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Long-term Childhood Outcomes of Breech Birth by Intended Mode of Delivery: A Population Record Linkage Study

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**CONFLICTS OF INTEREST** The authors declare no conflicts of interest.
ABSTRACT (word count=242/250 max)

Introduction: There is a lack of information on childhood outcomes by mode of delivery for term breech presentation. We aimed to compare childhood mortality, cerebral palsy, hospitalizations, development, and educational outcomes associated with intended vaginal breech birth (VBB) compared to planned cesarean section (CS).

Materials and Methods: Population birth and hospital records from New South Wales, Australia were used to identify women with non-anomalous pregnancies eligible for VBB from 2001 to 2012. Intended mode of delivery was inferred from labor onset and management. Death, hospital, and education records were used for follow-up until 2014. Cox proportional hazards regression and modified Poisson regression were used for analysis.

Results: Of 15,340 women considered eligible for VBB, 7.8% intended VBB, 74.2% planned CS, and intention was uncertain for 18.1%. Intended VBB did not differ from planned CS on infant mortality (Fisher’s exact p=0.55), childhood mortality (Fisher’s exact p=0.50), cerebral palsy (Fisher’s exact p=1.00), hospitalization in the first year of life (adjusted HR 1.04; 95% CI 0.90 – 1.20), hospitalization between the first and sixth birthdays (0.92; 0.82 – 1.04), being developmentally vulnerable (adjusted RR 1.22; 95% CI 0.48 – 1.88) or having special needs status (0.95; 0.48 – 1.88) when aged 4 – 6, scoring more than 1 standard deviation below the mean on tests of reading (1.10; 0.87 – 1.40) and numeracy (1.04; 0.81 – 1.34) when aged 7 – 9.

Conclusions: Planned vaginal breech birth confers no additional risks for child health, development, or educational achievement compared to planned cesarean section.

KEYWORDS (8/8 MESH terms): breech presentation; cesarean section; infant mortality; hospitalization; cerebral palsy, developmental disabilities; educational achievement; cohort study;
KEY MESSAGE (34/40 max): Planned cesarean section and intended vaginal birth have comparable outcomes on childhood health, development, and educational achievement. Current approaches to decision-making on mode of delivery for breech presentation based on short-term outcomes and maternal preferences are appropriate.

Target journal=Acta Obstetricia (US spelling)

Manuscript word count= 2974 /3000 max

References= 26 /30 max

Tables and Figures = 1 figure and 4 tables /8 max

LIST OF ABBREVIATIONS

AEDC Australian Early Developmental Census
AvEDI Australian version of the Early Development Instrument
CS cesarean section
NSW New South Wales
VBB vaginal breech birth
INTRODUCTION

Little is known about the long-term outcomes of mode of delivery for term breech presentation. Women and practitioners want choice regarding mode of delivery but the evidence shows cesarean section (CS) is safer than vaginal breech birth (VBB) for term breech presentation, at least in the short-term. The Term Breech Trial [1] and two smaller trials demonstrated a marked reduction in perinatal mortality associated with planned CS compared to planned VBB, with a modest increase in short-term maternal morbidity [2]. Two-year follow-up of a subset of Term Breech Trial infants revealed no difference in the composite outcome of death or developmental delay [3]. While this secondary outcome analysis was noted to be underpowered [3], it remains the only evidence for the longer term impact of breech mode of delivery. Hence in the present study, we aimed to investigate the health and developmental outcomes associated with intended VBB compared to planned CS for term breech presentation, through follow-up of a birth cohort into childhood.

MATERIALS AND METHODS

Study design and data sources

This was a population-based record linkage study that made use of birth, hospital, death, developmental, and education data from the state of New South Wales (NSW), Australia. NSW is the most populous state in Australia encompassing one third of the country’s births, approximately 93,000 births each year. Data for the present study came from the following population datasets: birth records 2001–2012 (Perinatal Data Collection), hospital records 2000–2014 (Admitted Patient Data Collection), death register 2002–2014 (NSW Register of Deaths), the Australian Early Developmental Census 2009 and 2012
(AEDC), and the National Assessment Program – Literacy and Numeracy 2008 – 2014 (NAPLAN).

