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A MASTER'S PROJECT  
SUBMITTED TO THE GRADUATE FACULTY  
OF THE GRADUATE SCHOOL  
BETHEL UNIVERSITY

BY  
CASSIE M. KURTZ  
AND  
ANNA R. PICKER

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
MASTER OF SCIENCE IN NURSE-MIDWIFERY

MAY 2019  
BETHEL UNIVERSITY

Risks and Benefits of Trial of Labor After Cesarean When Compared to Elective Repeat Cesarean Section in Rural Facilities

Cassie M. Kurtz

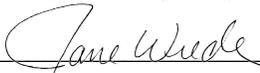
and

Anna R. Picker

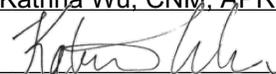
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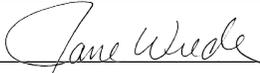
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Anna Picker and Cassie Kurtz

## Abstract

**Background/Purpose:** Trial of Labor After Cesarean (TOLAC) is a safe delivery option for many women. Due to demographics, availability in rural communities, and lack of education and opportunity, many women are not attempting them. Women should have access to TOLAC regardless of their geographic location, socio-economic status, or insurance. The American College of Obstetricians and Gynecologists (ACOG) practice bulletin urges that facilities have an emergency plan in place if an emergent cesarean is required. It does not state that staff must be immediately available. Rather, it recommends that facilities provide cesarean delivery for situations that are threatening to the life of the mother or the fetus. There is no explicit definition of timing from onset of complications to delivery. The ACOG bulletins do not outlaw Vaginal Birth After Cesarean (VBAC) in hospitals that do not have 24/7 resources for emergency cesarean. Alternatively, both bulletins recommend having serious, educational discussions with the mother about the hospital's resources, as well as the benefits and risks of VBAC.

**Theoretical Framework:** Imogene King's Goal Attainment theory incorporates self, perception, growth and development, space, time, interaction, communication, transaction, and coping so that we can properly care for patients (Caceres, 2015). This framework is imperative to this project because nurse-midwives work alongside women in health and pregnancy. Imogene King's nursing theory describes an interpersonal relationship that allows people to achieve certain life goals (Nursing Theory, 2016). Nurse-midwives are the ones counseling, empowering, and guiding women to make the best decisions for them and their babies. As a nurse-midwife, the goal is to help patients find strong maternal identity during pregnancy, birth, and motherhood.

**Methods:** 20 research articles were ultimately chosen and reviewed for their pertinence to TOLAC, VBAC, and ERCD.

**Results/Findings:** Risks of adverse events in a TOLAC are low. The overall success rate of VBAC found in our critical literature review was 63.4-91%. This is similar to overall data reports stating success rates of 60-80%.

**Conclusion and Midwifery Implications:** TOLAC is a safe delivery method, independent of demographics. Emergency policies and procedures should be in place. Each candidate should be carefully evaluated using a VBAC prediction tool. Risks and benefits should be weighed carefully on an individual basis.

**Keywords:** TOLAC, rural, uterine rupture, risks, success, vaginal after cesarean, response time, repeat cesarean section rates, infant outcomes, maternal outcomes, VBAC, induced labor, & spontaneous labor.

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## **Chapter I: Introduction**

Trial of Labor After Cesarean (TOLAC) is an attempt to have a vaginal delivery after a woman has had a previous cesarean section (Practice Bulletin No. 184 Summary, 2017). A successful TOLAC is then considered a Vaginal Birth after Cesarean Section (VBAC). Many rural communities do not offer women the choice to have a TOLAC due to lack of resources and safety concerns. This paper will explore why this is and what the risks are for a woman and her fetus. VBAC is associated with less maternal morbidity and decreased risk of future pregnancy complications (Practice Bulletin No. 184 Summary, 2017). Even though TOLAC may be a beneficial option for many women, there are several factors that can lead to a failed TOLAC. When a woman is not considered a good candidate for TOLAC there is an increased risk of maternal and perinatal morbidity, when compared with an Elective Repeat Cesarean Delivery (ERCD) or VBAC (Practice Bulletin No. 184 Summary, 2017). Assessing each individual woman's likeliness of a successful TOLAC is important to the outcome of the maternal and fetal well-being (Practice Bulletin No. 184 Summary, 2017). Proper review of risks and benefits, along with patient counseling and informed consent is crucial.

