Wide Range Achievement Test at age 14. Covariates included breastfeeding duration, cigarette and alcohol consumption in late pregnancy, household income, hypertensive disorders in pregnancy, gestation, birthweight, maternal age BMI and education and number of children in the home at age five.

Results: After adjustment, there was no statistically significant association between cognitive performance and offspring birth mode at age five (p=0.11). The adjusted difference of mean scores at five years on the PPVT-R for elective caesarean section birth compared to those born by vaginal delivery was -2.2 (95% CI -4.3 to -0.2), whereas for emergency caesarean section it was 0.0 (95% CI -2.0 to 2.0). There were no differences in cognitive or academic performance at ages 14 and 21.

Table 1. Test scores measuring cognition at three ages of follow-up as means (SD) comparing offspring born via caesarean birth with offspring born via spontaneous vaginal birth

Measure of cognition	Mean test scores (SD)			Unadjusted mean difference (95% CI)				Adjusted mean difference (95% CI)			
	Spontaneous vaginal	Elective caesarean	Emergency caesarean	Spontaneous vaginal	Elective caesarean	Emergency caesarean	P	Spontaneous vaginal	Elective caesarean	Emergency caesarean	P
Picture Peabody Vocabulary Test (age 5)	99.7 (13.4)	97.4 (14.5)	100.4 (14.8)	Reference	-2.3 (-4.2, -0.4)	0.7 (-1.2, 2.7)	0.041	Reference	-2.2 (-4.3, -0.2)	0.0 (-2.0, 2.0)	0.11
Wide Range Achievement Test (age 14)	100.1 (14.7)	99.4 (15.6)	99.3 (15.2)	Reference	-0.7 (-2.9, 1.5)	-0.8 (-2.9, 1.3)	0.63	Reference	-0.3 (-2.8, 2.3)	0.1 (-2.3, 2.4)	0.98
Raven's Standard Progressive Matrices (age 14)	100.2 (14.7)	100.6 (14.8)	99.8 (15.4)	Reference	0.4 (-1.7, 2.6)	-0.4 (-2.5, 1.7)	0.85	Reference	1.1 (-1.3, 3.6)	-0.5 (-2.9, 1.8)	0.59
Picture Peabody Vocabulary Test (age 21)	103.2 (10.2)	103.7 (10.4)	103.8 (10.8)	Reference	0.4 (-1.3, 2.2)	0.5 (-1.3, 2.3)	0.76	Reference	-0.1 (-2.2, 1.9)	0.0 (-2.0, 1.9)	0.99

Conclusion: Birth mode was not significantly associated with offspring cognitive or academic performance.