The birth records describe all births of at least 20 weeks gestation or at least 400g birth weight, including information on maternal health, pregnancy, labor, delivery, and infant characteristics. The hospital records are a census of hospital admissions from public and private hospitals. Trained medical coders classify diagnoses and procedures associated with each hospital admission according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) [4] and the Australian Classification of Health Interventions [5]. Conditions identified using the birth and hospital records have been previously validated and shown to have high accuracy [6-8].

The mandated death registry includes all deaths certified by a medical practitioner.

The AEDC includes a national triennial assessment of early childhood development administered in the first year of school and conducted for the first time in 2009 [9]. The instrument (the Australian version of the Early Development Instrument [AvEDI]) is completed by teachers and assesses development in the 5 domains of physical health and well-being; social competence; emotional maturity; language and cognitive skills; and communication skills and general knowledge [10].

The NAPLAN is a series of nationally standardized tests administered to all Year 3, 5, 7 and 9 school students to assess basic skills in reading, writing, language conventions, and numeracy [11, 12]. Only results for students in government (i.e. public) schools were available in the research dataset.

All of the datasets were linked by the NSW Centre for Health Record Linkage using probabilistic record linkage [13]. To preserve privacy, personal identifiers were removed and a linkage key was provided to the study authors to merge relevant records for the current
study. Ethical approval for data linkage and the study was obtained from the NSW Population Health Services Research Ethics Committee.

**Study population**

The study population included children of women with non-anomalous singleton breech presentation at term (≥37 weeks) considered eligible for vaginal breech birth (VBB) during July 2001 to December 2012 in New South Wales, Australia (Figure 1).

Eligibility for VBB was based on international obstetrics and gynecology college guidelines [14-16]. These recommend that vaginal breech delivery should occur in a hospital with access to emergency caesarean section and for infants with estimated birthweight between 2,500 to 4,000 grams, in addition to other favorable factors based on clinical judgement. As in a previous study [17], we excluded women if they had: previous stillbirth, prior cesarean section (CS), maternal pelvic abnormality, pre-existing medical conditions (hypertension, diabetes, cardiovascular disease, renal disease, thyroid disease, auto-immune disease), pregnancy complications (pregnancy hypertension, gestational diabetes, antepartum hemorrhage, abruption, placenta previa), indication for caesarean as fetal distress (in absence of labor), intrapartum hemorrhage, antepartum stillbirth, or if the birth resulted in a small-for-gestational age infant, an infant with major congenital anomalies, or cord prolapse. Women could be included multiple times if they had more than one term breech pregnancy during the study period.

**Intended mode of delivery**

We inferred intended mode of delivery from the combined birth and hospital records [17]. Women who Intended VBB were those with spontaneous labor and uncomplicated vaginal breech birth, those with evidence of labor or intent to labor, including labor induction
or augmentation, spontaneous labor with caesarean delivery for failure to progress or fetal
distress, or a failed trial of labor. Women with Planned CS were those without labor. A third
group, Intention Uncertain, included women whose intention to labor was unclear, in
particular women who had spontaneous labor onset but delivered by CS with a non-specific
indication for CS (“other clinical” or “non-clinical”).

**Outcomes**

1. Infant and childhood mortality: were identified from hospital and death
   records. Infant mortality comprised any deaths up to the 1\textsuperscript{st} birthday. Childhood mortality
   included any death from the child’s 1\textsuperscript{st} to up to the 6\textsuperscript{th} birthday.

2. Infant and childhood hospitalization: Infant hospitalization included any
   hospital admission after the birth discharge home to the child’s 1\textsuperscript{st} birthday. Childhood
   hospitalization referred to any admissions between the 1\textsuperscript{st} and 6\textsuperscript{th} birthdays.

3. Cerebral palsy: Any diagnosis of cerebral palsy identified from the hospital
   records using ICD-10-AM diagnostic codes G80 – G83.

4. Developmentally vulnerable/special needs status in the first year of school:
   Scores for each domain of the AvEDI are nationally standardized and “developmentally
   vulnerable” children were those who scored below the 10\textsuperscript{th} percentile in 1 or more domain
   [9]. As children with medically diagnosed special needs were excluded from assessment,
   “special needs status” was also examined as an outcome. Follow-up for the developmental
   outcomes ranged from 4 to 7 years due to the varying age of school entry.

