Improving management of breech presentation at term
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Citation for published version (APA):
Vlemmix, F. (2014). Improving management of breech presentation at term

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Term breech deliveries in the Netherlands: did the increased cesarean rate affect neonatal outcome? A population based cohort study

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ACTA Obstetricia et Gynelogica; accepted for publication.
ABSTRACT

Objective The aim of this study was to evaluate the effect of the increased cesarean rate for term breech presentation on neonatal outcome. We also investigate whether the clinical case selection for vaginal delivery applied by Dutch obstetricians led to an optimization of neonatal outcome, or if there is still room for improvement in terms of perinatal outcome.

Design Retrospective cohort.

Setting the Netherlands.

Population Singleton term breech deliveries from 37 0/7 to 41 6/7 weeks, excluding fetus with congenital malformations or antenatal death.

Method We used data from the Dutch national perinatal registry from 1999 up to 2007.

Main outcome measures Perinatal mortality and morbidity.

Results We studied 58,320 women with a term breech delivery. There was an increase in the elective cesarean rate (from 24% to 60%). As a consequence, overall perinatal mortality decreased (1.3 vs. 0.7‰; OR 0.51 (95% CI 0.28 – 0.93)), while it remained stable in the planned vaginal birth group (1.7 vs. 1.6‰; OR 0.96 (95% CI 0.52 – 1.76)). The number of caesareans to prevent one perinatal death was 338.

Conclusions Adjustment of the national guidelines after publication of the Term Breech Trial resulted in a shift towards elective cesarean and a decrease of perinatal mortality and morbidity among women delivering a child in breech at term. Still 40% of these women attempt vaginal birth. The relative safety of an elective cesarean should be weighed against the consequences of a scarred uterus in future pregnancies.
INTRODUCTION

The term breech trial was the largest randomized controlled trial to investigate the effect of mode of delivery for term breech deliveries on neonatal and maternal outcomes. The study reported a highly significant decrease in combined perinatal mortality and morbidity scores among women undergoing a planned caesarean compared to those planned to deliver vaginally (5.0 vs. 16.0‰), RR 0.33; 95%CI 0.19-0.56). The relative benefit of a planned caesarean was strongest in countries with a perinatal mortality rate below 2.0% (57.0 vs. 4.0‰), RR 0.07; 95%CI 0.02-0.29). However, planned caesarean delivery was not associated with a reduction in risk of death or neurodevelopmental delay in children at 2 years of age. The authors suggested that the fact that only 44% of children from the initial trial were investigated in the follow up may have limited statistical power to detect differences at age 2. Maternal outcomes immediately postpartum and at 2 years were similar after planned caesarean section and planned vaginal birth for the singleton breech fetus at term.

Publication of the term breech trial had a worldwide impact on clinical practice. An Australian population study reported an increase of elective caesarean rate for breech deliveries up to 76.6% and an overall caesarean rate of 96.3% in 2005. A Danish study reported an increase of overall caesarean rate up to 94.2% in 2008. Within the latter cohort, intrapartum and early neonatal mortality was reduced from 1.3‰ (1997 - 2000) to 0.5‰ in (2001 - 2008) (RR 0.38; 95%CI 0.15-0.98).

In the Netherlands, the overall caesarean rate increased from 50 to 78% within three months after publication of the term breech trial, mainly due to an increase of elective cesareans. This resulted in a significant decrease of neonatal death (OR 0.53; 95%CI 0.33-0.83) and neonatal trauma (OR 0.26; 95%CI 0.14-0.50) between 1998 and 2002. However, the most recent ‘Dutch report of perinatal care’ from 2008 showed that after the initial rise in elective caesareans, there was no further increase, and the overall caesarean rate remained stable at 80%.

The difference in cesarean rate for term breech presentation between the Netherlands and other countries is remarkable and can only be explained in a multifactorial way. Factors potentially influencing the difference in clinical care are; interpretation of research findings presented in published articles.
The aim of this study is to evaluate the effect of the rise in cesarean rate for term breech delivery on neonatal outcome up to 2007. Furthermore, in order to investigate whether the Dutch management of the clinical obstetric issue of safe term breech delivery is justified, we wondered whether the clinical case selection for vaginal delivery applied by Dutch obstetricians, resulting in a relatively large proportion of women (40%) with a term breech being selected for vaginal delivery, led to an optimization of neonatal outcome, or if there is still room for improvement in terms of perinatal mortality and morbidity.