### **History of TOLAC, VBAC, and Cesarean Sections**

In 1965, the overall cesarean birth rate was a low 4.5% (ACNM, 2010). Between 1970 and 2016, the rate in the U.S. increased from 5% to 31.9%. The cesarean rate increase is due to several practice changes in the birthing practice: the introduction of electronic fetal monitoring, the decrease in the attempts at vaginal breech deliveries, and the continued belief of "once a cesarean, always a cesarean" (Practice Bulletin No. 184 Summary, 2017). The World Health Organization (WHO) suggests that the ideal rate for cesarean section should only be 10%-15%

(World Health Organization [WHO], 2015). Women in their first pregnancy, who were considered low risk, had a primary cesarean rate of 28.1% that peaked in 2008. This rate was down to 25.8% in 2015 (ACNM, 2017). However, more work is needed to reach the WHO suggested cesarean section rate of 10-15%.

Using U.S. birth certificate data, the American College of Nurse-Midwives (ACNM) discovered that the VBAC rate was 11.9% in 2015, a significant decrease when compared to 28.6% in 1989. Despite this decrease, VBAC success rates were 70% in 2015 which has been a consistent percentage over the last decade (ACNM, 2017). In addition, women with a prior vaginal birth had an 86.6% VBAC delivery success rate compared to a 60.9% success rate in women without a history of a prior vaginal delivery (ACNM, 2010). Many factors play a role in the rate of VBAC success including maternal age, setting, provider types, and obstetric history.

### **ACOG Practice Bulletin**

The American College of Obstetricians and Gynecologists (ACOG) published a practice bulletin with recommendations for VBAC in 2017. Prior to this, last practice bulletin on TOLAC released by ACOG was in 2010. Although there are many similarities between the two bulletins, the most significant difference is that the 2017 bulletin does not require staff to be immediately available to provide emergency cesarean sections (Goer, 2017). Rather, it recommends that facilities provide cesarean delivery for situations that are threatening to the life of either the mother or the fetus with no explicit definition of timing from onset of adverse event and cesarean section. Neither bulletin outlaws VBAC in hospitals that do not have 24/7 resources for emergency cesarean. Both bulletins recommend having serious, educational discussions with the mother about the hospital's resources, as well as the benefits and risks of TOLAC. Both bulletins

also stress the importance of the hospitals having a plan in case of an emergency. The 2017 practice bulletin highlights that a woman who has had one previous low transverse cesarean should be offered a TOLAC, even if the facility does not offer them. Also new to the 2017 bulletin is that home birth is contraindicated for TOLAC. Fetal heart tone (FHT) monitoring should be continuous as the FHT changes could be the first sign of uterine rupture (Practice Bulletin No. 184 Summary, 2017).

The practice bulletin recommends not using certain drugs for cervical ripening or induction, such as Cytotec. Cytotec, which is generally used to ripen the cervix, increases the risk of uterine rupture for any woman (Oden & Certificate, 2009). The risk of uterine rupture is higher in induced or augmented labors when compared to spontaneous labor. The risk increased 2.5 times for induced labors (1.0%) and 2.25 times for augmented labors (0.9%) (Landon, 2017).

### **Maternal Mortality in the United States**

The rate of maternal deaths in the U.S. has been steadily increasing, even doubling in the past 20 years (Practice Bulletin No. 115 Summary, 2010). This increase has been due to more cesarean deliveries, increasing maternal age, obesity, and changing population demographics (Practice Bulletin No. 115 Summary, 2010). The cause for the rise of cesarean deliveries over the past few decades is somewhat unclear, but could be related to complexities associated with caring for women with a high body mass index or who had infertility treatments. Some cesarean sections are found to be done without medically justifiable cause or due to women requesting them (Panda, Begley & Daly, 2018).

Factors that have influenced clinicians' decisions to perform cesarean sections include the following: personal beliefs of what is considered clinical or non-clinical, the facilities'

policies and guidelines that they work for, financial issues, fear of legal consequences, lack of access to facilities and resources, and lack of cooperation among professionals (Panda et al., 2018). According to the systematic review and meta synthesis analysis done by Panda et al. (2018), the perception of risk and choice for cesarean section over vaginal delivery included the following: to avoid risk of unclear situations, to avoid the risk of urinary incontinence, fecal incontinence, and pelvic floor prolapse following vaginal births. In this study, cesarean section was referred to as the ‘safe option’ by obstetricians compared to midwives referring to vaginal delivery as a way for women to enjoy ‘the fruits of pregnancy’ (Panda et. al., 2018).

Between 1990 and 2013, the maternal mortality rate in the U.S. doubled from 12 per 100,000 births to 28 per 100,000 births (Agrawal, 2015). The U.S. has a higher ratio of maternal deaths than most high-income countries, with approximately half of all maternal deaths in the U.S. estimated to be preventable (Gaskin, 2008). According to the WHO, each year, 1,200 women suffer complications in pregnancy and childbirth (WHO, 2015). Contributing factors include inconsistent obstetrical practice, a lack of standardized approach to managing emergencies, and late identification of problems (Agrawal, 2015). There has also been an increase in chronic health problems in pregnancy such as hypertension, obesity, and diabetes (Agrawal, 2015).