5. Low scores on standardized tests in the third year of school: were scores on
   the NAPLAN more than 1 standard deviation below the mean in the NSW population for
   each test and year. Students exempted from testing due to serious or complex disabilities
were considered low scorers. Testing took place in Year 3 of primary school, corresponding to follow-up at ages 7 through 9.

**Covariates**

The birth record provided information on pregnancy characteristics, including: maternal age, country of birth, parity, smoking during pregnancy, gestational age at birth, infant sex, and quintile of socioeconomic disadvantage based on postcode at birth [18].

The developmental data provided the child’s gender, age at assessment, language other than English at home, year of assessment, and school and teacher identifiers.

The education data provided child’s gender, age at test, non-English speaking background, highest parental education, highest parental occupation, year of test, and school identifier.

**Statistical analyses**

All analyses were conducted using SAS 9.3 (SAS Institute, NC). Only the Intended VBB and Planned CS groups were directly compared. Contingency tables and chi-squared tests were used to examine differences between groups on the covariates.

For infant mortality, childhood mortality, and cerebral palsy, Fisher’s exact test was used to determine if there was a significant difference between the Intended VBB and Planned CS groups. In accordance with data use guidelines, the exact numbers were not reported by group because of small numbers and the potentially identifiable nature of these individuals.

Cox proportional hazards regression was used to examine if hospitalization in the infant and childhood periods differed in the Intended VBB group compared to the Planned CS group. For infant hospitalizations, children were censored at death or their first birthday.
For childhood hospitalizations, children were censored at death, their 6th birthday or the last day for which hospital data was available (31 March 2014), whichever came first. The crude models included only mode of delivery group as an explanatory variable. The adjusted models included maternal age, country of birth, parity, smoking during pregnancy, infant sex, gestational age at birth, and socioeconomic disadvantage.

Modified Poisson regressions were used to calculate the relative risk and 95% confidence intervals associated with the developmental and educational outcomes for Intended VBB compared to Planned CS. For developmental vulnerability and special needs status, the adjusted model included child gender, quintile of socioeconomic disadvantage at birth, language other than English at home, age at assessment, and year of assessment. Correlation of outcomes between children in the same school or those rated by the same teacher were controlled for by using school and teacher identifiers as cluster variables. For low scores on tests of reading and numeracy, the adjusted models included child gender, age at test, non-English speaking background, highest level of parental education, highest level of parental occupation, and test year. Clustering by school was included in all models for reading and numeracy.

For brevity, only the results of modelling for mode of delivery are presented, with the full models shown in the Supplementary Materials.

RESULTS

Of 15,281 term breech pregnancies eligible for VBB, 7.7% were categorized as Intended VBB, 74.2% Planned CS, and 18.1% where delivery intentions were uncertain (Figure 1). Among women who Intended VBB, 55.5% birthed vaginally and 44.5% delivered by CS. Among women who Planned CS, all delivered by CS.
Women who Intended VBB were more likely Australian-born, more socioeconomically disadvantaged, more likely multiparous, and more likely smokers than women who Planned CS (Table 1). Gestational age at birth was later for the Intended VBB group with 55.4% born by 39 weeks, compared to 88.0% in the Planned CS group. More male infants were born to women who Intended VBB than those who Planned CS (Table 1).

The Intended VBB and Planned CS children with developmental outcome data did not differ on gender, socioeconomic disadvantage, language spoken at home, age at assessment, or year of assessment (Table 2).

Similarly, for children with standardized test results in Year 3 of school, the distributions of gender, age at testing, non-English speaking background, parental education, and year of test did not differ by mode of delivery (Table 3). However fewer of the Intended VBB parents were professionals and more had unknown or no occupation compared to parents in the Planned CS group.

**Mortality**

There were 8 deaths across the Intended VBB and Planned CS groups in the first year of life and 7 deaths between the first and sixth birthdays. The rate of mortality did not differ significantly between the Intended VBB and Planned CS groups in either the infant (Fisher’s exact test p=0.55) or the childhood periods (Fisher’s exact test p=0.50). No further analysis was undertaken due to the small number of cases.

