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ABSTRACT

Background: Recent population-wide changes in perinatal risk factors may affect rates of breech presentation at birth, and have implications for the provision of breech services and clinical training in breech management.

Aims: To determine the trend in breech presentation at term and investigate whether changes in maternal and pregnancy characteristics explain the observed trend.

Materials and Methods: All singleton term (≥37 week) births in New South Wales during 2002 – 2012 were identified through birth and associated hospital records. Annual rates of breech presentation were determined. Logistic regression modelling was used to predict expected rates of breech presentation over time and these were compared with observed rates. *A priori* predictors included maternal age, country of birth, parity, smoking during pregnancy, diabetes, pregnancy hypertension, placenta praevia, previous singleton term breech, previous caesarean section, infant sex, gestational age, birthweight, and congenital anomalies. Hospital and Medicare data were used to assess trends in external cephalic version.

Results: Among 914,147 singleton term births, 3.1% were breech at delivery. Rates declined from 3.6% in 2002 to 2.7% in 2012 (test for trend $p<0.001$). Breech presentation was predicted to increase from 3.6% in 2002 to 4.3% in 2012 because of increased maternal age, nulliparity, maternal diabetes, history of breech presentation and previous caesarean section. Use of external cephalic version appears to have increased over time.

Conclusions: Breech presentation at delivery has decreased in New South Wales. Increased use of external cephalic version likely accounts for this decline, as changes in risk factors do not.

INTRODUCTION

Breech presentation occurs in 2 to 4% of births at term [1, 2] and is associated with greater perinatal mortality and morbidity than vertex presentation [3, 4]. Risk factors for breech presentation include older maternal age [5-7], nulliparity [5-7], pre-existing diabetes [7, 8], gestational diabetes [7], smoking [5], placenta previa [7], uterine abnormalities [6, 9], previous breech presentation [10], previous caesarean section [5], small fetal size [5-7], and congenital anomalies [6, 7, 10]. There is also some evidence that the rate of breech presentation may differ by ethnicity, with women of African ancestry appearing to have the lowest rates [5, 8].

In New South Wales (NSW), breech presentation was reported to be stable at 3.4% from the 1990s to the early 2000s [11, 12]. However, there have been substantial changes in maternal and pregnancy characteristics over recent years [13]: with increases in maternal age, nulliparity, previous caesarean section, diabetes, placenta previa, and early term birth likely to result in increased rates of breech presentation. On the other hand, population trends that might lead to lower rates of breech presentation include increases in fetal size at birth, mothers born outside Australia, and a decline in maternal smoking [14]. Furthermore, anecdotal reports suggest increased use of external cephalic version (ECV) which has the potential to reduce the rate of breech presentation at birth by 30% or more [15].

Changes in the rate of breech risk factors and the provision of ECV will affect the rate of breech presentation, with implications for service provision, quality of care, and clinical training. The aim of the current study was to examine the trend in breech presentation at term in NSW and to determine how known risk factors have contributed to this trend. A secondary aim was to report on concurrent trends in the use of ECV.

MATERIALS AND METHODS

Study population

The study population included all singleton births at term (37 – 42 completed weeks of gestation) during the 11-year period from 1st January 2002 to 31st December 2012 in NSW, Australia.

Data sources

Data for this study were sourced from two routinely collected administrative datasets. Breech presentation and risk factors for breech presentation were identified from the NSW Perinatal Data Collection (birth records) and the NSW Admitted Patient Data Collection (hospital records).

The birth records describe all births in NSW of at least 20 weeks gestation or at least 400g birth weight. The birth records are completed by an attending midwife or medical practitioner and include information on maternal health, pregnancy, labour, delivery, and infant characteristics. The hospital records are a census of discharges, transfers and deaths from NSW public and private hospitals. Diagnoses and procedures associated with each hospital record are coded by trained medical coders according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) [16] and the Australian Classification of Health Interventions [17], respectively.