### **Evidence Demonstrating Need**

According to the American College of Obstetricians and Gynecologists (2017), there are no randomized trials that compare maternal or neonatal outcomes between women who are attempting TOLAC and those who are undergoing ERCD (Practice Bulletin No. 184 Summary, 2017, p. 218). Observational studies are used to gather recommendations regarding the approach

to delivery. These studies have examined the probability of a successful VBAC once TOLAC has been attempted and the maternal and neonatal morbidities that are associated with TOLAC compared to a repeat cesarean delivery (Practice Bulletin No. 184 Summary, 2017). Evidence suggests that women with at least 60-70% likelihood of achieving VBAC who attempt a TOLAC contact less or the same risk of maternal morbidity than a woman who chose ERCD (Practice Bulletin No. 184 Summary, 2017). Contrarily, a woman who has lower than a 60% likelihood of achieving VBAC, as calculated by a VBAC calculator tool, is more likely to experience morbidity than a woman having an ERCD (Practice Bulletin No. 184 Summary, 2017). Practice Bulletin No. 184 Summary, (2017) stated that “most maternal morbidity related to TOLAC occurs when repeat cesarean delivery becomes necessary” (p. 217). They also found that the maternal death risk with ERCD is 0.96%, compared to 0.19% with TOLAC. Neonatal morbidity is higher with a failed TOLAC than in VBAC, but lower in VBAC than ERCD (Practice Bulletin No. 184 Summary, 2017).

In 1985, a panel of investigators from the National Institutes of Health (as cited in Practice Bulletin No. 184 Summary, 2017) recommended an increase in the TOLAC rate, which was at a low 5%. By 1996, the TOLAC rate was 28.3%, as there was an increase in the percentage of women attempting TOLAC. There was also an increase in uterine rupture and other complications. This is most likely due to an unrecognized risk for rupture when using cervical ripening agents and/or tocolytics (Practice Bulletin No. 184 Summary, 2017). By 2006, the VBAC rate decreased to 8.5% and many hospitals stopped offering TOLAC (Practice Bulletin No. 184 Summary, 2017). Furthermore, in 2010 the National Institutes of Health (as cited in Practice Bulletin No. 184 Summary, 2017) recognized that concern for liability had a major impact on healthcare facilities and providers offering TOLAC. As of 2006, the TOLAC

attempt rate reached a low point of 15.9% (Berghella, 2019). There are many factors that lead to cesarean decision including: where women live, which hospital they choose, and even the nurse during labor. In 2018 only 9% of women were attempting TOLAC even though TOLAC success rates are 60-80% (Van Dis, 2018).

Factors that affect cesarean section rates include: provider preference, patient convenience, abnormal labor patterns or an arrest of labor, and nonreassuring fetal heart rate (Tolcher, Holbert, Weaver, McGree, Olson, El-Nashar, Famuyide & Brost, 2015). The most common reasons for cesarean births were failure to progress/cephalopelvic disproportion and nonreassuring fetal heart rate pattern (ACNM, 2017). A trial of labor is a reasonable option for many pregnant women and this option should be available to women with one prior low transverse uterine incision (ACNM, 2017). The primary concern for women who labor after one or more cesarean births is rupture of the uterus. The incidence of uterine rupture in these women is 4.7/1000 while the incidence of uterine rupture in women who undergo ERCD is 0.3/1000 (ACNM, 2017). The risks associated with an increased chance for uterine rupture include the following factors: increasing maternal age, a pregnancy that goes beyond 40 weeks, a birth weight greater than 4,000 grams, less than 18 to 24 months between pregnancies, single-layer uterine closure, uterine closure with a locked stitch, two or more previous cesarean deliveries, and the use of prostaglandins (Landon & Frey, 2017).

Women with a previous T-shaped, J-shaped, or classical incision or women with history of fundal surgery are at a significantly higher risk for uterine rupture during labor, therefore they are not candidates for TOLAC (ACNM, 2017). Rupture rates for women with this history ranges from 1% to 12% (Landon & Frey, 2017). The risk of maternal morbidity and mortality are greater with ERCD due to the risk for blood transfusions and admissions to intensive care units.

Future risks such as: hysterectomy, bowel and bladder injuries, transfusions, infections, and abnormal placenta conditions such as, placenta previa and placenta accreta are associated with having multiple cesarean deliveries (Practice Bulletin No. 115 Summary, 2010).

Vaginal birth after cesarean (VBAC) reduces the likelihood of maternal morbidity associated with multiple cesarean births (ACNM, 2017). Potential health advantages for women that are able to achieve a VBAC include avoiding major abdominal surgery, a shorter recovery period, lower rates of hemorrhage, thromboembolism, and potential infection (Practice Bulletin No. 184 Summary, 2017).