MATERIAL AND METHODS

This study was performed in a population based cohort using the Netherlands Perinatal Registry (PRN). The PRN consists of population-based data containing information on pregnancies, deliveries and (re)admissions until 7 days after birth. The PRN database is obtained by a validated linkage of three different registries: the midwifery registry (LVR 1), the obstetric registry (LVR 2) and the neonatology registry (LNR) of hospital admissions of newborns. The coverage of the PRN registry is about 96% of all deliveries in the Netherlands. All data contained in the PRN are voluntarily recorded by the caregiver during prenatal care, delivery and the neonatal period. Data on neonatal admissions are registered in 53-58% of hospitals in The Netherlands. The neonatal follow up, up to 28 days after birth, is provided by 80% of neonatal care units to the PRN. The data are sent to the national registry office annually, where a number of range and consistency checks are conducted. For this study all births between 1 January 1999 (inception of the PRN registry) and 31 December 2007 (the most recent, validated and linked year available at start of the analyses for this study) were selected. The PRN gave approval for anonymous use of requested data for this analyses (#11.47). No ethical approval or informed consent was required for this retrospective cohort study as the use of the data was within the confines pose by Dutch law on the use of registry data.

We studied pregnant women with singleton breech presentations who delivered between 37 0/7 and 41 6/7 weeks of gestation. Exclusion criteria were

(Reflected by differences in content and style of phrasing of guidelines and translation of guidelines to women by their attending physician), claim culture, jurisdiction and organization of obstetric care.
antepartum death and major congenital malformations. Major congenital
malformations were defined as lethal congenital malformations (e.g. trisomy
18, Potter’s syndrome, central nervous system abnormalities (meningomy-
elocele, exencephaly, anencephaly, hydrocephaly and microcephaly) and in-
fants with multiple congenital malformations (including spina bifida, intesti-
nal atresias and congenital heart disease). To validate the perinatal mortality
we verified all causes of mortality through the hospital charts.

Planned vaginal birth was defined as initially intended vaginal birth; the com-
bination of actual vaginal birth and emergency caesarean delivery, includ-
ing both failure to progress and fetal distress as indications for a caesarean
delivery. Elective caesarean section was defined as all women opting for a
planned caesarean delivery.

The primary outcome was perinatal mortality, defined as intrapartum death
or death within 28 days after birth. Secondary outcomes were; a five-minute
Apgar score below 7, neonatal trauma (defined as a composite of intracere-
bral bleeding, cephalic hematoma, facial nerve paresis, brachial plexus le-
sion, fracture of clavicle, humerus or femur and other trauma), and poor
neonatal outcome was defined as perinatal mortality, five-minute Apgar
score below 7 and neonatal trauma.

We analysed trends of mode of delivery and neonatal outcomes over the
years and differences in neonatal outcomes before and after publication
of the term breech trial (before October 2000 and after November 2000).
We performed univariate analysis and provided outcomes for different
subgroups: parity (nulliparous/multiparous), birth weight (<=3500 / >3500
gram), type of breech (complete/frank), and onset of labor (spontaneous vs.
induced or augmented).

Furthermore, we looked at the difference in elective caesarean delivery rate
in relation to neonatal outcomes among Dutch hospitals. We not only com-
pared neonatal outcome before and after November 2000, but also the im-
pact of planned vaginal delivery and elective caesarean delivery. All statisti-
cal analyses were carried out with SAS 9.2 (SAS Institute, Cary, NC).
RESULTS

There were 1.4 million singleton term deliveries in the nine year study period, of which 4.4% were breech deliveries. We excluded 161 cases of antenatal death (0.27%) and 642 cases with major congenital abnormalities (1.09%) from the analysis, leaving 58 320 women in the study. Figure 1 shows the trend in the mode of delivery for breech presentation between 1999 and 2007. Publication of the term breech trial led to an increase in elective caesareans from 24% before publication of the study to 60% after.

