A review of the literature and analysis of the National Inpatient Sample Database was performed to describe the trends in vaginal birth after cesarean availability in the United States and the factors associated with changing use. Vaginal birth after cesarean increased after the first National Institutes of Health Consensus Conference on Cesarean Childbirth in 1981. It increased from 3% to a maximum rate of 28.3% in 1996. Despite studies reporting stable success rates of approximately 70% and low complication rates (<1%), concerns about patient safety and physician liability have led to more restrictive policies and a decrease in vaginal birth after cesarean use. The current rate is approximately 8.5%, and decreased rates have been noted for all age and ethnic groups. There is decreased use of vaginal birth after cesarean as the result of concerns about patient safety and physician liability, which has resulted in decreased availability.

KEYWORDS cesarean delivery, vaginal birth after cesarean, uterine rupture, trends
What Spurred the Change in US Practice Patterns Shifting the Tide in Favor of VBAC?

Three overlapping series of events (or phenomena) led to the widespread uptake of VBAC across the country. The first event was the NIH Consensus Conference on Cesarean Childbirth in 1981.10 The NIH convened a panel of experts to evaluate the causes of the increasing cesarean rate. The meeting ended with a series of recommendations to decrease the overall national cesarean rate, most prominent of which was to increase the use of VBAC.

After the meeting, during the 1980s and 1990s, there were numerous publications in which the authors systematically provided an evidence base for more liberal use of VBAC. These studies broadened clinical criteria to include external cephalic version, breech, twins, medical complications (such as diabetes, pre-eclampsia, preterm delivery), undocumented scar, lower vertical incision, and more than 1 previous cesarean.10-15 Further, although most clinical studies were initially based in tertiary care, academic teaching hospitals, there was a series of publications establishing the safety and efficacy in small community hospitals, free standing birth centers, and clinician providers other than obstetricians, such as family practitioners and nurse midwives.10-17

In recognition of the growing body of literature supporting VBAC, and concurrent with the evolution of practice guideline development, ACOG published a series of guidelines that were successively less restrictive.10-15,18 The first statement published in 1982 shortly after the NIH Consensus conference stated that with careful selection of patients, proper facilities, and staff (including in-house physician and anesthesia), VBAC appears to be an “acceptable option.”11 The 1995 guideline was perhaps the most liberal, and strongest endorsement stating that “all women “should” undergo VBAC in the absence of medical or obstetrical contraindications.”18

The third phenomenon contributing to the increase in VBAC use was interest by policy makers and third-party payers. Specifically, the advent of quality monitoring and public reporting of quality indicators, such as cesarean and VBAC rates, has been shown to lead to targeted clinical improvements in most hospital settings.19-23 The net effect of these phenomenal changes lead to the highest VBAC rate ever reported in the United States at 28.3% in 1996 (see Fig. 1).24,25

Although the article by McMahon et al commonly credited with the demise of VBAC, it is noteworthy that the findings of the article were not new and in fact supported the well-known, widely published existing evidence base established as early as the 1950s:

- VBAC success is approximately 70% (60%-80%);
- uterine rupture occurs in approximately 1% of trial of labors; and
- uterine rupture is more common with attempted VBAC than elective repeat cesarean section.

The publicity surrounding the McMahon et al’s study solidified in the public’s eye the risks of adverse outcomes associated with failed trial of labor. Notably, adverse outcomes (uterine rupture, hysterectomy, transfusion, “major operative injury,” maternal or newborn death) are more likely with failed VBAC.