**Cerebral palsy**

There were 14 children with cerebral palsy across the Intended VBB and Planned CS groups and the rate of cerebral palsy did not differ significantly between groups (Fisher’s exact, p=1.00). No further analysis was undertaken due to the small number of cases.
Hospitalizations

Of the Intended VBB, 18.9% had a hospitalization in the first year of life and 18.6% of the Planned CS were hospitalized during this period (Table 4). Between the first and sixth birthdays, 28.6% of children in the Intended VBB group were admitted to hospital at least once, compared to 30.3% in the Planned CS group. The hazard for infant and childhood hospitalizations did not differ between the Intended VBB and Planned CS groups, either before or after adjustment for the potential confounders (Table 4).

Developmental outcomes

Median follow-up for developmental outcomes was 5 years (IQR 5 – 6 years). There was no significant difference in the proportion of children deemed developmentally vulnerable in the Intended VBB or Planned CS groups (Table 4). There was similarly no difference in the rate of special needs by intended mode of delivery. Modelling showed that Intended VBB was not significantly associated with increased risk of developmental vulnerability or special needs status compared to Planned CS, before and after adjustment for covariates (Table 4).

Educational outcomes

Median follow-up for the educational outcomes was 8 years (IQR 8 – 8 years). A larger proportion of the Intended VBB group (18.8%) had low reading scores compared to children in the Planned CS group (14.8%) although this was not a statistically significant difference. For numeracy, 17.9% of Intended VBB children had low scores while 15.6% of children in the Planned CS group did and this was also not a statistically significant
difference. The risk of low test scores in the Intended VBB were not different to that of the Planned CS, even after control for differences in child and parental characteristics (Table 4).

**DISCUSSION**

In a population of low-risk breech pregnancies, Intended VBB was not associated with poorer long-term child outcomes compared to Planned CS. These outcomes included death and hospitalizations up to age 6, development in the first year of school when aged 5 to 6, and educational achievement when aged 7 to 9. Our findings indicate that VBB does not confer long-term risks (or benefits) compared to CS for term breech presentation.

Consistent with results from the Term Breech Trial [3], we found no difference in mortality, cerebral palsy, developmental, or educational outcomes across the two mode of delivery groups. The Term Breech Trial reported a 40% risk increase of parent-reported infant medical problems such as “upper respiratory, gastrointestinal, ear, skin, allergies, and other problems” associated with planned CS, but we found no difference between planned CS and intended VBB groups in either infant or childhood hospitalizations. However we cannot rule out an increase in chronic conditions such as asthma and allergies associated with CS, as these conditions do not routinely result in hospitalization.

Intended mode of delivery did not affect developmental outcomes or educational achievement. Although previous observational studies have investigated developmental and cognitive outcomes for breech infants compared to vertex infants due to the known link between breech presentation and congenital anomalies, few have examined the contribution of mode of delivery. Those that have report no differences in neurological abnormality [19], special needs [20], parent-rated psychological morbidity [21] or the combined outcome of head trauma, neonatal seizures, cerebral palsy, mental retardation, and spasticity [22].
Only the largest and most recent study, of 14,063 breech births in Scotland, reported that students delivered by vaginal breech birth had a small but statistically significant increased risk of low examination achievement, compared to those students delivered by planned cesarean section [23]. The difference between our results and those of the Scottish study may be due to the use of actual mode of delivery as the exposure, the inclusion of infants with congenital anomalies, or population selection for eligibility. We used intended mode of delivery to prevent outcomes associated with cesarean deliveries being biased by indication. Only one previous study has examined outcomes by intended rather than actual mode of delivery and this study also reported no difference in the rate of handicap across elective cesarean section and planned vaginal birth groups [24]. We excluded infants with congenital anomalies given the known association with breech presentation. Similarly, we excluded women who would not be considered eligible for vaginal breech birth to avoid confounding by indication. These methodological considerations are important strengths of the current study that allow us to more accurately estimate the effect of mode of delivery.

Other strengths of this study include the population-based cohort, long follow-up period, and objective exposure and outcome measures. The large population cohort allowed sufficient numbers for comparison even though VBB was relatively uncommon. The population cohort also ensures generalizability of the results as they pertain to the relative difference between CS and VBB, albeit not in terms of absolute rates as these were a highly select group of women. The long follow-up included all children who were still resident in the state up to 8 years after birth and enabled examination of developmental and educational outcomes which have rarely been explored.