Figure 1. Trends in vaginal birth and cesarean section rate in women with an infant in breech presentation at term between 1999 and 2007

Figure 2: Trends in perinatal outcome after breech birth (elective cesarean and planned vaginal birth) at term between 1999 and 2007
Figure 2 shows the impact on the neonatal outcome. The increase in elective caesarean rate resulted in a decrease in perinatal death (1.3‰ before Oct 2000 vs. 0.7‰ after Nov 2000, OR 0.51; 95%CI 0.28-0.93), a decrease in low Apgar score (20.2 vs. 9.6‰, OR 0.47; 95%CI 0.40-0.55), and a decrease in neonatal trauma (4.8 vs. 2.2‰; OR 0.46 95%CI 0.34-0.63) (Table 1).

Subgroup analysis showed a smaller increase in elective caesarean rate among multiparous compared to nulliparous (31 vs. 39%). The increase of 31% in elective caesarean delivery within the multiparous group did not result in statistically significant decrease of overall perinatal mortality rate among multiparous women, although there was also in this group a positive trend (0.8‰ before Oct 2000 vs. 0.6‰ after Dec 2000, OR 0.69; 95%CI 0.22-2.20) (Table 2).

Table 1. Neonatal outcome following term breech delivery before and after publication of the Term Breech Trial (TBT)

<table>
<thead>
<tr>
<th></th>
<th>Before TBT</th>
<th>After TBT</th>
<th>Odds ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>12,383</td>
<td>45,937</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective cesarean (%)</td>
<td>24</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency cesarean (%)</td>
<td>34</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal death^</td>
<td>16 (1.3)</td>
<td>30 (0.7)</td>
<td>0.51 (0.28 - 0.93)</td>
<td>0.01</td>
</tr>
<tr>
<td>Low Apgar score*</td>
<td>250 (20.2)</td>
<td>439 (9.6)</td>
<td>0.47 (0.40 - 0.55)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Neonatal Trauma~</td>
<td>60 (4.8)</td>
<td>103 (2.2)</td>
<td>0.46 (0.34 - 0.63)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Nulliparous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>7,677</td>
<td>28,871</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective cesarean (%)</td>
<td>23</td>
<td>62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal death^</td>
<td>12 (1.6)</td>
<td>20 (0.7)</td>
<td>0.44 (0.22 - 0.91)</td>
<td>0.03</td>
</tr>
<tr>
<td>Low Apgar score*</td>
<td>170 (22.1)</td>
<td>269 (9.3)</td>
<td>0.42 (0.34 - 0.50)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Neonatal Trauma~</td>
<td>40 (5.2)</td>
<td>67 (2.3)</td>
<td>0.44 (0.30 - 0.66)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Multiparous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>4,706</td>
<td>17,066</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective cesarean (%)</td>
<td>26</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal death^</td>
<td>4 (0.8)</td>
<td>10 (0.6)</td>
<td>0.69 (0.22 – 2.20)</td>
<td>0.53</td>
</tr>
<tr>
<td>Low Apgar score*</td>
<td>80 (17.0)</td>
<td>170 (10.0)</td>
<td>0.58 (0.45 - 0.76)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Neonatal Trauma~</td>
<td>20 (4.2)</td>
<td>36 (2.1)</td>
<td>0.50 (0.29 - 0.86)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

^Intrapartum death and neonatal mortality up to 7 days
*Five-minute Apgar score <7
~Composite score of: intracerebral bleeding, cephalic haematoma, facial nerve paralyis, brachial plexus lesion, fracture of clavicle, humerus or femur and other trauma
\(^{\dagger}\)Percentage of pursued vaginal birth
Table 2. Neonatal outcome in case of term breech delivery according to mode of delivery.

