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## Trends in attempted and successful trial of labor after cesarean in the U.S. from 2010 to 2020

Ann M. Bruno, MD MS<sup>1,2</sup>, Amanda A. Allshouse, MS<sup>1</sup>, Torri D. Metz, MD MS<sup>1,2</sup>

<sup>1</sup>University of Utah Health, Salt Lake City, UT;

<sup>2</sup>Intermountain Healthcare, Murray, UT

### Abstract

The vaginal birth after cesarean (VBAC) rate was last reported as 13.8% in 2019. However, contemporary trends in attempted and successful trial of labor (TOLAC) among individuals with prior cesarean delivery are not known. We performed a repeated cross-sectional analysis of singleton, cephalic, term deliveries in those with history of one or two prior cesarean deliveries in the National Vital Statistics System from 2010 to 2020. Temporal trends in attempted and successful TOLAC, as well as VBAC, were characterized using joinpoint regression. Overall 4,277,800 deliveries were included. Attempted TOLAC increased from 15.3% in 2010 to 21.7% in 2020 with an annual percentage change of 4.25% (95% CI 2.9–5.6%). Successful TOLAC increased from 69.8% to 74.7% with an annual percentage change of 0.91% (95% CI 0.7–1.2%). The VBAC rate similarly increased. Rates of attempted and successful TOLAC, and VBAC, are increasing; efforts should continue to support TOLAC in appropriate candidates.

### Précis:

National rates of attempted and successful trial of labor after cesarean increased from 2010 to 2020.

### Introduction

Options for delivery in individuals with a history of cesarean in a subsequent pregnancy include planned repeat cesarean, or pursuing trial of labor after cesarean (TOLAC).<sup>1–3</sup> The vaginal birth after cesarean (VBAC) rate is tracked in annual vital statistics and was last reported as 13.8% in 2019.<sup>4</sup> The VBAC rate does not provide detail on nationwide rates of attempted and successful TOLAC, and recent trends are not known.<sup>5</sup> We aimed to evaluate trends in attempted and successful TOLAC, as well as VBAC, using national vital statistics data.

### Methods

This was a repeated cross-sectional analysis of singleton, cephalic, term deliveries with history of one or two prior cesarean deliveries in the National Vital Statistics System

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**Corresponding Author:** Ann Bruno, Department of Obstetrics & Gynecology, University of Utah Health, Salt Lake City, Utah, ann.bruno@hsc.utah.edu.

(NVSS) from 2010 to 2020. The NVSS contains publicly available natality data from all 50 U.S. states.<sup>6–8</sup> The study timeframe encompassed use of two birth certificate versions – 1989 and 2003. TOLAC data are only available using the 2003 birth certificate version; thus, only states using the 2003 version during any particular year were included with adoption in all states by 2016. Attempted TOLAC was defined using birth certificate mode of delivery as vaginal, or cesarean with trial of labor attempted. Successful TOLAC was defined by vaginal mode of delivery among those attempting TOLAC. VBAC rate was defined by vaginal mode of delivery among all deliveries with a history of cesarean.

Rates of attempted and successful TOLAC, and VBAC, were described and compared over time using the National Cancer Institute's Joinpoint Regression Program with the annual percentage change (APC) with 95% CI reported.<sup>9</sup> A sensitivity analysis limited to individuals with only one prior cesarean was performed. This study was exempt from Institutional Review Board approval as all data were deidentified.

## Results

Overall, 4,277,800 deliveries were included. Of these, 77% had only one prior cesarean delivery and 45% had a prior vaginal delivery. See Appendix 1 for additional population demographics. The rate of attempted TOLAC increased over the study period from 15.3% in 2010 to 21.7% in 2020 with an APC of 4.25% (95% CI 2.9–5.6%; Table 1). The rate of successful TOLAC increased from 69.8% to 74.7% during the study period (APC 0.91%, 95% CI 0.7–1.2%). The VBAC rate similarly increased with an APC of 5.21% (95% CI 3.8–6.7%; Figure 1). In sensitivity analysis limited to those with history of only one prior cesarean, results were similar.

## Discussion

We found the nationwide rate of attempted and successful TOLAC, and VBAC, increased over the last decade.

Using National Hospital Discharge Survey data, Uddin & Simon found rates of attempted TOLAC varied widely from a high of 51.8% in 1995 to a low of 15.9% in 2006.<sup>5</sup> They found the rate of attempted TOLAC was increasing (average APC 1.2% from 2005–2009, 95% CI 0.0–2.3%) while the rate of successful TOLAC was decreasing (average APC –3.4% from 2000–2009, 95% CI –4.3 to –2.5%).<sup>5</sup> Our findings extend this prior work to a contemporary time frame using national data.

Strengths of this analysis include use of a large, nationally representative sample. Limitations include the absence of granular clinical details and risk of misclassification from birth certificate reporting.