The main limitation of the present study are potential losses to follow-up. The main reason for loss would be relocation interstate or overseas but it is unlikely that relocation would be systematically related to intended mode of delivery and therefore the results should
remain unbiased. For the educational outcomes, only information on children who attended government schools was available, however, the consistency between the educational outcomes and the developmental outcomes (available for all school types) suggests that such systematic error is unlikely.

The main implication from this study is that vaginal breech birth does not confer additional risks for long-term child health, development and educational achievement compared to planned cesarean section. One caveat to this is the timing of cesarean section. There is emerging evidence that planned birth at early term (37 – 38 weeks) independently increases the risk of developmental vulnerability and poor academic performance relative to birth at 39 – 40 weeks [25]. We found more than a third of infants born by Planned CS were born prior to 39 completed weeks of gestation which is contrary to local guidelines [26]. Delaying planned delivery where possible allows for continued fetal development and promotes better outcomes for all infants, not just those who are breech.

Decision-making around mode of delivery for term breech presentation based upon known short-term risks to a woman and her baby, long-term implications of caesarean section for later pregnancies, and women’s preferences appears appropriate. We did not explore long-term maternal outcomes which would be of interest to women and clinicians deciding between vaginal and cesarean delivery. Vaginal birth may be preferred for other reasons, and therefore should be fully facilitated through availability and access to external cephalic version. However, in cases where external cephalic version is not available or fails, women can be reassured that the mode of delivery does not have adverse consequences for the health of the infant over the long-term.
ACKNOWLEDGEMENTS

This study uses unit record data from population health data collections, the Australian Early Development Census and the National Assessment Program – Literacy and Numeracy. We thank the Ministry of Health, the NSW Department of Education and Communities and the Australian Government Department of Education for provision of population data, and the NSW Centre for Health Record Linkage for record linkage. The findings and views reported in this article are those of the authors and should not be attributed to the departments that provided data.

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REFERENCES

FIGURE AND TABLE LEGENDS

Figure 1. Flowchart showing selection of the study population and definition of the intended mode of delivery groups for term breech presentation.

Table 1. Maternal and pregnancy characteristics, by intended mode of delivery for term breech presentation.

Table 2. Child characteristics relevant to developmental outcomes, by intended mode of delivery for term breech presentation.

Table 3. Child and parent characteristics relevant to educational outcomes, by intended mode of delivery for term breech presentation.

Table 4. Hospitalization, developmental, and educational outcomes by intended mode of delivery for term breech presentation.
FIGURES

Figure 1. Flowchart showing selection of the study population and definition of the intended mode of delivery groups for term breech presentation.

NSW births Jul 2001 – Dec 2012
n=1,066,599

Breech-presenting term (≥37 weeks) singletons
n=30,412

Fully linked data available
n=29,675 (97.6%)

Eligible for VBB
N=15,281 (51.5%)

Incomplete linkage to hospital records,
n=737 (2.4%):
494 (1.6%) missing baby’s hospital birth record
171 (0.6%) missing mother’s hospital delivery record
72 (0.2%) missing mother and baby hospital records

Ineligible for VBB, n=14,394 (48.5% of those with fully linked data):
318 (1.1%) delivered in hospital without access to CS
3098 (10.4%) infant birthweight outside 2500 – 4000g
249 (0.8%) previous stillbirth
5457 (18.4%) prior CS/uterine scar
333 (1.1%) maternal pelvic abnormality
2264 (7.6%) any hypertension
2206 (7.4%) any diabetes
173 (0.6%) cardiovascular disease
95 (0.3%) renal disease
125 (0.4%) thyroid disease
118 (0.4%) auto-immune disease
555 (1.8%) antepartum hemorrhage
60 (0.2%) abruption
399 (1.3%) placenta previa
285 (1.0%) CS for fetal distress in absence of labor
65 (0.2%) intrapartum hemorrhage
13 (0.04%) antepartum stillbirth
3196 (10.8%) small-for-gestational age infant
157 (0.5%) infant with major congenital anomalies
1148 (3.9%) cord prolapse
Note: can be excluded for multiple reasons

(1) Intended VBB
VBB, labor, or intent to labor#
n=1,183 (7.7% of VBB eligible)

(2) Planned CS
No labor
n=11,339 (74.2% of VBB eligible)

(3) Intention uncertain
Intrapartum CS and intention unknown
n=2,759 (18.1% of VBB eligible)

#Labor or intention to labor includes: vaginal delivery (n=657), induced labor (n=353), induction/augmentation by artificial rupture of membranes (n=266), induction/augmentation by oxytocics (n=321), induction/augmentation by prostaglandins (n=124),

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induction/augmentation by other method (n=14), spontaneous labor with cesarean delivery for failure to progress or fetal distress (n=179), or failed trial of labor (n=2). Reasons for inclusion are not mutually exclusive.
Table 1. Maternal and pregnancy characteristics, by intended mode of delivery for term breech presentation.