<table>
<thead>
<tr>
<th></th>
<th>Vaginal birth</th>
<th></th>
<th>Emergency caesarean</th>
<th></th>
<th>Pursued vaginal birth*</th>
<th></th>
<th>Elective caesarean</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before TBT</td>
<td>After TBT</td>
<td>Before TBT</td>
<td>After TBT</td>
<td>Before TBT</td>
<td>After TBT</td>
<td>Before TBT</td>
<td>After TBT</td>
</tr>
<tr>
<td>Perinatal death^</td>
<td>11 (1.8)</td>
<td>17 (1.7)</td>
<td>5 (1.6)</td>
<td>13 (1.6)</td>
<td>16 (1.7)</td>
<td>30 (1.6)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Low Apgar score*</td>
<td>178 (28.6)</td>
<td>274</td>
<td>59 (18.4)</td>
<td>100 (12.1)</td>
<td>237 (25.1)</td>
<td>374 (20.3)</td>
<td>13 (4.4)</td>
<td>65 (2.4)</td>
</tr>
<tr>
<td>Neonatal Trauma~</td>
<td>56 (9.0)</td>
<td>62 (6.1)</td>
<td>4 (1.2)</td>
<td>14 (1.7)</td>
<td>60 (6.4)</td>
<td>76 (4.1)</td>
<td>0 (0.0)</td>
<td>27 (1.0)</td>
</tr>
<tr>
<td>Intra cerebral bleeding</td>
<td>3 (0.5)</td>
<td>3 (0.3)</td>
<td>-</td>
<td>1 (0.1)</td>
<td>3 (0.3)</td>
<td>4 (0.2)</td>
<td>-</td>
<td>1 (0.04)</td>
</tr>
<tr>
<td>Cephalic hematoma</td>
<td>3 (0.5)</td>
<td>1 (0.1)</td>
<td>-</td>
<td>1 (0.1)</td>
<td>3 (0.3)</td>
<td>2 (0.1)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Facial nerve lesion</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Brachial plexus lesion</td>
<td>25 (4.0)</td>
<td>28 (2.8)</td>
<td>-</td>
<td>-</td>
<td>25 (2.7)</td>
<td>28 (1.5)</td>
<td>-</td>
<td>6 (0.2)</td>
</tr>
<tr>
<td>Clavicula fracture</td>
<td>10 (1.6)</td>
<td>19 (1.9)</td>
<td>-</td>
<td>-</td>
<td>10 (1.0)</td>
<td>19 (1.0)</td>
<td>-</td>
<td>1 (0.04)</td>
</tr>
<tr>
<td>Humerus fracture</td>
<td>9 (1.4)</td>
<td>3 (0.3)</td>
<td>-</td>
<td>-</td>
<td>9 (1.0)</td>
<td>3 (0.2)</td>
<td>-</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>Femur fracture</td>
<td>1 (0.2)</td>
<td>-</td>
<td>1 (0.3)</td>
<td>-</td>
<td>2 (0.2)</td>
<td>-</td>
<td>-</td>
<td>6 (0.2)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (1.6)</td>
<td>18 (1.8)</td>
<td>3 (0.9)</td>
<td>12 (1.4)</td>
<td>22 (2.3)</td>
<td>30 (1.6)</td>
<td>-</td>
<td>11 (0.4)</td>
</tr>
</tbody>
</table>

^Intrapartum death and neonatal mortality up to 7 days
*Five-minute Apgar score <7
~composite score of: intracerebral bleeding, cephalic haematoma, facial nerve paresis, brachial plexus lesion, fracture of clavicle, humerus or femur and other trauma. One child could have suffered multiple neonatal traumata and therefore the separate trauma do not always add up to the composite outcome of children with neonatal trauma.

¥Composite of vaginal delivery and emergency caesarean.
Despite the increased emergency caesarean rate (from 34 to 45%) within the planned vaginal birth group after publication of the term breech trial, the perinatal mortality rate within the planned vaginal breech group remained stable (1.7 before October 2000 vs. 1.6‰ after December 2000, OR 0.96; 95%CI 0.52-1.76). The prevalence of low Apgar score (25.1 vs. 20.3‰, OR 0.81; 95% 0.68-0.95) and of neonatal trauma (6.4 vs. 4.1‰, OR 0.65; 95% 0.46-0.92) improved in women with a planned vaginal delivery after publication of the term breech trial (Table 2). Of the 46 cases of perinatal mortality, breech presentation had not been diagnosed until birth in 9 cases (19.1%).

Table 3 shows the gain in neonatal outcome by performing an elective caesarean delivery. There was no perinatal mortality in the elective caesarean group, compared to 1.6‰ in the planned vaginal birth group. Elective caesarean delivery was associated with a lower risk of poor neonatal outcome compared to planned vaginal birth (OR 0.14, 95% CI 0.11 to 0.18), including a lower risk of low Apgar score (OR 0.12, 95% CI 0.09 to 0.16), and a lower risk of neonatal trauma (OR 0.24, 95% CI 0.15 to 0.37).