Further decline in the national VBAC rate was noted after the release of an updated ACOG practice bulletin released in 1999.8 In response to both ongoing patient safety concerns emphasized by the work of McMahon et al, as well as clinician concerns about malpractice liability, this recommendation altered ACOG’s previous position.15 The language was altered such that instead of “encouraging” VBAC, women should be “offered” VBAC if no contraindications, in settings in which a physician capable of performing a cesarean is “immediately” available throughout active labor, in institutions equipped to respond to emergencies.8,15 As previously mentioned, these recommendations parallel ACOG’s own initial recommendations in 1982.11 Nonetheless, in the current medico-legal climate, the health system personnel requirements became burdensome for both physicians and hospitals and directly contributed to the abolition of VBAC at some facilities.27,28 Figure 1 shows the rate of VBAC over time since the initial NIH Cesarean Childbirth Conference and summarizes key external events likely to have influenced VBAC utilization.

Why a Reversal in VBAC Rates and a Subsequent Increased in Cesarean Rates to Unprecedented Levels?

Recent VBAC rate estimates suggest the national rate has plummeted to as low as 8.5%.23 The decline appears to start around 1997, shortly after a publication by McMahon et al.26

Figure 1 Trends in VBAC rates since 1981 NIH Consensus Conference on cesarean childbirth with timeline of external events impacting VBAC rates. (Reprinted with permission.24,25) (Color version of figure is available online.)
Factors Associated with Variation in Vaginal Birth After Cesarean Birth

Regional Variation

In general, VBAC use is inversely related to cesarean use such that high VBAC rates are associated with lower cesarean rates. This is perhaps best demonstrated at the institutional level, but it can be seen regionally at the area or state level. For example, Taffel reported in 1996 that Southern states tended to have high cesarean rates and low VBAC rates, whereas Western states tended to have lower cesarean rates and greater VBAC rates. Northeast and Midwest states have intermediate rates. More recent data suggest similar trends, with Southern states having the lowest VBAC rates (average rate across states was 8.2, range 4-12) and Western states having the greatest VBAC rate (average rate 12.7, range 5-19.2). The distribution suggests that there is significant interstate variation that is not easily generalized to specific regions.

National Cesarean and VBAC rates are summarized by the National Center for Health Statistics on the basis of method of delivery recorded on birth certificates. Birth certificate documentation was changed in 2003 to capture additional information, and not all states have transitioned to the revised methodology. As such, the data collected across states could not be combined to produce a final representative national cesarean or VBAC rate. Relying on birth certificate data has certain advantages; however, comparable results can be obtained with the use of administrative data. The authors therefore used data from the Nationwide Inpatient Sample (NIS) for the years 2000, 2003, and 2005 to calculate national cesarean and VBAC rates inclusive of this transition period. The NIS contains all-payer data from participating states and is designed to approximate a 20% sample of US community hospitals and represent approximately 90% of all hospital discharges in the United States. Details of the sampling strategy can be found in HCUP Publishing.

Diagnosis Related Group codes 370-375 and Major Diagnostic Category code 14 were used to identify delivery hospitalizations. International Classification of Diseases, ninth revision Clinical Modification codes were used to define labor and delivery routes, as well as multiple gestation and fetal demise, thereby limiting the study to singleton live-born deliveries. As shown in Table 1, the elective repeat cesarean rate increased during this time (from 59% to 83%), whereas the VBAC process measures (VBAC attempt rate and VBAC success rate), as well as the overall VBAC rate declined. It is important to understand the denominator when referring to VBAC use:

- VBAC attempt rate = attempted VBAC/all women with previous cesarean
- VBAC success rate = VBAC success/VBAC attempt
- VBAC rate = successful VBAC/all women with previous cesarean.

In the NIS data, the VBAC success rate decreased to 60% in 2003, suggesting poor candidate selection, inadequate or suboptimal trials, or a problem with the administrative coding such that not all successful trials of labor were identified. This finding warrants further investigation. If this is a consistent reproducible trend, it is disconcerting, because failed VBACs are associated with markedly increased maternal and neonatal adverse events.