<table>
<thead>
<tr>
<th></th>
<th>Intended VBB</th>
<th>Planned CS</th>
<th>Intention Uncertain</th>
<th>Difference between groups*</th>
<th>Statistic, p-value</th>
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<tr>
<td></td>
<td>n=1183</td>
<td>n=11339</td>
<td>n=2759</td>
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<td></td>
<td>n (col%)</td>
<td>n (col%)</td>
<td>n (col%)</td>
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<tr>
<td>Maternal age</td>
<td></td>
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<tr>
<td>&lt;20 years</td>
<td>33 (2.8)</td>
<td>287 (2.5)</td>
<td>105 (3.8)</td>
<td>X^2(2)=1.15, p=0.56</td>
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<td>20-34 years</td>
<td>898 (75.9)</td>
<td>8496 (74.9)</td>
<td>2129 (77.2)</td>
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<tr>
<td>35+ years</td>
<td>252 (21.3)</td>
<td>2556 (22.5)</td>
<td>525 (19.0)</td>
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<tr>
<td>Country of birth</td>
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<td>X^2(1)=6.12, p=0.01</td>
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<tr>
<td>Overseas</td>
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<td>3312 (29.2)</td>
<td>831 (30.1)</td>
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<tr>
<td>Australia</td>
<td>878 (74.2)</td>
<td>8027 (70.8)</td>
<td>1928 (69.9)</td>
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<tr>
<td>Socioeconomic disadvantage (quintile)</td>
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<td>X^2(5)=55.31, p&lt;0.0001</td>
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<td>Most disadvantaged</td>
<td>202 (17.1)</td>
<td>1676 (14.8)</td>
<td>541 (19.6)</td>
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<td></td>
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<tr>
<td>2</td>
<td>231 (19.5)</td>
<td>1951 (17.2)</td>
<td>526 (19.1)</td>
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<tr>
<td>3</td>
<td>271 (22.9)</td>
<td>2084 (18.4)</td>
<td>551 (20.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>257 (21.7)</td>
<td>2425 (21.4)</td>
<td>517 (18.7)</td>
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<td>Least disadvantaged</td>
<td>222 (18.8)</td>
<td>3177 (28.0)</td>
<td>617 (22.4)</td>
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<td>Parity</td>
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<td>X^2(2)=265.23, p&lt;0.0001</td>
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<td>Nulliparous</td>
<td>574 (48.5)</td>
<td>8092 (71.4)</td>
<td>1799 (65.2)</td>
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<td>Multiparous</td>
<td>609 (51.5)</td>
<td>3237 (28.6)</td>
<td>958 (34.7)</td>
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<td>Smoking during pregnancy</td>
<td>159 (13.4)</td>
<td>1019 (9.0)</td>
<td>358 (13.0)</td>
<td>X^2(1)=24.93, p&lt;0.0001</td>
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<td></td>
<td></td>
<td></td>
<td>X^2(4)=1058.61, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>37 weeks</td>
<td>109 (9.2)</td>
<td>698 (6.2)</td>
<td>527 (19.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38 weeks</td>
<td>242 (20.5)</td>
<td>3762 (33.2)</td>
<td>893 (32.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39 weeks</td>
<td>304 (25.7)</td>
<td>5519 (48.7)</td>
<td>775 (28.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 weeks</td>
<td>343 (29.0)</td>
<td>1088 (9.6)</td>
<td>443 (16.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 – 43 weeks</td>
<td>185 (15.6)</td>
<td>272 (2.4)</td>
<td>121 (4.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant sex</td>
<td></td>
<td></td>
<td></td>
<td>X^2(1)=4.20, p=0.04</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>628 (53.1)</td>
<td>6372 (56.2)</td>
<td>1501 (54.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>555 (46.9)</td>
<td>4967 (43.8)</td>
<td>1258 (45.6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Tests compared Intended VBB and Planned CS groups only.
Table 2. Child characteristics relevant to developmental outcomes, by intended mode of delivery for term breech presentation.