The birth records and maternal and infant hospital records were linked by the NSW Centre for Health Record Linkage (http://www.cherel.org.au/) using probabilistic record linkage. It has been shown that probabilistic linkage has a high rate of accuracy

[18]. To preserve privacy, personal identifiers were removed before the data were provided to the authors. A linkage key was provided for the authors to merge the relevant birth and hospital records for the current study. Ethics approval for data linkage and the study was obtained from the NSW Population Health Services Research Ethics Committee.

There is no single data source capturing the provision of ECV. Information on inpatients undergoing ECV is recorded in the hospital records and we extracted these to examine the number of ECV procedures conducted over the study period. We also used Medicare Item Reports to determine the number of ECV procedures (item code “16501”) billed to Medicare for women aged 15 – 54 years in NSW during the study period [19]. The overlap between hospital and Medicare data is unknown.

Outcome and Predictors

Breech presentation at birth was the study outcome of interest and was recorded in the birth records. This was compared with all other presentations at birth. Predictors were selected *a priori* based on literature review and specialist knowledge of risk factors for breech presentation. Information on risk factors was identified from the birth and/or hospital records [20, 21]. Risk factors considered were: maternal age (in years), parity (nulliparous/multiparous), maternal country of birth was used as a proxy for maternal ethnicity and categorised using the Standard Australian Classification of Countries major groups (Oceania/North West Europe/Southern and Eastern Europe/North Africa and Middle East/South East Asia/North Ease Asia/Southern and Central Asia/Americas/Subsaharan Africa) [22], smoking during pregnancy (none/any), previous caesarean section (no/yes), previous term singleton breech (no/yes), maternal diabetes including pre-existing and gestational diabetes (none/any), pregnancy hypertension (no/yes), placenta praevia (no/yes), infant sex (male/female), gestational age (37/38/39/40/41/42 weeks), birthweight for gestational age and sex (<10th- small for gestational age, 10-90th, >90th percentile- large for gestational age) [23], and infant congenital anomalies (none/any). Congenital anomalies were identified from the infant's hospital record at birth.

Statistical analyses

The rate of breech presentation per year was calculated for 2002 – 2012. Changes in the overall rate of the predictors were tabulated and tests for trends using the Wald chi-square were conducted. Relative change was calculated using [(2012 rate-2002 rate) / (2002 rate)] * 100.

To examine the impact of changing risk factors on the trend in breech presentation, the study population was split into 2 datasets: development data from the year 2002 and prediction data from the years 2003 to 2012. Logistic regression was used to model the association between breech presentation and the risk factors using 2002 data. All *a priori* identified risk factors were included in modelling irrespective of crude associations. This predictive model was applied to subsequent years to predict the expected rate of breech presentation based on actual changes in the risk factors. The predicted rates were compared to the observed rates of breech presentation.

ECVs per 100 term deliveries in the study population were calculated based on the number of ECV records in the hospital and Medicare data for NSW.

All analyses were conducted using SAS 9.3 (SAS Institute, NC).

RESULTS

Breech presentations accounted for 3.1% of 914,147 term births during the 11-year study period. The observed rate of breech presentation decreased from 3.6% to 2.7% between 2002 and 2012 (test for trend $p<0.001$) (Figure 1).

The risk factors for breech presentation changed over time (Table 1). Compared to a decade earlier, women who gave birth in 2012 were significantly older, more likely to have been born overseas, nulliparous, have diabetes or placenta praevia. Multiparous women were more likely to have a history of caesarean section and previous term breech. More babies were born at earlier gestations in 2012 compared to earlier years. There was a significant decline in small-for-gestational-age infants and the rate of congenital anomalies. The infant sex ratio was unchanged. A declining trend in breech presentation was seen across all risk factor categories (data not shown).

The predictive model demonstrated that most of the *a priori* risk factors were associated with breech presentation with the exception of maternal smoking and maternal diabetes. Maternal country of birth showed reduced breech presentation in mothers from North Africa and the Middle East compared to those born in Australia. The strongest risk factors for breech presentation in this population were previous term breech presentation, nulliparity, and placenta praevia (Table 2).