### **Statement of Purpose**

Women are facing barriers to gain access to the choice of TOLAC. The purpose of this literature review is to determine the current risk of TOLAC and why many rural facilities are unable to offer them to women. Many scholarly articles, studies, practice bulletins, and practice guidelines were reviewed to determine the risk and benefit of TOLAC. Specific areas of focus include both maternal and fetal mortality and morbidity risks with TOLAC, VBAC, and ERCD. These researchers want to understand the risk of uterine rupture in rural communities where surgical teams are not always in-house during a labor. In such conditions, can a TOLAC be offered safely to a woman? Current guidelines show that there is a low level of evidence on the requirement of surgical and anesthesia personnel to be immediately available. Reviewing current research could lead to developing integrated services that could eliminate these barriers.

## **Rural Health Care Challenge**

The most current American College of Obstetricians and Gynecologists (2017) best-practice guidelines state TOLAC should not occur in a home birth. ACOG practice guidelines also state TOLAC should be cared for in a Level 1 facility or higher, and there should be the capability of performing an emergency cesarean section (Practice Bulletin No. 184 Summary, 2017, pp. 224-225). This is the challenge most rural facilities have because they do not have operating room staff in-house at all times. When emergencies may arise, resources needed for emergency delivery include a plan for gathering staff and a plan for managing uterine rupture (Practice Bulletin No. 184 Summary, 2017). Drills or other simulations may be useful in preparing for these emergencies. If necessary resources are not available, women should be given alternative options early in the course of antenatal care, including a transfer to another facility that would give them the option for TOLAC (Practice Bulletin No. 184 Summary, 2017).

Many rural hospitals are considered critical access hospitals. This is to ensure access to health care close to home for residents in rural communities. “Critical Access Hospital” was designated in 1997 by the Balanced Budget Act. It is a term that was given to rural facilities and was defined by the Centers for Medicare and Medicaid Services (Rural Health Information Hub, 2018). The definition of hospitals as critical access hospital was due to many rural facilities closing in the 1980’s and 1990’s, and this term was created to require small facilities to uphold program requirements through health care legislation. The design of critical access hospitals decreased financial vulnerability and improved rural access to health care (Rural Health Information Hub, 2018).

For a hospital to be designated as a rural access hospital, a facility must be located more than 35 miles from the next hospital, have less than 25 acute care beds, maintain an average length of stay of 96 hours or less, and provide 24/7 emergency care (Rural Health Information Hub, 2018). The number and types of services vary from one community to another and are based on the needs of the community. Therefore, there are several small hospitals that do not offer obstetrical services. As of 2018, there are 1,348 critical access hospitals in the U.S. In order to become a critical access designated facility, the hospital must participate in Medicare and hold an acute care hospital license (Rural Health Information Hub, 2018).

The American College of Obstetricians and Gynecologists defines rural health as health care in a nonmetropolitan area (Practice Bulletin No. 115 Summary, 2014). A formal opinion from the ACOG committee provided national data that reported little difference between metropolitan and nonmetropolitan women for obstetrical outcomes. When comparing women living in metropolitan areas, national level data found that in rural areas, woman had slightly higher rates of hospitalizations with complications in pregnancy in 2008. In 2008, only 6.4% of OB/GYNs practice in rural settings (Committee Opinion No. 695 Summary, 2017, p. 2). The ACOG recommended several interventions in order to reduce rural health care disparities including collaborative care and partnerships with physicians as consultants, continued education, and retention of rural health providers (Committee Opinion No. 695 Summary, 2017). Among their recommendations, they concluded that further research is needed in order to understand acceptable VBAC conditions in rural health areas and improve health care for rural women.

## **Significance to Nurse-Midwifery**

The American College of Nurse-Midwives (ACNM) states that nurse-midwives provide a full range of medical services, not only for pregnant women, but for adolescent to postmenopausal women. Primary care, family planning, preconception care, pregnancy care, delivery and postpartum, and newborn care up to 28 days of life are all within the scope of a midwife's capability (ACNM, 2004). A nurse-midwife is an advanced practice nurse who obtains a master's degree in order to practice. As of August 2017, there were 11,826 Certified Nurse-Midwives (CNM) and 101 Certified Midwives (CM) in the United States (ACNM, 2016). Providing comprehensive assessments, a midwife can diagnose and treat women much like an OB/GYN, with the exception of surgical services (ACNM, 2016). It is fully within the scope of a midwife to assess women for eligibility for a TOLAC and provide patients with the most current and up-to-date recommendations relating to them and their pregnancy.