<table>
<thead>
<tr>
<th>For developmental outcomes</th>
<th>Intended VBB n=176</th>
<th>Planned CS n=1909</th>
<th>Intention Uncertain n=466</th>
<th>Difference between groups* Statistic, p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=2551</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>94 (53.4)</td>
<td>1047 (54.9)</td>
<td>280 (60.1)</td>
<td>$\chi^2(1)=0.13, p=0.71$</td>
</tr>
<tr>
<td>Male</td>
<td>82 (46.6)</td>
<td>862 (45.2)</td>
<td>186 (39.9)</td>
<td></td>
</tr>
<tr>
<td>Socioeconomic disadvantage at birth (quintile)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most disadvantaged</td>
<td>27 (15.3)</td>
<td>274 (14.4)</td>
<td>105 (22.5)</td>
<td>$X^2(4)=6.42, p=0.17$</td>
</tr>
<tr>
<td>2</td>
<td>35 (19.9)</td>
<td>358 (18.8)</td>
<td>85 (18.2)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>45 (25.6)</td>
<td>362 (19.0)</td>
<td>96 (20.6)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>32 (18.2)</td>
<td>426 (22.3)</td>
<td>82 (17.6)</td>
<td></td>
</tr>
<tr>
<td>Least disadvantaged</td>
<td>37 (21.0)</td>
<td>489 (25.6)</td>
<td>98 (21.0)</td>
<td></td>
</tr>
<tr>
<td>Language other than English at home</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34 (19.3)</td>
<td>378 (19.8)</td>
<td>118 (25.3)</td>
<td>$X^2(1)=0.02, p=0.88$</td>
<td></td>
</tr>
<tr>
<td>Age at test (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 – 5</td>
<td>140 (79.6)</td>
<td>1490 (78.1)</td>
<td>376 (80.7)</td>
<td>$X^2(1)=0.21, p=0.65$</td>
</tr>
<tr>
<td>6 – 7</td>
<td>36 (20.5)</td>
<td>419 (22.0)</td>
<td>90 (19.3)</td>
<td></td>
</tr>
<tr>
<td>Year of AvEDI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>96 (54.6)</td>
<td>974 (51.0)</td>
<td>239 (51.3)</td>
<td>$X^2(1)=0.80, p=0.37$</td>
</tr>
<tr>
<td>2012</td>
<td>80 (45.5)</td>
<td>935 (48.9)</td>
<td>227 (48.7)</td>
<td></td>
</tr>
</tbody>
</table>

*Tests compared Intended VBB and Planned CS groups only.
Table 3. Child and parent characteristics relevant to educational outcomes, by intended mode of delivery for term breech presentation.