Taking into account changes in risk factors, breech presentation was predicted to increase over time, from 3.6% in 2002 to 4.3% in 2012 (Figure 1).

ECV procedures as identified in hospital admission data in NSW increased from 111 to 481 over the period 2002 to 2012, equivalent to 0.14 to 0.53 per 100 term deliveries (Figure 2). The number of ECVs billed to Medicare in NSW also increased from 43 in 2002 to 240 in 2012, constituting 0.05 to 0.26 per 100 term deliveries for those years (Figure 2).

DISCUSSION

The rate of breech presentation in New South Wales decreased from 3.6% of term singleton births in 2002 to 2.7% in 2012 ($p<0.001$). This finding is at odds with the expected trend based on breech risk factors, which predict an increase in breech presentation from 3.6% to 4.3% over this period ($p<0.001$). We contend that the use of ECV is responsible for this disparity as the available data, albeit limited, demonstrate clear increases in ECV procedures. That the overall rate of breech presentation was 3.4% in 1990 – 1997 [11] and is 3.1% for 2002 – 2012 suggests that the use of ECV in NSW may have been gradually increasing.

Nation-wide, breech presentation in all confinements was reported to be 4.5% in 2002 and had declined to 3.8% in 2012 [24, 25]. Although these statistics include preterm breech presentation and breech in multiple pregnancies, the trends by state also show a declining trend, consistent with the trend observed here for term confinements delivered in NSW [24, 25]. We are aware of only one study on trends in breech presentation outside Australia: in Norway, breech presentation increased from 2.2% in 1967 to 3.4% in 1994 and this was attributed to increased maternal age, nulliparity, and a shift towards earlier gestational age at birth [2]. The authors however noted that ECV was not a standard procedure in Norway during this period, unlike in the current study.

Other explanations for the decline in breech presentation such as changes in the reporting of breech cannot be discounted. However, given that most of the risk factors for breech presentation increased over the study period, another protective factor for breech presentation at delivery would have had to increase substantially over the same period to offset these trends and produce the observed decline. We saw the same declining trend in breech presentation across all risk factor categories, implying that population-wide changes are responsible.

We did not have comprehensive individual-level data on whether ECV was offered, conducted, or successful. Anecdotally, ECV is mostly performed in outpatient clinics and outpatients are not included in the hospital admissions data. Similarly, patients in public hospitals (the majority of pregnant women) are not billed for ECV either as outpatients or inpatients and hence are not included in the Medicare statistics. Thus the observed statistics for ECV almost certainly underestimate total procedures, even though the observed trends likely reflect the overall trend in ECV.

While the literature supports the use of ECV for reducing breech presentation at delivery [26], few studies have examined whether uptake of ECV has impacted on population trends in breech presentation. One study conducted in the early 1990s at an Israeli hospital showed that introduction of an ECV policy reduced term breech presentations from 3.9% to 2.4% [27], but other studies on trends in breech presentation have not examined concomitant rates of ECV [2].

Implications

The findings have implications for the management of breech presentation, the provision of breech services, and for clinical training. We found that the strongest risk factors for breech presentation were previous breech presentation, nulliparity, and placenta previa; none of which are modifiable. That previous term breech presentation is the strongest predictor of recurrence suggests women with such history should be closely monitored. In particular, ultrasonography of women with a history of breech presentation at term may be warranted given the relatively low sensitivity of clinical examination for diagnosing non-cephalic presentations [28].

We do not know if detection of breech presentation occurred antenatally or in labour, although the increasing trend in ECV and decreasing breech presentations at delivery would be consistent with improvements in antenatal detection. Additional improvements in antenatal detection and the provision of ECV may further reduce the need for caesarean section and reduce the attendant surgical and long-term risks [26]. Furthermore, successful ECV and ensuing cephalic presentation at birth avoids the neonatal risks associated with vaginal breech birth [29]. Thus, the positive benefits of reducing caesarean section and vaginal breech deliveries may be enhanced if ECV is offered consistently to eligible women.