Exclusion of the nine women with breech presentation not diagnosed until labor, who were all included in the planned vaginal birth group, did not alter the difference in perinatal mortality between the two groups (1.3‰ in the planned vaginal birth group vs. none in the elective caesarean group).

Table 4 shows the relation between mode of delivery and neonatal outcome for different subgroups. Elective caesarean led to a strong decrease in neonatal morbidity and mortality regardless of parity, type of breech, birth weight, or onset of labor.

**Table 3.** Neonatal outcomes per mode of delivery: Elective cesarean delivery compared to pursued vaginal breech delivery since publication of the Term Breech Trial.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pursued vaginal birth*</th>
<th>Elective cesarean delivery</th>
<th>Odds ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor neonatal outcome*</td>
<td>424 (23.1)</td>
<td>92 (3.3)</td>
<td>0.14 (0.11–0.18)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Perinatal death^</td>
<td>30 (1.6)</td>
<td>0</td>
<td>-</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Low Apgar score*</td>
<td>374 (20.3)</td>
<td>65 (2.5)</td>
<td>0.12 (0.09–0.16)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Neonatal Trauma~</td>
<td>76 (4.1)</td>
<td>27 (1.0)</td>
<td>0.24 (0.15–0.37)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

*Composite of perinatal death, low Apgar score and neonatal trauma
^Intrapartum death and neonatal mortality up to 7 days
*Five-minute Apgar score <7
~Composite score of: intracerebral bleeding, cephalic haematoma, facial nerve paresis, brachial plexus lesion, fracture of clavicle, humerus or femur and other trauma
†Composite of vaginal delivery (55%) and emergency cesarean (45%)
Table 4: Neonatal outcomes for planned vaginal breech vs. elective cesarean delivery since publication of the term breech trial for different subgroups

<table>
<thead>
<tr>
<th></th>
<th>Perinatal death^</th>
<th>Low Apgar score*</th>
<th>Neonatal traumata</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds ratio (Incidences) (%)^</td>
<td>Odds ratio</td>
<td>p-value</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nulliparous</td>
<td>- (1.8 vs. 0‰)</td>
<td>0.11 (0.08 – 0.15)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>Multiparous</td>
<td>- (1.4 vs. 0‰)</td>
<td>0.13 (0.09 – 0.20)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td><strong>Type of breech</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete</td>
<td>- (3.2 vs. 0‰)</td>
<td>0.11 (0.07 – 0.17)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>Frank</td>
<td>- (1.2 vs. 0‰)</td>
<td>0.11 (0.08 – 0.15)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td><strong>Birth weight</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤3500 grams</td>
<td>- (2.0 vs. 0‰)</td>
<td>0.11 (0.08 – 0.15)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>&gt;3500 grams</td>
<td>- (0.8 vs. 0‰)</td>
<td>0.13 (0.08 – 0.21)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td><strong>Onset of labor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>- (1.5 vs. 0‰)</td>
<td>0.15 (0.12 – 0.20)</td>
<td>0.008</td>
</tr>
<tr>
<td>Induced /</td>
<td>- (2.1 vs. 0‰)</td>
<td>0.09 (00.06 –</td>
<td>&lt;0.000</td>
</tr>
</tbody>
</table>

^Intrapartum death and neonatal mortality up to 7 days. No odds ratios could be calculated for perinatal mortality since there was no mortality in the planned cesarean group.

* No odds ratio could be calculated due to no events in the elective cesarean delivery group.

* Five-minute Apgar score <7
In stratified analysis results for parity, type of breech, birth weight and onset of labor, did not change the strong relationship between mode of delivery and poor neonatal outcome. There was no interaction between parity and mode of delivery for poor neonatal outcome. Birth weight below 3500gr was related to a poorer outcome compared to higher birth weight (>3500gr). Complete breech was related to a poorer outcome compared to frank breech presentation and induced or augmented labor to a worse outcome compared to spontaneous birth (table 4).

Data from 99 different hospitals are registered in the PRN registry. The total number of breech births within seven years after the term breech trial varied from 9 to 739 per hospital with a median of 381. The elective caesarean rate in these women varied from 14 to 80% between the hospitals. Perinatal death (n=30) occurred in 24 hospitals (24%), with a maximum of 9.4‰ (3 of 318 breech deliveries in seven years). Correlation analyses did neither demonstrate an association between hospital elective caesarean rate and perinatal death, low Apgar score, neonatal trauma, or poor neonatal outcome, nor was there an association between the volume of breech births and the neonatal outcome.