<table>
<thead>
<tr>
<th>For educational outcomes</th>
<th>Intended VBB n=318</th>
<th>Planned CS n=2641</th>
<th>Intention Uncertain n=705</th>
<th>Difference between groups*</th>
<th>Statistic, p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=3664</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>163 (51.3)</td>
<td>1466 (55.5)</td>
<td>407 (57.7)</td>
<td>$\chi^2(1)=207$, p=0.15</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>155 (48.7)</td>
<td>1175 (44.5)</td>
<td>298 (42.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at test (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>16 (5.0)</td>
<td>128 (4.9)</td>
<td>42 (6.0)</td>
<td>$\chi^2(3)=3.97$, p=0.26</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>264 (83.0)</td>
<td>2244 (85.0)</td>
<td>592 (84.0)</td>
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<td></td>
</tr>
<tr>
<td>9</td>
<td>37 (11.6)</td>
<td>268 (10.2)</td>
<td>71 (10.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>x (0.3)</td>
<td>x (0.0)</td>
<td>x (0.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-English speaking background</td>
<td>75 (23.6)</td>
<td>613 (23.2)</td>
<td>200 (28.4)</td>
<td>$\chi^2(2)=1.63$, p=0.44</td>
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<tr>
<td>Parental education</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Unknown and ≤Year 12</td>
<td>79 (24.8)</td>
<td>571 (21.6)</td>
<td>181 (25.7)</td>
<td>$\chi^2(3)=4.65$, p=0.20</td>
<td></td>
</tr>
<tr>
<td>Certificate I-IV</td>
<td>89 (28.0)</td>
<td>717 (27.2)</td>
<td>219 (31.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>50 (15.7)</td>
<td>369 (14.0)</td>
<td>100 (14.2)</td>
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<td></td>
</tr>
<tr>
<td>Bachelor degree or above</td>
<td>100 (31.5)</td>
<td>984 (37.3)</td>
<td>205 (29.1)</td>
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<td></td>
</tr>
<tr>
<td>Parental occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown or Not in paid</td>
<td>64 (20.1)</td>
<td>388 (14.7)</td>
<td>142 (20.1)</td>
<td>$\chi^2(4)=9.46$, p=0.05</td>
<td></td>
</tr>
<tr>
<td>Hospitality and labourers</td>
<td>43 (13.5)</td>
<td>352 (13.3)</td>
<td>117 (16.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trades, office workers,</td>
<td>71 (22.3)</td>
<td>535 (20.3)</td>
<td>142 (20.1)</td>
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<td></td>
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<tr>
<td>sales and service staff</td>
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</tr>
<tr>
<td>Managers and associate</td>
<td>70 (22.0)</td>
<td>666 (25.2)</td>
<td>156 (22.1)</td>
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<td></td>
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<tr>
<td>professionals</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Senior management and</td>
<td>70 (22.0)</td>
<td>700 (26.5)</td>
<td>148 (21.0)</td>
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</tr>
<tr>
<td>professionals</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Year of NAPLAN</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2009</td>
<td>x (0.3)</td>
<td>x (0.3)</td>
<td>x (0.3)</td>
<td>$\chi^2(5)=3.13$, p=0.68</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>62 (19.5)</td>
<td>449 (17.0)</td>
<td>122 (17.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>69 (21.7)</td>
<td>534 (20.6)</td>
<td>135 (19.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>63 (19.8)</td>
<td>588 (22.3)</td>
<td>148 (21.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>54 (17.0)</td>
<td>514 (19.5)</td>
<td>148 (21.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>69 (21.7)</td>
<td>540 (20.5)</td>
<td>150 (21.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Tests compared Intended VBB and Planned CS groups only.
“x” indicates number censored due to cell size <5.
Table 4. Hospitalization, developmental, and educational outcomes by intended mode of delivery for term breech presentation.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intended VBB (col%)</th>
<th>Planned CS (col%)</th>
<th>Crude HR* (95% CI)</th>
<th>Adjusted HR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any hospitalization in the 1st year of life</td>
<td>18.9</td>
<td>18.6</td>
<td>1.03 (0.90 – 1.18)</td>
<td>1.04 (0.90 – 1.20)</td>
</tr>
<tr>
<td>Any hospitalization between 1st and 6th birthdays</td>
<td>28.6</td>
<td>30.3</td>
<td>0.93 (0.83 – 1.04)</td>
<td>0.92 (0.82 – 1.04)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intended VBB (col%)</th>
<th>Planned CS (col%)</th>
<th>Crude RR* (95% CI)</th>
<th>Adjusted RR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmentally vulnerable</td>
<td>19.3</td>
<td>15.6</td>
<td>1.22 (0.89 – 1.68)</td>
<td>1.22 (0.88 – 1.69)</td>
</tr>
<tr>
<td>Special needs</td>
<td>4.6</td>
<td>4.8</td>
<td>0.96 (0.47 – 1.94)</td>
<td>0.95 (0.48 – 1.88)</td>
</tr>
<tr>
<td>Low reading score</td>
<td>18.6</td>
<td>14.8</td>
<td>1.22 (0.95 – 1.56)</td>
<td>1.10 (0.87 – 1.40)</td>
</tr>
<tr>
<td>Low numeracy score</td>
<td>17.9</td>
<td>15.6</td>
<td>1.12 (0.87 – 1.46)</td>
<td>1.04 (0.81 – 1.34)</td>
</tr>
</tbody>
</table>

Note: Base Ns for each outcome are different hence frequencies are not shown for simplicity. *Hazard ratio / relative risk of outcome in Intended VBB compared to Planned CS (referent).