

# Mode of birth among women with one previous caesarean section in the Netherlands: a 20-year population-based study

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## Abstract

**Objective** Describe changes over time regarding mode of birth and perinatal outcomes in women with one previous caesarean section in the Netherlands over the past 20 years. **Design** Population-based study. **Setting** Nationwide. **Population** All women with one previous caesarean section and no previous vaginal birth, who gave birth to a term singleton in cephalic presentation between 2000 and 2019 (n=143,308). **Methods** Analysis of Dutch perinatal registry data. **Main outcome measures** Primary: mode of birth per year, intended vaginal birth versus planned caesarean section. Secondary: failed versus successful vaginal birth in case of intended vaginal birth after caesarean (VBAC), and adverse perinatal outcome (perinatal mortality up to 28 days, low Apgar score at 5 minutes, asphyxia, and NICU admission >24 hours). **Results** A decrease of 21.5% was seen in women with one previous caesarean section intending VBAC in a subsequent pregnancy, from 77.2% in 2000 to 55.7% in 2019, with a marked acceleration from 2009 onwards. The VBAC success rate dropped gradually, from 71.0% to 65.3%. Overall caesarean section rate (planned and unplanned) increased from 45.1% to 63.6%. Adverse perinatal outcomes were higher in women intending VBAC compared to planned caesarean section. However, after an initial decrease, perinatal mortality remained stable from 2009 onwards with only a minimal difference between both modes of birth. **Conclusions** In the Netherlands, the proportion of women intending VBAC after a previous caesarean section has decreased markedly, particularly from 2009 onwards. This decrease was not accompanied by a synchronous decrease in perinatal mortality after that year.

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## **ABSTRACT**

### **Objective**

Describe changes over time regarding mode of birth and perinatal outcomes in women with one previous caesarean section in the Netherlands over the past 20 years.

### **Design**

Population-based study.

### **Setting**

Nationwide.

### **Population**

All women with one previous caesarean section and no previous vaginal birth, who gave birth to a term singleton in cephalic presentation between 2000 and 2019 (n=143,308).

### **Methods**

Analysis of data in the Dutch perinatal registry.

### **Main outcome measures**

Primary outcome was mode of birth per year: intended vaginal birth versus planned caesarean section. Secondary outcomes were failed versus successful vaginal birth in case of intended vaginal birth after caesarean (VBAC), and adverse perinatal outcome (perinatal mortality up to 28 days, low Apgar score at 5 minutes, asphyxia, and neonatal intensive care unit admission >24 hours).

### **Results**

A decrease of 21.5% was seen in women with one previous caesarean section intending VBAC in a subsequent pregnancy, from 77.2% in 2000 to 55.7% in 2019, with a marked acceleration from 2009 onwards. The VBAC success rate also dropped gradually, from 71.0% to 65.3%. Overall caesarean section rate (planned and unplanned) increased from 45.1% to 63.6%. Adverse perinatal outcomes were higher in women intending VBAC compared to planned caesarean section. However, after an initial decrease, perinatal mortality remained stable from 2009 onwards with only a minimal difference between both modes of birth.

### **Conclusions**

In the Netherlands, the proportion of women intending VBAC after a previous caesarean section has decreased markedly, particularly from 2009 onwards. This decrease was not accompanied by a synchronous decrease in perinatal mortality after that year.

## Funding

None.

## Keywords

Caesarean section, vaginal birth after caesarean section, trial of labour after caesarean section, obstetrics, high-risk pregnancy, Robson group 5.

## Tweetable abstract

Intended vaginal births after caesarean section decreased in the Netherlands, without synchronously reduced perinatal deaths

## INTRODUCTION

Globally, caesarean section rates have increased to 21.1% of all births in 2018 <sup>(1, 2)</sup>. Although caesarean sections can be lifesaving, many are not performed on medical indication despite the procedure being associated with increased maternal and perinatal risks <sup>(1-7)</sup>. The World Health Organization (WHO) aims to reduce such non-indicated caesarean sections <sup>(4, 8)</sup>. Although the greatest benefit is expected from performing the first caesarean section only on strict medical indication, reducing the second by offering women a chance to attempt vaginal birth after caesarean (VBAC) is another strategy proposed by the WHO and in most guidelines <sup>(4, 9-11)</sup>.