The American College of Nurse-Midwives' (ACNM) position statement states that women have the right to safe and accessible options for subsequent births (ACNM, 2010). The ACNM also concludes that women who are candidates for a TOLAC should consider this birth option and that all women in all geographic areas should be offered the option using informed decision making, risk assessments (ACNM, 2010). Each woman should receive evidence-based information and be able to make an informed decision on birth type. Informed consent or refusal should be based on knowledge of the benefits and harm possible to both a woman and her baby. Midwives are responsible for providing informed consent, assessing ongoing risk, and establishing arrangements for medical consult and emergency care if necessary. According to the

ACNM (2010), women should have access to a facility which offers TOLAC regardless of their geographic location, socio-economic status, or insurance type. Women attempting TOLAC should also have access to providers who can respond in a timely manner should there be the need for emergency intervention (ACNM, 2010).

King and Pinger (2014) suggest some proven benefits of midwifery which they call “Pearls of Midwifery”. Practicing these pearls may benefit women attempting a TOLAC. Intrapartum care practices for a laboring woman that are associated with the Pearls of Midwifery care include strategies that promote normal physiologic vaginal birth. These strategies are associated with a lower cesarean rate and improve maternal, neonatal, and labor outcomes. Continuous support throughout labor results in significantly shorter labors, less oxytocin augmentation, and fewer cesareans. Another midwifery pearl includes the fact that VBAC is safe for most women (King & Pinger, 2014). Furthermore, CNMs could bridge the gap in rural health needs for more OB/GYN services.

### **Theoretical Framework**

Imogene King’s Theory of Goal Attainment is the theory used to guide this literature review. King’s theory was introduced in the 1960s (Nursing Theory, 2016). The model focuses on the attainment of certain life goals. The purpose of this theory is to describe how nurses can successfully support patients in setting and meeting health related goals. The premise of the theory is that the nurse and patient go hand-in-hand when communicating information, setting goals together, and working to achieve those goals. The concepts for the personal system are perception, self, growth and development, body image, space, and time. The concepts for the interpersonal system include: interaction, communication, transaction, role, and stress. The

concepts for the social system include: organization, authority, power, status, and decision-making.

King believes health involves dynamic life experiences of a human being (Nursing Theory, 2016). This implies continuous adjustment to stressors in the internal and external environment through optimum use of resources to achieve maximum potential for daily living. King defines nursing as a process of action, reaction, and interaction between nurse and client (Nursing Theory, 2016). The nurse brings knowledge, the patient perceives the information, and together a goal can be met. It is thought that by creating a strong interpersonal relationship goals can be made and achieved and satisfaction will take place (Nursing Theory, 2016). The focus is the patient and the goals are set mutually.

Key terms King uses in her theory are perception, communication, interaction, transition, and stress (Nursing Theory, 2016). Perception is how the environment is perceived and interacted with. Communication is intrapersonal and interpersonal exchanges that facilitate information sharing. Interaction is perception and communication between a person and the environment and between a person and another person. Goals, needs, and values of the nurse and patient influence the interaction process. Interactive behaviors in this case are goal oriented. Transition is interactions between humans to achieve goals. Stress is mediator of growth, development and performance. A person must successfully engage with individuals and the environment to control stressors and successfully grow, develop, and perform (Nursing Theory, 2016).

A healthy mother and healthy baby are the goals of obstetrical care. Offering TOLAC after obtaining informed consent aligns with King's theory because midwives are patient

advocates who help women make informed decisions (Nursing Theory, 2016). Nurse-midwives also help patients attain certain goals. King's framework complements this project because nurse-midwives work beside women during pregnancy and women's health. Midwives counsel, empower, and guide women to make the best decisions for themselves and their babies (Nursing Theory, 2016). Nurse-midwives ultimately have a goal of helping patients find strong maternal identity during pregnancy, birth, and long into motherhood. King's Theory of Goal Attainment influences the interaction process with goals, needs, and values. Women have the right to participate in the decisions that influence their lives, health, and baby's health (Nursing Theory, 2016). Women also have the right to accept or reject care. The goals of the midwife and the goals of the woman may not be congruent. The way that a situation is perceived creates an environment for success (Van Dis, 2018). It has been proven that the nurse involved in a labor can have significant differences in delivery outcomes depending on the interpersonal relationship (Van Dis, 2018). It is possible that environmental stressors will change the plan of care. For this reason, a strong interpersonal relationship between patient and midwife will create better outcomes. According to King, people are social beings that need access to health information, prevention of illness, and the need for care when they are vulnerable, such as in childbirth (Nursing Theory, 2016).

## **Summary**

It is important to teach and educate women on the risks and benefits of TOLAC versus ERCD in order to help them make an informed decision regarding what is best for them. There are important risks and benefits to consider for both of these delivery options. Women's preferences should be honored, while providing evidence-based information, including risk assessment, at a level that she and her family can understand.

## **Chapter II: Methods**

The purpose of this chapter is to describe which methods were used in identifying and accumulating scholarly articles for research of risk of TOLAC when compared to elective repeat cesarean birth. Multiple databases were searched, and keywords were identified to gather a multitude of quality articles.