The success rate of ECV has been estimated to be 65 – 70% with 3% of fetuses reverting back to breech, and 4% of the unsuccessful ECVs becoming cephalic before delivery [15]. Since a third of these breech fetuses will still be breech at delivery, there is a continued need for clinical training in the management of breech births, especially for those cases diagnosed in labour. However, increased use of ECV may mean that exposure and opportunities for training may decline, with consequences for the quality of care.

Given the evidence for the efficacy of ECV, the decreasing rate of term breech presentation and the proportion of women undergoing ECV may be a good indicator of the quality of clinical care [30]. More comprehensive population data on ECV including numbers of women eligible, those who are offered ECV, and those for whom the procedure is successful would allow for the direct assessment of how ECV contributes to trends in breech presentation.

Conclusion

Between 2002 and 2012, breech presentation declined from 3.4% to 2.7% in NSW. This occurred in contrast to the increasing trend in breech risk factors over the same period. The corresponding increase in ECV over the study period suggests ECV has contributed to the decline in breech presentation, although the data on ECV are not comprehensive. Thus, with improved antenatal detection and more widespread provision of ECV, breech births may be reduced even further. Although, a decline in breech presentations at birth may have implications for clinical training, increased rates of ECV will reduce the risks associated with caesarean section and vaginal breech birth and result in improved outcomes for mothers and infants.

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Table 1. Change in risk factors for breech presentation, 2002 – 2012 (N=914,147).

	2002 **N=76,618** n (col%)	**2007** **N=85,970** n (col%)	**2012** **N=87,811** n(col%)	**Relative Change** (%)	**Test for trend, p-value**
Breech presentation	2,739 (3.6%)	2,631 (3.1%)	2,393 (2.7%)	25.0% ▼	X^2=208.76, p<0.0001
Maternal age[#] (mean, SD)	29.5 (5.5)	30.1 (5.6)	30.3 (5.6)	2.7%▲	t=39.37, p<0.0001
<20 years	4,977 (6.5%)	4,667 (5.4%)	4,379 (5.0%)	23.1%▼	
20 – 34 years	57,420 (74.9%)	61,847 (71.9%)	62,978 (71.7%)	4.3%▼	
35+ years	14,174 (18.5%)	19,450 (22.6%)	20,445 (23.3%)	25.9%▲	
Country of birth					
Oceania	58,880 (76.9%)	63,823 (74.2%)	60,170 (68.5%)	10.9%▼	X^2=3362.89, p<0.0001
North West Europe	4,285 (5.6%)	4,789 (5.6%)	4,599 (5.2%)	7.1% ▼	X^2=5.68, p=0.02
Southern and Eastern Europe	3,042 (4.0%)	3,464 (4.0%)	3,554 (4.1%)	2.5%▲	X^2=5.28, p=0.02
North Africa and Middle East	4,119 (5.4%)	4,709 (5.5%)	5,330 (6.1%)	13.0%▲	X^2=40.13, p<0.0001
South East Asia	2,720 (3.6%)	3,701 (4.3%)	5,682 (6.5%)	80.6%▲	X^2=1772.53, p<0.0001
North East Asia	1,593 (2.1%)	2,926 (3.4%)	5,145 (5.9%)	181.0%▲	X^2=4481.90, p<0.0001
Southern and Central Asia	471 (0.6%)	622 (0.7%)	748 (0.9%)	50.0%▲	X^2=51.70, p<0.0001
Americas	677 (0.9%)	724 (0.8%)	805 (0.9%)	-	-
Sub-Saharan Africa	767 (1.0%)	1,072 (1.3%)	1,267 (1.4%)	40.0%▲	X^2=193.02, p<0.0001
Nulliparous	30,809 (40.2%)	35,110 (40.8%)	37,201 (42.4%)	5.5%▲	X^2=111.11, p<0.0001
Smoking during pregnancy	12,147 (15.9%)	10,435 (12.1%)	8,721 (9.9%)	37.7%▼	X^2=2509.38, p<0.0001
Maternal diabetes	4,158 (5.4%)	5,394 (6.3%)	7,903 (9.0%)	66.7%▲	X^2=1356.01, p<0.0001
Pregnancy hypertension	6,072 (7.9%)	5,824 (6.8%)	5,640 (6.4%)	19.0%▼	X^2=329.82, p<0.0001
Placenta praevia	219 (0.3%)	346 (0.4%)	435 (0.5%)	66.7%▲	X^2=77.07, p<0.0001
Previous singleton term breech	1,166 (1.5%)	1,843 (2.1%)	1,798 (2.1%)	40.0% ▲	X^2=60.20, p<0.0001
Previous caesarean section	8,965 (11.7%)	12,236 (14.2%)	13,796 (15.7%)	34.2% ▲	X^2=1231.43, p<0.0001
Female infant sex	37,353 (48.8%)	41,930 (48.8%)	42,613 (48.5%)	0.6% ▼	X^2=1.73, p=0.19
Gestational age* (mean, SD)	39.5 (1.2)	39.3 (1.2)	39.2 (1.1)	0.8% ▼	t=-75.94, p<0.0001
37 weeks	3,965 (5.2%)	5,045 (5.9%)	6,062 (6.9%)	32.7%▲	
38 weeks	12,145 (15.9%)	16,000 (18.6%)	17,191 (19.6%)	23.3%▲	
39 weeks	18,925 (24.7%)	24,433 (28.4%)	27,953 (31.8%)	28.7%▲	
40 weeks	25,521 (33.3%)	24,813 (30.0%)	24,085 (27.4%)	17.7%▼	
41 weeks	14,212 (18.6%)	13,804 (16.0%)	12,005 (13.7%)	26.3%▼	
42 weeks	1,850 (2.4%)	875 (1.0%)	515 (0.6%)	75.0%▼	
Size at birth					
SGA (<10%tile)	7,728 (10.1%)	7,611 (8.9%)	7,431 (8.5%)	15.8%▼	X^2=326.93, p<0.0001
$10\text{-}90^{th}$ %tile	61,181 (79.9%)	69,020 (80.3%)	70,720 (80.5%)	0.8%▲	
LGA (>90^{th} %tile)	7,685 (10.0%)	9,306 (10.8%)	9,650 (11.0%)	10.0%▲	
Any congenital anomaly	7011 (9.2%)	7820 (9.1%)	6553 (7.5%)	18.5%▼	X^2=1625.58, p<0.0001

