

## Mode of delivery may be the risk factor for infant infectious morbidity

LETTER TO THE EDITOR – ARCHIVES OF DISEASE IN CHILDHOOD

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We read with interest “Hospitalisation for bronchiolitis in infants is more common after elective caesarean delivery”.<sup>1</sup> A previous study has reported that asthma before 3 years of age is associated with both planned and emergency caesarean, (with higher risk for emergency caesarean).<sup>2</sup> The suggested pathway is that gut microflora play a part in the development of the infant immune system, and children born by caesarean have atypical microflora colonisation compared to those born vaginally.<sup>3</sup> Surprisingly, Moore *et al* found that only planned caesarean had a statistically significant risk for bronchiolitis; attributing this to the effects of labour. We decided to replicate the study in another population, and investigate an additional potential infectious morbidity, to test the hypothesis that any caesarean is the exposure of interest.

The state of New South Wales in Australia has linked birth data and childhood hospital admission records.<sup>4</sup> Our analysis included de-identified records of 626,700 singleton livebirths of 37-41 weeks gestation for the years 2001-2008. Bronchiolitis was identified using the same ICD-10 code (J21)<sup>1</sup> and gastrointestinal infection admissions identified with ICD-10 codes A08 and A09. Logistic regression was used to model hospital admission before the first birthday for each condition. The same maternal and infant factors as in Moore *et al* were included as covariates in the models.

The proportion of infants delivered by caesarean was 26.1%: 14.9% planned and 11.2% emergency. The proportion with any admission before 12 months with bronchiolitis was 3.4% and with gastrointestinal infection was 1.7%. Table 1 shows the adjusted odds ratios (aOR) and 95% confidence intervals for these outcomes by mode of delivery, after adjustment for: preeclampsia, gestational diabetes, breech presentation, gestational age, smoking, maternal asthma admission, infant gender, birth season, small-for-gestational age/large-for-gestational age, previous pregnancies, maternal age categories, socio-economic score, and birth year. Both planned and emergency caesarean had statistically significant associations with both outcomes. The effect magnitudes were larger for gastrointestinal admissions than for bronchiolitis (Table 1).

Lack of information on breastfeeding (important in early immune response) is a limitation of both our own and Moore’s analyses. As a proxy we identified women with a lactation complication diagnosis (0.7%). Women delivered by caesarean were 70% more likely than normal vaginal delivery to have a complication recorded. Women with a lactation complication had infants more likely to have gastrointestinal admissions [OR=1.31 (1.07-1.61)] but with equivocal evidence for bronchiolitis admissions [OR=1.14 (0.98-1.33)]. As sensitivity analyses, we added lactation complication as a covariate to the models. The effect estimates for caesarean were virtually unchanged, but that may be due to under-enumeration of lactation complications.

Our bronchiolitis result is very similar to the adjusted incidence rate ratio (aIRR) reported for bronchiolitis admission after planned caesarean in Moore *et al*: aIRR=1.11 (1.01-1.23). However we also found a risk for emergency caesarean. Our results are more consistent with a hypothesis in which the birth canal is the relevant exposure rather than labour *per se*. Further research, especially including breastfeeding exposure, is needed to clarify the relevant exposure.

1. Moore HC, et al. Hospitalisation for bronchiolitis in infants is more common after elective caesarean delivery. *Arch Dis Child* 2011;Online(doi: 10.1136/archdischild-2011-300607):1-5.
2. Metsala J, et al. Perinatal factors and the risk of asthma in childhood--a population-based register study in Finland. *Am J Epidemiol* 2008;168(2):170-8.
3. Gronlund MM, et al. Fecal microflora in healthy infants born by different methods of delivery: permanent changes in intestinal flora after cesarean delivery. *J Pediatr Gastroenterol Nutr* 1999;28(1):19-25.
4. Algert CS, et al. Pregnancy exposures and risk of childhood asthma admission in a population birth cohort. *Pediatr Allergy Immunol* 2011;Online(doi: 10.1111/j.1399-3038.2011.01206.x):1-7.

Table 1 Adjusted odds ratios for any admission with bronchiolitis and gastrointestinal infectious disease before the first birthday, by mode of delivery.

Mode of delivery	aOR (95% CI) of admission with bronchiolitis at <12 months	aOR (95% CI) of admission with gastrointestinal disease at <12 months
Planned caesarean*	1.12 (1.08-1.17)	1.22 (1.15-1.29)
Emergency caesarean†	1.13 (1.07-1.18)	1.26 (1.18-1.34)
Instrumental delivery	0.91 (0.86-0.97)	1.02 (0.96-1.10)
Normal vaginal delivery	1.00 (referent)	1.00 (referent)

\* caesarean delivery before the onset of labour

† intrapartum caesarean delivery - after the onset of labour