### **Search Strategies**

Research articles were limited to the last five years, 2013 to 2018, due to the large amount of practice recommendation changes regarding TOLAC; TOLAC management has changed multiple times over the last ten years. VBACs are safe and appropriate for most women who have had a prior cesarean delivery, including for some women who have had two previous cesareans (King & Pinger, 2014). Medical liability is a huge factor on the willingness of physicians and healthcare facilities to offer TOLAC (Practice Bulletin No. 184 Summary, 2017). Over the last ten years, investigators have attempted to create a scoring system to assist in the prediction of VBAC; most have had limitations and have not been widely used (Practice Bulletin No. 184 Summary, 2017). However, one model has been used for women with a prior low-transverse cesarean delivery, singleton pregnancy, and cephalic fetal presentation. This model has been used at the first prenatal visit to predict the probability that a VBAC will be achieved if TOLAC is undertaken. This model is based on maternal age, BMI, race, prior vaginal delivery, history of VBAC, and indication for prior cesarean delivery (Practice Bulletin No. 184 Summary, 2017). All of these topics were sought out in our search of selected articles.

Utilizing CINAHL and PubMed, a total of 192 articles were yielded from keyword searches. Many articles were excluded due to relevancy to the subject matter and duplicates of articles. A total of 20 articles were chosen. Databases used to search for studies were CINAHL and PubMed MEDLINE. Cochrane, ACOG, ACNM, and The Journal of Midwifery & Women's Health were also used in gathering important information for this project. Keywords utilized in searches include: TOLAC, rural, uterine rupture, risks, success, vaginal after cesarean, response time, repeat cesarean section rates, infant outcome, maternal outcome, VBAC, spontaneous labor, and induced labor.

### **Criteria for Inclusion and Exclusion**

Inclusion criteria for the chosen articles included free full-text sources, studies in the last five years, clinical studies, clinical trials, randomized controlled trials, U.S. based studies (or areas of the world with similar socioeconomic and health care status), and articles that had relevant data regarding risk of TOLAC when compared to ERCD. Articles were excluded for multiple reasons. Many articles conducted outside of the U.S. were excluded due to differences in health care practices. However, there were not enough articles with adequate data for us to use from the U.S. only. Thirteen articles were from hospitals in the U.S., two from India, one from Taiwan, one from Kuwait, one from Ghana, one from Denmark, and one from England. Non-research articles, those that were not free full text, meta-analysis, opinions, and reviews were excluded. Waterbirth is not our focus, so those studies were excluded. Also excluded were any articles about uterine rupture that were from an unscarred uterus, unless they were comparing them to a scarred uterus.

## **Summary of Selected Studies**

The focus of the information gathered was to learn more about TOLAC risk, specifically in rural communities. Many women are not offered this birth option due to resources and demographics. These researchers wanted to explore birth options and the risks of TOLAC in order to bring evidence-based best practices back to rural communities. Therefore, articles chosen included risk of TOLAC, complications, why women chose TOLAC versus elective repeat cesarean and outcomes for mother and fetus with and without uterine rupture. According to ACOG (2017), no randomized trials comparing maternal or neonatal outcomes of TOLAC and ERCD exist due to the nature of the topic studied (Practice Bulletin No. 184 Summary, 2017). Of the 192 articles yielded in the initial search there were 82 abstracts reviewed. Twenty articles were ultimately chosen to be included in matrices for pertinence and quality to our research project.

## **Evaluation Criteria**

Articles were selected based on relevance and quality. The Johns Hopkins appraisal tool was used to evaluate each article (Dearholt & Dang, 2012). The Johns Hopkins appraisal tool rates articles as one of four levels (I-IV) and qualifies them as high quality, good quality, or poor quality. Level I studies are experimental, randomized controlled trials, and systematic reviews of randomized controlled trials. Level II studies are quasi-experimental, systematic reviews of quasi-experimental, or a study which obtains a combination of randomized controlled and quasi-experimental. Level III studies are non-experimental, qualitative, reviews of randomized controlled trials, or combination studies of both quasi-experimental and non-

experimental. Level IV are opinion articles based on evidence and studies that have been done previously. Level IV can be clinical practice guidelines or other conclusions made by an expert or group of experts. Majority of our articles used were level II and III due to the nature of our topic. There are no randomized controlled trials done on this topic (Practice Bulletin No. 184 Summary, 2017). Studies included were prospective cohort studies (3), quasi-experimental (6), qualitative (1), retrospective cohort (5), case-control (1), cohort descriptive (3), quantitative (1), and cross-sectional (1). We had 8 level I studies, 8 level II studies, 4 level III studies, and 0 level IV studies. Five articles were considered high quality, 15 good quality, and 0 poor quality.