Table 2. Results of predictive models for breech presentation based on 2002 data (N=76,618).

	2002 Model	
Risk Factor	**Crude OR (95% CI)**	**Adjusted OR (95% CI)**
Maternal age (per year increase)	1.03 (1.02 – 1.04)	1.04 (1.03 – 1.05)
Maternal country of birth		
Oceania (includes Australia)	Ref	Ref
North-west Europe	1.18 (1.01 – 1.38)	1.11 (0.94 – 1.30)
Southern and Eastern Europe	0.73 (0.59 – 0.92)	0.82 (0.65 – 1.03)
North Africa and Middle East	1.05 (0.89 – 1.24)	0.84 (0.70 – 0.99)
South East Asia	1.14 (0.94 – 1.38)	0.85 (0.70 – 1.04)
North East Asia	1.12 (0.87 – 1.44)	0.93 (0.71 – 1.21)
Southern and Central Asia	1.15 (0.73 – 1.80)	1.05 (0.67 – 1.67)
Americas	1.05 (0.71 – 1.56)	0.83 (0.55 – 1.26)
Sub-Saharan Africa	0.79 (0.51 – 1.20)	0.70 (0.45 – 1.08)
Nulliparous (vs. multiparous)	1.68 (1.56 – 1.81)	2.43 (2.22 – 2.66)
Smoking during pregnancy (vs. none)	0.95 (0.86 – 1.06)	1.04 (0.93 – 1.17)
Maternal diabetes (vs none)	1.30 (1.11 – 1.51)	0.94 (0.81 – 1.10)
Pregnancy hypertension (vs none)	0.88 (0.76 – 1.02)	0.64 (0.55 – 0.74)
Placenta praevia (vs none)	4.18 (2.82 – 6.19)	2.35 (1.57 – 3.53)
Previous term breech presentation (vs. none)	3.46 (2.87 – 4.17)	3.53 (2.86 – 4.37)
Previous caesarean section (vs. none)	1.46 (1.31 – 1.62)	1.19 (1.05 – 1.36)
Female infant sex (vs male)	1.17 (1.08 – 1.26)	1.21 (1.12 – 1.31)
Gestational age (weeks)		
37	Ref	Ref
38	1.08 (0.93 – 1.24)	1.08 (0.94 – 1.25)
39	0.77 (0.67 – 0.89)	0.78 (0.68 – 0.90)
40	0.22 (0.19 – 0.26)	0.22 (0.19 – 0.26)
41	0.12 (0.10 – 0.15)	0.11 (0.09 – 0.14)
42	0.11 (0.07 – 0.19)	0.10 (0.06 – 0.17)
Infant birthweight		
SGA <10th %tile	1.26 (1.13 – 1.42)	1.21 (1.08 – 1.37)
10-90th %tile	Ref	Ref
LGA >90th %tile	0.80 (0.70 – 0.92)	0.83 (0.71 – 0.96)
Congenital anomaly (vs none)	1.90 (1.71 – 2.11)	1.81 (1.62 – 2.02)