Hospital Variation

Researchers have shown variation in hospital specific cesarean rates that are independent of patient clinical risk factors, and this has been ascribed to differences in practice patterns or the cultural milieu within hospitals. Although it is difficult to characterize practice patterns or to define specific criteria that define a hospital’s culture, there are traditional structural variables that can define a hospital and be associated with specific resources, such as whether it is a private or public hospital, teaching or nonteaching hospital, or community or tertiary care center. In general, public hospitals, teaching hospitals, and academic tertiary care hospitals have lower rates of cesarean delivery. DeFranco et al. set out to describe VBAC outcomes by hospital type for 25,065 women who delivered between 1996 and 2000. The study included 17 hospitals located in Pennsylvania, Delaware, and Rhode Island. There were 6 university hospitals, and 11 community hospitals. Five of the community hospitals had Ob/Gyn training programs. The authors found a difference in VBAC attempt and success rates by hospital type. The VBAC attempt rate was greater in hospitals with Ob/Gyn training programs (56.1% vs 51.3%) and greater in university hospitals compared with community hospitals (61% vs 50.4%). The success rate across all hospital types was 75%. The occurrence of failed VBAC, blood transfusion, or composite adverse outcome did not differ by hospital setting; however, there was

| Table 1 Method of Delivery for Women with Previous Cesareans, Nationwide Inpatient Sample, 2000, 2003, 2005 |
|-------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Total deliveries                                | 3,975,574                       | 3,964,514                       | 4,100,779                       |
| Total previous cesarean                         | 482,913 (12.1)                  | 540,038 (13.6)                  | 596,725 (14.6)                  |
| Elective repeat (% total previous cesarean)     | 285,636 (59.1)                  | 423,786 (78.5)                  | 495,151 (83.0)                  |
| Attempted VBAC                                  | 197,276 (40.9)                  | 116,251 (21.5)                  | 101,574 (17.0)                  |
| Successful VBAC                                 | 136,334                        | 74,397                          | 61,210                          |
| % success = success/attempt                     | 69.1%                          | 64.0%                           | 60.3%                           |
| VBAC rate = success VBAC/all priors             | 28.2                           | 13.8                            | 10.3                            |

Abbreviations: NIS, Nationwide Inpatient sample; VBAC, vaginal birth after cesarean.
increased risk of uterine rupture at community hospitals (1.2% vs 0.6% in university hospitals).

Yeh et al by using birth certificate data, examined the trend in VBAC use for New York State for the period 1998 to 2002. The study encompassed 33 hospitals and 11,446 low-risk women who had a prior cesarean delivery. The authors found significant variation in VBAC attempts by hospital location (area of residence), and level of newborn nursery specialization, but not delivery volume. The VBAC attempt rate declined during the period studied from 42.7/100 to 24.1/100. VBAC attempt did not vary by hospital size. Importantly, VBAC success remained stable at 70% across all hospital types.

When the NIS data were used, we found that VBAC attempt was more likely in urban hospitals, but there was no difference in success by hospital location. Similar to Yeh et al, there was no association between the VBAC process measures and hospital volume (data not shown).

Provider Variation

Given current recommendations that a physician “capable of performing a cesarean” and associated resources (anesthesiologist, OR, and OR team) be “immediately available” it is intriguing that studies suggest VBAC use is greater when care is provided by clinicians who are not private obstetricians. Russillo et al reported a successful VBAC rate of 81% for family practitioners. Lieberman et al reported a successful VBAC rate of 87% for certified nurse midwives in a national study of VBAC in birthing centers. Further, survey data from ACOG members confirms that US obstetricians report they are doing fewer VBACs due to concern about liability, patient preference, and limited resources at their delivery hospital.

Patient Variation

Multiple patient factors have been studied as independent risk factors for both cesarean delivery in general, and VBAC in particular. Maternal age, race/ethnicity, and insurance type are the most commonly studied, although evaluation by specific clinical conditions, or stratification into “low-risk/no risk” or “high-risk” groups has also been done to provide for meaningful comparisons across strata.