### **Summary**

Database searches using the Bethel University Library were conducted to identify quality and appropriate research articles. The articles were narrowed down to 20 total matrices using inclusion and exclusion criteria. Using the Johns Hopkins Research Evidence Appraisal Tool, the articles were evaluated for level of evidence and quality of research (Dearholt & Dang, 2012). Although the goal was to limit the studied articles to those in the U.S., some international studies were used for comparison. The international articles used had medical capabilities and medical facilities similar many areas in the United States.

### **Chapter III: Literature Review and Analysis**

This chapter will synthesis the finding of a literature review conducted to examine the current risk of offering TOLAC and the challenges of this service in rural health settings. Major themes that emerged from this literature review include success rates, candidate selection, informed consent and special considerations.

#### **Success Rates**

Success rate is defined as the number of women who attempted a TOLAC that successfully had a VBAC. In addition to having a VBAC, duration of labor, and maternal and infant morbidity and mortality rates need to be discussed in evaluating overall success of offering women a TOLAC option after a cesarean. In the articles that reported the success rate of VBAC, there was an overall success range of 63.4%-91% (Abdelazim et al., 2014; Boatin, Adu-Bonsaffoh, Wylie, & Obed, 2017; Knight et al., 2013; Landon & Grobman, 2016; Mirteymouri, Ayati, Pourali, Mahmoodinia, & Mahmoodinia, 2016; Metz et al., 2013; Nkwabong, Fomulu, & Youmsi, 2015; Ram et al., 2017; Tessmer-Tuck et al., 2014).

Knight et al. (2013) conducted a cohort study using data from hospital statistics which included N=143,970 women, between the ages of 15-45 whose first birth resulted in a live, singleton delivery between 2004 and 2011. Of those women, n=75,086 women attempted TOLAC for a second birth and 63.4% were successful. Strengths of this study include the large sample size and a long study period of eight years. Knight et al. (2013) found that there was a lower success rate for women with a history of an emergency cesarean section, especially when

the cesarean section was a result of a failed induction of labor (OR, 0.59; 95% CI, 0.53-0.67) (p. 183).

Mirteymour et al. (2016) conducted a small study (N=80) at a large medical facility at Mashhad University, Iran. The study included women with one previous cesarean section who were eligible for TOLAC. This study had the highest success rate of VBAC of 91% in the critical review of twenty studies. This study lacks a large sample size; and none of the studied subjects needed induction. All women included were low risk and had no history of classical incision, history of uterine surgery, indication for cesarean section, uterine anomalies, macrosomia, or more than one previous cesarean section (Mirteymour et al., 2016). This study supports that there is increased VBAC success rate for women entering labor spontaneously.

Landon and Grobman (2016) provided a large sample size (N=17,898) study where n=13,139 women had a successful VBAC (73.4%). The prospective cohort study evaluated medical records from a network of 19 hospitals. The study reviewed perinatal outcomes in women who had TOLAC (n=17,898) and women who had a repeat cesarean section (n=15,801). Women with one previous vaginal birth had an 86.7% chance of success compared to 60.9% in women with no previous vaginal birth (OR 4.2 (95% CI 3.8-4.5, p<0.001) (Landon & Grobman, 2016).

Abdelazim et al. (2014) studied N=122 women in a comparative prospective study who were eligible for TOLAC and found that 72.13% were successful. All women in this study had one prior low transverse cesarean section, no medical problems in pregnancy such as severe hypertension or uncontrolled diabetes, singleton pregnancy with vertex presentation, fetal weight estimated at <3500 g, adequate pelvis, and spontaneous labor without fetal heart rate problems

(Abdelazim et al., 2014). This study also supports that women are more likely to be a successful VBAC if they enter labor spontaneously.

In a retrospective study by Boatin et al. (2017) N=431 women attempted TOLAC and 81.6% of them were successful. None of these women were given medications to strengthen or speed up labor. Of the women that experienced a failed TOLAC, 54.3% of cesarean sections were emergent and 46.7% were non-emergent. The most common reason found for repeat cesarean was cephalopelvic disproportion (Boatin et al., 2017).

### **Duration of Labor**

Duration of labor is shorter with success versus failure of TOLAC along with greater success if a woman is admitted in a more advanced dilation (Abdelazim et al., 2014; Grantz et al., 2015). A study by Abdelazim et al. (2014) revealed in a comparative prospective study including N=122 women attempting TOLAC that labor was shorter in successful TOLAC when compared to unsuccessful TOLAC (6.4 hours  $\pm$  0.33 versus 8.4 hours  $\pm$  0.22). Women who enter the hospital with more advanced cervical dilation are also noted to have higher success when compared to those who fail (5.1 cm  $\pm$  0.9 versus 4.0 cm  $\pm$  0.7) (Abdelazim et al., 2014).