This study provides U.S. population-level trends on attempted and successful TOLAC. It remains unknown whether changes in practitioner and hospital support of TOLAC, state and national level initiatives focused on cesarean reduction, or other factors contributed to these findings. While rates of attempted and successful TOLAC are increasing, the highest annual rate of attempted TOLAC (22%) in 2020 remains below historical peaks and overall

increases are modest. Nonetheless, the high TOLAC success rate (75%) supports continued efforts to encourage TOLAC in appropriate candidates.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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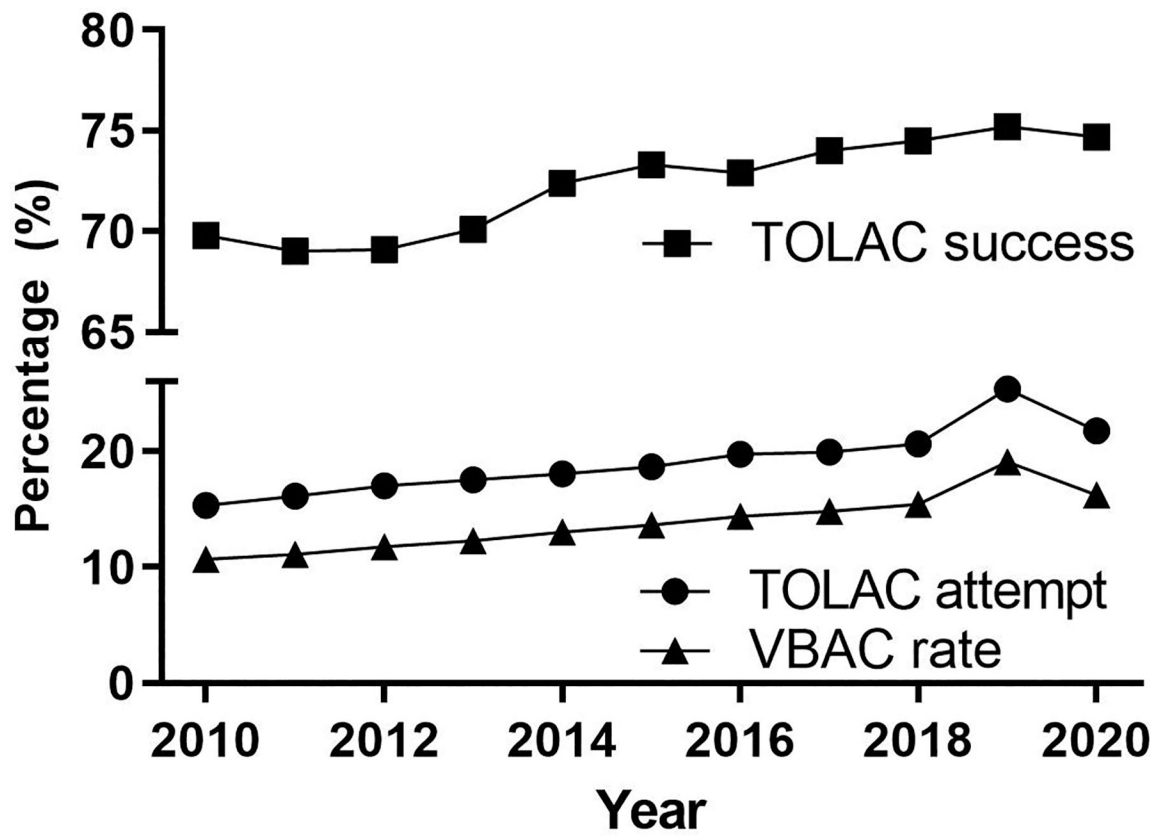
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**Figure 1.** Trends in trial of labor and vaginal birth after cesarean among singleton, cephalic, term deliveries in the U.S. from 2010 to 2020.  
Trial of labor (TOLAC); Vaginal birth after cesarean (VBAC)

**Table 1.**

Rates of attempted and successful trial of labor after cesarean, and rates of vaginal birth after cesarean, among singleton, cephalic, term deliveries in the U.S. from 2010 to 2020

Year	Deliveries*	Attempt TOLAC	Successful TOLAC <sup>†</sup>	VBAC <sup>‡</sup>
2010	293,723	44,888 (15.3)	31,324 (69.8)	31,324 (10.7)
2011	328,720	52,866 (16.1)	36,487 (69.0)	36,487 (11.1)
2012	352,190	59,936 (17.0)	41,393 (69.1)	41,393 (11.8)
2013	371,051	64,868 (17.5)	45,500 (70.1)	45,500 (12.3)
2014	408,525	73,427 (18.0)	53,155 (72.4)	53,155 (13.0)
2015	421,722	78,422 (18.6)	57,455 (73.3)	57,455 (13.6)
2016	445,577	87,909 (19.7)	64,060 (72.9)	64,060 (14.4)
2017	441,286	88,006 (19.9)	65,130 (74.0)	65,130 (14.8)
2018	438,610	90,537 (20.6)	67,479 (74.5)	67,479 (15.4)
2019	367,246	93,076 (25.3)	69,971 (75.2)	69,971 (19.1)
2020	409,150	88,797 (21.7)	66,319 (74.7)	66,319 (16.2)

Data presented as n(%). Trial of labor (TOLAC); vaginal birth after cesarean (VBAC)

\* Individuals missing mode of delivery data (0.1%) were excluded from analysis.

<sup>†</sup> Successful TOLAC defined as vaginal mode of delivery among those attempting TOLAC.

<sup>‡</sup> VBAC defined as vaginal mode of delivery among all deliveries with a history of cesarean.