Note: 194 (0.3%) of 2002 data were excluded in the adjusted model due to missing values.

FIGURE LEGENDS

Figure 1. Observed and predicted trends in rate of breech presentation in New South Wales, Australia, 2002 – 2012 (N=914,147).

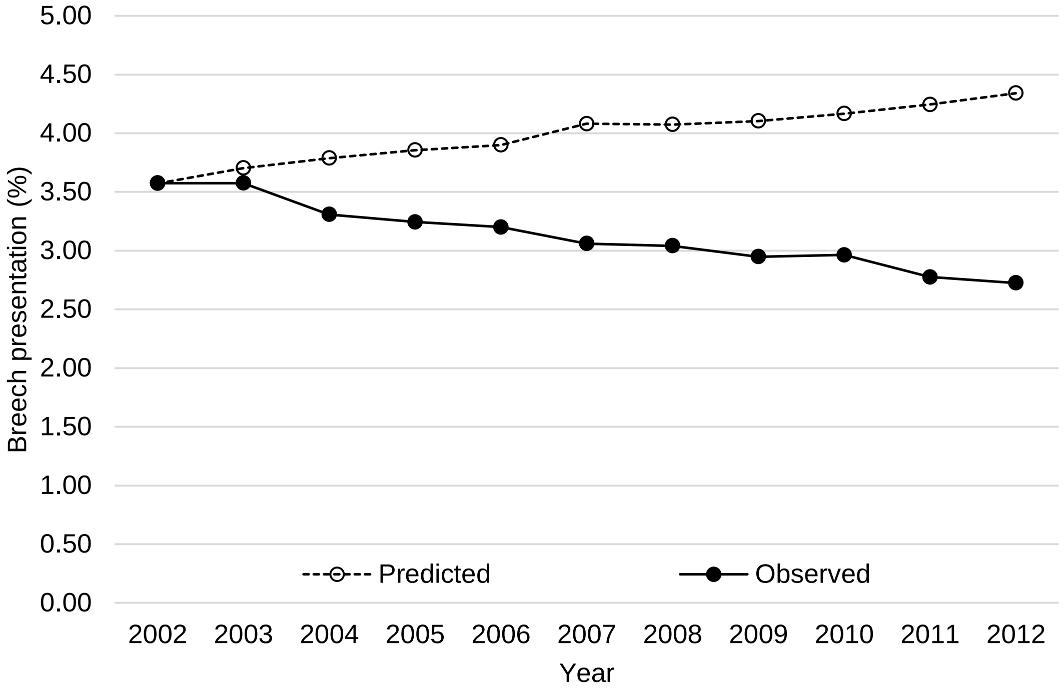

Figure 2. External cephalic version (per 100 singleton term deliveries) in New South Wales, Australia, 2002 – 2012.