Since 1996, VBAC use has decreased across all age groups. Srinivas et al reported women greater than 35 were less likely to attempt VBAC, more likely to be unsuccessful and more likely to experience VBAC related operative complications. Likewise, the VBAC rate has declined for all racial/ethnic groups. Historically, white women have had greater rates of VBAC and Hispanic women have had lower rates of VBAC when compared with other ethnic groups (Fig. 2). Although VBAC attempt and success rates tend to parallel one another, Cahill et al noted the opposite finding for black women. In their multicenter study, black women were more likely to attempt and fail VBAC but had lower uterine rupture rates when compared with other ethnic groups. Hollard et al reported similar attempted VBAC rates for all ethnic groups but lower success rates for black and Hispanic women after adjusting for patient specific factors (age >35 years, parity, weight gain, diabetes, hospital site, prenatal care provided, gestational age, induction, labor augmentation, epidural analgesia, and birth weight >4000 g).

Figure 2

Trends in VBAC rate by race/ethnicity 1989-2004. (Reprinted with permission.)

The NIS database revealed younger women and black women were more likely to attempt VBAC. The trend analysis corroborated the Cahill et al findings. In this nationally representative sample, black women were more likely to attempt VBAC and also were more likely to fail. Further study is warranted to understand what factors (eg, biological differences, clinical differences in labor or patient-provider interactions, or provider preferences and practices) explain these observed differences.

Cesarean and VBAC rates vary by insurance status. Studies suggest that patients with private insurance have higher cesarean and lower VBAC rates. Among patients with Medicaid, belonging to a health maintenance organization (ie, HMO) and delivering in public compared with private hospitals may increase likelihood of VBAC. Analyzing the NIS dataset for 2000, 2003 and 2005, we found there was no difference in the VBAC process measures by insurance type. Perhaps the low use of VBAC is independent of insurance type because it is predicated on hospital resources. It is also possible that the advent of different types of private insurance (eg, HMO, preferred provider organization, fee for service) has obscured the meaning of “private insurance” in administrative data.

Finally, patient-specific clinical characteristics have an impact VBAC success. Many clinical conditions have been individually evaluated (and/or controlled for), and these include but are not limited to prematurity, pre-eclampsia, twins, more than 1 cesarean, and obesity. Gregory et al stratified patients into high risk (one or more maternal, fetal, or placental condition) and low risk (no conditions) and found attempted and successful VBAC rates varied widely by these conditions ranging from 10% to 73%. The VBAC success rate for low-risk women was 74.5% versus 50.3% for high-risk women. Similarly, the rate of adverse events was lower in the low-risk group. Similar findings by other investigators suggest there may be promise in the development of models to predict ideal VBAC candidates, or patients at increased risk for adverse events. Several models have been proposed, but none have been integrated into standard obstetrical practice.
International Data
As previously mentioned, VBAC has been widely practiced in Europe since the standardization of the low transverse uterine incision as the incision of choice. 3 Indeed, publications from the United Kingdom, Ireland, France, Scotland, and the Netherlands consistently demonstrate most women with previous cesarean attempt VBAC (attempted VBAC rates approach 50%-70%) and success rates ranging from 70% to 75%. 3,60-65 It is noteworthy, unlike the United States, the model of care in these countries rely heavily on nurse midwives. Similarly, in Canada where VBAC guidelines are comparable to the United States, VBAC is more commonly attempted, although trend data suggest that VBAC rates have decreased since 1997 in a manner parallel to the United States, from 35% to 20% between 1997 and 2005. 66,67 There are other cohort studies from countries as varied as Nigeria, Malaysia, India, and Taiwan, with outcomes (VBAC success rates, complications rates) that are similar to that reported in the United States. However, the health systems in these countries are not directly comparable with the United States and hence will not be considered further.