While a successful VBAC has the lowest rate of maternal complications at no increased perinatal risk, an unsuccessful intended VBAC results in an unplanned caesarean section, associated with increased risk of adverse maternal and perinatal outcomes <sup>(12, 13)</sup>. Moreover, trial of labour may result in uterine rupture (0.16-0.80% after one previous caesarean section <sup>(14)</sup>), a severe complication with considerable associated maternal and perinatal risk <sup>(12, 15, 16)</sup>. At the same time, repeated caesarean sections substantially increase the risk of placenta praevia, abnormally invasive placenta and postpartum haemorrhage in subsequent pregnancies <sup>(13, 17-20)</sup> and are associated with increased risks of maternal mortality in the Netherlands compared to vaginal birth <sup>(6)</sup>.

There is considerable variation in VBAC rates between European countries, with relatively high rates occurring only in countries with relatively low overall caesarean section rates (e.g., Sweden, Finland, the Netherlands). Inversely, relatively low VBAC rates occur in countries with high overall caesarean section rates (e.g., Italy, Greece, Ireland) <sup>(1, 2, 21, 22)</sup>. In the Netherlands, VBAC is generally still considered a safe option for women with one previous caesarean section in presence of continuous foetal monitoring, immediate access to an operating room and staff competent to perform neonatal resuscitation <sup>(11)</sup>. Mode of birth is decided based on individual counselling with considerations of risks and benefits, and a prediction model is often used to estimate the individual likelihood of a successful VBAC <sup>(11, 23)</sup>.

In the Netherlands, neither changes over time in women intending VBAC versus those who opt for planned caesarean section, nor changes in perinatal outcomes in both groups have recently been comprehensively analysed. Our primary aim was to describe changes over time in mode of birth among women with a previous caesarean section between 2000 and 2019. Our secondary aims were to describe VBAC success rates and adverse perinatal outcomes among women with one previous caesarean section in the same time frame.

## METHODS

### Study design

We conducted a nationwide population-based study using the Dutch Perinatal Registry (Perined) from 2000 to 2019.

## Setting

Between 2000 and 2019, 3,436,258 women in the Netherlands gave birth after 24 weeks' gestation, with an average of 171,812 births per year (in 2000  $n=184,246$ , in 2019  $n=160,898$ ). In 2000, 64.5% of births took place in obstetrician-led care in the hospital, 9.5% in primary midwifery-led care at a low-risk birth unit in the hospital and 25.2% were homebirths attended by primary care midwives. In 2019, these percentages were 72.7%, 14.5% and 12.7% respectively<sup>(24)</sup>.

During the time period 2000-2019, the caesarean section rate after 24 weeks' gestation was 15.4% ( $n=528,096$ ), with a change from 13.2% in 2000 to 16.8% in 2015 (maximum) and then to 15.8% in 2019. The caesarean section rate increased especially among women with a previous caesarean section, who can be classified as Robson group 5<sup>(25, 26)</sup>. The proportion of caesarean section in Robson group 5 among all women who gave birth by caesarean section increased from 16.1% in 2000 to 25.7% in 2019 (see Appendix S2). In the same period, births of women in Robson group 5 represented 6.2% of all births<sup>(24)</sup>.

Women with a previous caesarean section – without other risk factors – generally receive antenatal care by a midwife in primary care, until 34-36 weeks' gestation, when mode of birth is decided in an individual counselling process with the obstetrician. Women opting for VBAC are advised to give birth in obstetrician-led care in a hospital with intravenous access and continuous CTG monitoring.