Since publication of the term breech trial, 1 692 more caesarean deliveries (combined elective and emergency caesarean) were performed annually. This led to an annual reduction of five neonatal deaths (number needed to treat (NNT) 338), 126 neonates with low Apgar scores (NNT 13), and 30 neonates with birth traumata (NNT 56).

If all women who nowadays still undergo a planned vaginal breech birth, would receive an elective caesarean, 6 490 more elective CS would be performed. This would lead to an additional annual reduction of 10 neonatal mortalities, 116 neonates with low Apgar scores and 20 neonates with birth traumata.

Breech deliveries account for 5.8% (10 of 172 per year) of the perinatal and neonatal mortality up to 28 days postpartum among term singleton deliveries in the Netherlands. A policy of elective caesarean for all term breech deliveries could lower the overall term neonatal mortality in term deliveries with 6.8% from 172 to 162 cases per year.
DISCUSSION

In this analysis of almost a decade of term breech deliveries in the Netherlands, we found a significant improvement of neonatal outcomes most likely due to the increased elective caesarean rate that occurred after publication of the Term Breech Trial. Nulliparous women benefitted more from the change in policy than multiparous women as elective caesarean rates were higher in the first group. Despite the lower percentage of women opting for or offered a vaginal delivery, and despite a higher emergency caesarean rate during vaginal breech birth, neonatal outcome within the planned vaginal birth group did not improve.

This study on breech birth is unique in its size, and the Dutch setting makes it possible to evaluate the effect of an increase, though not complete change in daily practice of elective caesarean for breech presentation at term. We showed that based on patient characteristics including parity, onset of labor, type of breech presentation and birth weight, no subgroup of women could be identified with a low risk of poor neonatal outcome during planned vaginal delivery compared to elective caesarean. Several other studies tried to identify a subgroup of patients with low risk at adverse perinatal outcome during vaginal breech delivery. Most of these studies have a lack of power to detect a significant difference on for instance perinatal mortality.\textsuperscript{8-11} There is one large prospective cohort trial from the PREMODA study group, who evaluated the birth outcome of 2,502 planned vaginal deliveries and 5,573 planned caesarean deliveries and could not find a significant difference in fetal and neonatal mortality or serious neonatal morbidity.\textsuperscript{12} Women were found eligible for planned vaginal delivery according to the CNGOF guideline and trial of labor was guided according to advices from national guidelines as well. The composite poor neonatal outcome was 16.0‰ in the planned vaginal delivery group vs. 14.5‰ in the planned caesarean group (OR 1.10, (95%CI 0.75-1.61)). Their rates of low Apgar scores and birth trauma are higher in the caesarean section group, but much lower in the planned vaginal breech group, compared to the data presented in this study. Their explanation of the non-significant results is partly the quality advantages of a prospective study design compared to all the significant results in retrospective studies. Similar to this prospective cohort study, we have evaluated the cause of all perinatal mortalities, which improves the reliability of our outcomes compared to those of other retrospective studies. Secondly, the authors state that the
regulated selection procedure for planned vaginal delivery and intrapartum management might explain the non-significant results. Although evidence based proof of these antenatal examinations is lacking, they assume that special attention to the decision on mode of delivery might be an explanation of the low poor neonatal outcome rate in the vaginal delivery group. The potential effectiveness of application of a consensus guidelines is also seen in a study by Vendittelli et al. with less neonatal complications in centers working according to these guidelines compared to other centers (OR 0.27 (95%CI 0.09-0.85)).\(^{13}\) Since vaginal breech delivery is still common practice in the Netherlands, the high poor neonatal outcome rates in comparison to other countries, should be focus of research and training of obstetricians.

In this study, we choose to use a cut off level of birth weight of 3500 grams and not small for gestational age. The correlation of small for gestational age and adverse neonatal outcome is reported in several studies.\(^{13-16}\) Concerning breech presentation, there is discussion among clinicians whether a term fetus below or above a certain birth weight could be more at risk for breech birth related adverse outcome. For instance in the previously mentioned PREMODA study, the estimated fetal weight should not exceed 3800 grams to qualify for planned vaginal breech delivery.