Access to Vaginal Birth After Cesarean
There is no doubt that the decrease in VBAC use is caused, in part, by decreased access. In fact, one external agency, the California Hospital Association and Reporting Task Force (CHART), has advocated that in addition to monitoring VBAC rates as a quality indicator, hospitals should be required to report whether they provide access to VBAC, and providing access to VBAC should be considered an indicator of hospital maternal healthcare quality. 68

Several investigators 27,28,69,70 have attempted to quantify the impact ACOG’s current guidelines had on VBAC access. Gochnour et al, 71 in a survey of physicians in Utah, reported that most physicians were aware of ACOG recommendations (97% OB’s, 79% FP’s), and 45% of physicians reported a decrease in VBAC practices. Although most physicians (87%) reported capacity to immediately perform a cesarean, it was less likely to be available in suburban or rural areas (100% urban, 88% suburban, 76% rural). Physicians practicing in rural and suburban areas reported the largest decline in the use of VBAC/trial of labors. Shihady et al 72 and Roberts et al 26 surveyed hospital administrators about clinical practices and policy changes post ACOG recommendation in several different states throughout the country. Both studies received response rates from more than 90%, and in both series, approximately 30% of hospitals stated they stopped allowing VBAC services. Of the hospitals that still allow VBAC, more than half had to change their policies to be compliant with ACOG recommendations.

Gaps in Knowledge About Vaginal Birth After Cesarean
What is known is clear and has been known for some time is that, in selected populations, VBAC is successful 70% of the time. Successful VBAC is associated with the greatest benefit and least risk to mother and baby. However, VBAC is not risk free. There are inherent maternal and neonatal risks that are exacerbated when VBAC fails. Cesarean is not risk free. There are inherent maternal and neonatal risks associated with elective cesarean delivery. 71 These risks are not always directly comparable.

What is unknown is less clear. For example, because the risks of VBAC and elective repeat cesarean section are not directly comparable, how do clinicians communicate these risks to women so that they can make informed decisions? 72

Who should communicate these risks? Clearly physicians are stakeholders in the outcome and what they say and how they say it influences patient choices. Attitude about childbirth, fear of labor, perceptions about womanhood, and vaginal birth are cultural phenomena influenced by society, spouse, family, friends, and personal values. As stated by Meddings et al, 73 women need to have access to nonbiased evidence-based information to engage in a collaborative partnership of equals with midwives and obstetricians. What is the incentive and resources for the medical profession to develop this nonbiased evidence base? How and whether to use decision tools, and what type is the most meaningful/helpful for the patient? 74 How and when do patient preferences become integrated into the decision-making process for VBAC?

Hierarchically, randomized trials are considered the gold standard for evaluating outcomes and effectiveness. Are patients and obstetricians ready to subject the “natural” process of vaginal birth to a trial? What should the primary outcome be? Qualitative studies suggest that psychosocial factors are as important if not more important for women than actual personal physical risk. 73 How can this be operationalized in such a study?

Dodd et al 75 offer justification for a randomized trial and a patient preference study of planned VBAC versus planned repeat cesarean. This type of study may have benefit when patients have strong treatment preferences and decline randomization. Dodd et al propose a restricted prospective multicenter cohort study design that allows inclusion of women with clear preferences for treatment, improves generalizability, and uses the same rigorous recruitment, treatment schedules, follow-up, and intention-to-treat analysis as a randomized control trial. The primary and secondary null hypothesis is that there will be no difference in neonatal or maternal risk of death and/or adverse events, respectively. The study has received institutional review board approval and is presumably underway.

In addition to a better knowledge base about how to communicate risks and benefits to patients in a meaningful manner, clinicians need a better set of tools to bring about more rapid dissemination and change in provider practices. Studies have consistently shown clinical practice lags behind evidence by 10 or more years (except for the decrease in VBAC use, which was surprisingly swift). 76,77

In conclusion, in the United States, where choice and autonomy are perceived as basic human rights, it is unlikely that a blanket universal VBAC policy will ever be possible. At best, one can hope for refined prediction tools that maximize...
success and minimize failure. Additionally, data that incontrovertibly establish the relative safety of VBAC would help ensure the health care system maintains and perhaps even improves access so that those women who want to choose VBAC will be able to do so.

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