## Participants

Our study population consisted of women with one previous caesarean section and a parity of one (so no vaginal birth in addition to the caesarean section), pregnant of a singleton in cephalic presentation with a gestation of at least 37 weeks (i.e., Robson group 5 with a parity of one), who gave birth between January 1<sup>st</sup>, 2000, and December 31<sup>st</sup>, 2019.

## Data source

We obtained data from the Dutch Perinatal Registry (Perined, formerly known as *Perinatale Registratie Nederland [PRN]*). The Registry contains information on pregnancy, birth, and maternal and perinatal characteristics and outcomes (Appendix S1) for 97% of all births in the Netherlands<sup>(27-29)</sup>. All characteristics except birth asphyxia, registration of which started only in 2008, were recorded routinely during the entire study period. Perined combines births in primary and hospital care by using a validated linkage method<sup>(30, 31)</sup>.

The Perined dataset did not contain information on the number of previous caesarean sections in women with a parity of two or more. This hampered assessment of vaginal births after one previous caesarean section in addition to one or more vaginal births. Therefore, in order to ensure a homogeneous group of participants we included only para 1 women with one previous caesarean section ( $n=144,166$ ; 67.8% of all women in Robson group 5, meaning all women with one or more previous caesarean sections in addition to any number of vaginal births). We excluded women from analysis in whom mode of birth in the current pregnancy was unknown ( $n=858$ ; 0.6% of Robson group 5 with a parity of one).

## Outcome measures

The primary outcome was mode of birth (planned caesarean section vs. intended VBAC) among women with one previous caesarean section. Secondary outcomes were VBAC success rates of women with one previous caesarean section and the rate of adverse perinatal outcomes (Apgar score  $<7$  after five minutes, asphyxia, NICU admission of at least 24 hours and perinatal death up to 28 days postpartum) among women with one previous caesarean section intending a VBAC compared to women who underwent a planned caesarean section.

Elaborate definitions of intended VBAC (i.e., trial of labour after caesarean, TOLAC), VBAC success rate, NICU admission of at least 24 hours, asphyxia, and perinatal mortality can be found in Appendix S1. Maternal and perinatal characteristics of women are described using international definitions and cut-off values and can also be found in Appendix S1.

## Statistical analysis

We used Microsoft Excel and R for Windows version 4.1.1.<sup>(32)</sup>. Descriptive statistics (i.e., frequencies and percentages for categorical data) were used and no data were imputed as missing data was negligible (<5%). Trends over time in mode of birth and perinatal outcomes were depicted in graphs. For all perinatal outcomes we excluded the cases with stillbirth or unknown moment of death.

Since our data are population-based rather than a sample that requires extrapolation we present our data as absolutes and percentages without statistical analysis.

## Ethics approval

The Perined registry approved the use of the data for this study (Approval no. 20.23). No individual patient consent or approval was required as data were used in correspondence with Perined regulations.

## Funding

None.

## RESULTS

Our study population consisted of 143,308 women with one previous caesarean section who gave birth to a singleton in cephalic presentation at term over the 20-year study period. Baseline characteristics are shown in Table 1 and compare women with a planned caesarean section to those with an intended VBAC.

The caesarean section rate (both planned and unplanned) among women with one previous caesarean section was 52.6% (n= 75,357, 2000-2019) and increased by 18.5% in 20 years, from 45.1% in 2000 to 63.6% in 2019. Women intended VBAC in 68.8% (n= 98,651, 2000-2019). Up to 2008 the proportion of women intending VBAC was relatively stable, but it decreased markedly from 2009 onwards (Figure 1). An increasing proportion of women gave birth by planned caesarean section in the same time frame. The average VBAC success rate was 68.9% (n= 67,951, 2000-2019). This rate dropped from 71.0% in 2000 to 65.3% in 2019.

Adverse perinatal outcomes were higher in women intending VBAC compared to those with a planned caesarean section (Table 1 and Figure 3). However, perinatal mortality decreased between 2000 and 2008, but stabilized from 2009 onwards (Figure 2).