An important strength of this study is the well-maintained, population-based national registry, covering 96% of all births. The missing 4% are deliveries supervised by general practitioners and midwives practices that did not contribute data to the PRN. Since breech presentation is an indication for hospital birth, we do not expect that these missing data would influence our outcomes. Neonatal morbidity of admitted children is not measured in all of the neonatal departments of the 99 hospitals. When analyses were restricted to the hospitals with complete neonatal admission registration, similar results were found.

Analysing data of a population-based national registry presented some disadvantages as well. Only data up to 2007 were available for analysis. However, a recent survey among 24 hospitals in the Netherlands showed similar elective caesarean rates for breech presentation at term in 2011 and 2012. Second, we were not able to perform a complete intention to treat analysis for mode of delivery. Women who opted for elective caesarean, but underwent a vaginal birth (for instance due to unexpected start of delivery and fast progression), could not be included in the caesarean group. In the term
breech trial, 9.7% of women with a planned caesarean in fact had a vaginal delivery. Evaluation of the perinatal mortalities in hospital files revealed that 19.1% breech presentations was not diagnosed until birth. We did not have this information for the whole study population, consequently there will be a misclassification of women in the planned vaginal birth group, who were simply not aware of the breech presentation. Thus the positive outcome of elective caesarean might be overestimated.

The high percentage of women opting for a planned vaginal breech birth is remarkable compared to other countries. We have no explanation for this high rate of trial of labor in case of breech presentation. It is probably a combination of a doctor and patient driven decision. The large intra hospital variation of planned caesarean rates (14-80%) reveal a large variety in management of breech presentation among hospitals. This might be a result of population differences and attitudes of obstetricians towards vaginal breech delivery.

When performing elective caesarean sections, attention should be paid to the gestational age at which these are planned in order to minimize neonatal morbidity related to elective caesarean sections such as respiratory distress syndrome. The downside of increased caesarean rates is the increased maternal morbidity and mortality. In our database, only two maternal deaths were reported within the study group. A previous study by the Dutch Maternal Mortality Committee, reported four maternal deaths after elective caesarean for term singleton breech delivery (0.47‰) from 2000-2002. Other studies report maternal mortality rates of 0.04‰ for elective caesarean and 0.13‰ for repeat caesarean. These data support the presumption of underreporting of maternal mortality and morbidity in the database. Therefore we cannot comment on the effects of modes of delivery on maternal outcomes in our cohort.

A frequently mentioned argument against a policy of elective caesarean delivery is the lower exposure of the health care professional to vaginal breech delivery, and thus a loss of expertise in this field. However, in our opinion, training of the professional is no reason to expose healthy foetuses to high risks. Experience should be gained by simulation training, as is current practice with other uncommon events such as shoulder dystocia, postpartum haemorrhage and newborn life support.
Our results can be used by clinicians during counselling of women with a term breech presentation for mode of delivery. In the current patient information leaflets of the Dutch Society of Obstetrics and Gynaecology is written that there is no difference in mortality or development at the age of two between vaginal and elective caesarean deliveries (based on the two year follow up of the Term Breech Trial). This information needs to be revised in the light of our findings with the significant difference in mortality rate. To properly inform patients, a combination of risk presentations (absolute risks, relative risks and figures) is necessary to enable individual informed decision making.\textsuperscript{22,23} For example, absolute numbers on a vaginal breech delivery should be mentioned as well; 55\% of all planned breech deliveries lead to a vaginal birth and the chance of a normal neonatal outcome without any additional neonatal care, is 97\% in case of planned vaginal breech birth in our study population.

During the study period, the percentage of breech presentation at birth remained stable around 4\%. This suggests that there is still room for improvement of the implementation of external cephalic version, as this relative safe treatment can significantly improve neonatal outcome by preventing breech presentation at birth.

Due to a rise in caesarean delivery rate in case of term breech presentation, there was a significant improvement of neonatal outcome. However, 40\% of term breech deliveries in the Netherlands are still planned vaginal deliveries and these deliveries generate a tenfold fetal mortality rate compared to elective caesarean delivery. Subgroup analysis could not identify antepartum parameters which could distinguish between women with low versus high risk vaginal breech birth. These facts need to be discussed when women opt for a vaginal breech delivery.
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