## DISCUSSION

### Main findings

The proportion of women intending VBAC in the Netherlands was stable between 2000 and 2008, but from 2009 onwards there was a steady and considerable decrease in VBAC attempts. This decrease is likely related to the publication of the EURO-PERISTAT report, which showed relatively high numbers of perinatal mortality in the Netherlands as compared to other European countries<sup>(33)</sup>. Publication of the report was followed by the designation of a steering committee on perinatal care in 2009, which developed and implemented a perinatal mortality reduction strategy over the years. The emphasis on reducing perinatal mortality is likely to have caused more defensive obstetric practice, with clinicians attempting to minimize adverse perinatal outcomes in the short term rather than considering women's outcomes or perinatal outcomes in subsequent pregnancies. Interestingly, this change in practice, with fewer women undergoing VBAC and more women giving birth by planned caesarean section after 2009 was not accompanied by a marked decrease in perinatal mortality in the second decade of the study period.

### Strengths and limitations

The main strength of our study is the nationwide population-based design and robust data extraction of almost all births in the Netherlands of the past twenty years.

Limitations are indwelled in the retrospective nature of a registry-set and some under- and misreporting might have occurred. The registry did not include the option to analyse women with one previous caesarean

section who also had a previous vaginal birth. Our study design does not allow for conclusions of causality particularly since indications for caesarean sections are not reported.

## Interpretation of results

The decline in intended VBAC indicates that it is less often the chosen mode of birth. While previous studies have demonstrated an area under the curve of 68-71% for various VBAC success predictions models<sup>(23)</sup>, the described changes over time will have certainly undermined the validity of these models. It is possible that currently used tools aimed to aid the decision-making process may deter women and clinicians from intending VBAC. We therefore question whether these prediction models should be applied in mode of birth counselling in case of a previous caesarean section.

Supporting VBAC has been suggested as a strategy to curb increasing caesarean section rates and their negative health consequences<sup>(3)</sup>. A recent study in Sweden demonstrated it is possible to turn the tide of decreasing VBAC in a similar obstetric culture and environment as compared to the Netherlands<sup>(34)</sup>: reporting a rise in intended and successful VBAC without an increase in adverse maternal and neonatal outcomes<sup>(35)</sup>. The authors mention an maternity care team with experience in managing labour in women with a previous caesarean section as the greatest contributor to the rising successful VBAC rate by increasing the number of women intending VBAC<sup>(35)</sup>.

We aim to raise awareness for the decrease in VBAC attempts in the Netherlands that appears not to be associated with improved clinical outcome. We recommend clinicians and policy makers to contemplate on the driving determinants behind the unjustified increase in caesarean section rates and look for means to counter this trend. As, in addition to all previously mentioned points, women indicate a higher quality of life after a VBAC compared to an elective caesarean section, VBAC is more cost-effective, and leads to considerably lower CO<sub>2</sub>-emissions than elective caesarean section<sup>(36, 37)</sup>.

## CONCLUSION

In the Netherlands, the proportion of women intending a VBAC after a previous caesarean section has decreased markedly in the past twenty years, particularly from 2009 onwards, after the publication of the EURO-PERISTAT report on perinatal mortality in Europe. This decrease was not accompanied by a synchronous decrease in perinatal mortality after that year. Clinicians and policymakers should try to curb this unjustified increase in planned caesarean sections.

## Disclosure of interest

None.

## Contribution to authorship

IK, LV, AR, and TA conceived the study. IK and LV drafted the first draft and were responsible for the analysis. IK, LV, and KV contributed to analysis and interpretation of data. KV, AR, and TA critically reviewed and revised the manuscript. AR and TA approved the final manuscript.

## Details of ethics approval

The Perined registry approved the use of the data for this study (Approval no. 20.23). No individual patient consent or approval was required as data were used in correspondence with Perined regulations.

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