In a retrospective observational study by Grantz et al. (2015), N=56,301 nulliparous women and n=2,892 TOLAC women, labor patterns were evaluated in TOLAC with normal neonatal outcomes. It was found that women attempting TOLAC were slightly slower to progress to 7 cm when compared to a nulliparous woman not attempting TOLAC (Grantz et al., 2015). Those who were induced for TOLAC were slower to progress to 8 cm when compared to nulliparous labors not doing TOLAC. Labor after 7-8 cm was similar for both groups of women studied. For induction of labor in TOLAC versus nulliparous, there is similar progression of

labor from 4-10 cm (6.2 versus 4.8 hours respectively,  $P=0.042$ ). Median labor (95th percentile) labor length for TOLAC when compared to nulliparous women in spontaneous labor was 2.2 hours longer ( $P=0.007$ ) (Grantz et al., 2015). Therefore, by helping providers understand that TOLAC labors may progress more slowly we may be able to decrease the decision for an unplanned repeat cesarean section. Overall, labor patterns were found slower for TOLAC women when compared to nulliparous women, particularly for induction.

### **Maternal Morbidity and Mortality**

Maternal morbidity and mortality identified in this review included postpartum hemorrhage, death, dehiscence and uterine rupture and were evaluated in several studies (Abdelazim et al., 2014; Abha & Chanrashekhar, 2014; Boatun, Bonsaffoh, Wylie, & Obed, 2017; Landon & Grobman, 2016; Lappen, Hackney, & Bailit, 2015; Metz et al., 2013; Mirteymour et al., 2016; Ram et al., 2017; Tessmer-Tuck et al., 2014; You, Chang, & Yen, 2017).

**Postpartum hemorrhage.** Postpartum hemorrhage was evaluated in three studies (Mirteymour et al., 2016; Ram et al., 2017; You, Chang, & Yen, 2017). In a study by Mirteymouri et al. (2016), postpartum hemorrhage occurred in 2.7% of women who obtained VBAC and 1.3% in women who had an ERCD. You, Chang, and Yen (2017) conducted a retrospective study from 2004-2017 that only evaluated uterine rupture in N=37 women. Of those women, 17 (56.7%) needed blood transfusions. Ram et al. (2017) concluded that postpartum hemorrhage was significantly higher for women at or greater than 39 weeks gestation at 1.4% ( $P=<0.05$ ).

**Maternal death.** Maternal death was measured in three studies (Boatin et al., 2017; Landon & Grobman, 2016; Mirteymouri et al., 2016). There were no maternal deaths reported by Boatin et al. (2017) or Mirteymouri et al. (2016). However, in a large prospective cohort study by Landon & Grobman (2016) that included 19 academic hospitals found uterine rupture risk at 0.69%, there were six perinatal deaths in 74 uterine ruptures. This study concluded that the risk of death is 0.14 per 1000 women undergoing TOLAC (Landon & Grobman, 2016). Women who have a repeat cesarean section are more likely to have perinatal mortality than those who have TOLAC (5.5% vs. 1.3%,  $P=0.002$  and  $P=0.002$  respectively) (Landon & Grobman, 2016).

**Uterine rupture.** Overall, the selected studies found that scar dehiscence and uterine rupture complicated anywhere from 0-1.69% of TOLAC (Abdelazim et al., 2014; Abha & Chanrashekhar, 2014; Boatin et al., 2017; Landon & Grobman, 2016; Metz et al., 2013; Mirteymouri et al., 2016; Ram et al., 2017; You et al., 2017). Of all TOLAC cases reviewed, it was found that the risk for any sort of complication was only 1% (Tessmer-Tuck et al., 2014). VBAC has less risk than a scheduled repeat cesarean, but failed TOLAC has higher complication rates than a scheduled repeat cesarean. Miretymouri et al. (2016) did not note any uterine rupture in their study; this study was a small sample size of  $N=80$ . All women in the study had one previous cesarean section and were all observed by experienced obstetrical providers (Miretymouri et al., 2016).

Abha and Chandrashekhar (2014) evaluated 40 uterine ruptures and concluded that there were 25 women who experienced uterine rupture with history of cesarean and 15 who experienced uterine rupture without previous cesarean. This study found that the rate of rupture was 1.69% for women with a previous uterine scar and 0.152% for women without. This study does not reflect the U.S. outcomes as it was done in Raipur, an underdeveloped country where

the risk is much higher. It was found that 44% of the TOLAC trials were unjustified and that in 52.5% of the cases injudicious use of oxytocin was used (Abha & Chandrashekhar, 2014).

Mets et al. (September, 2013) operated a study that included N=5,445 women. n=1,170 women chose to undergo a TOLAC in which n=938 (80%) were successful in a VBAC. Six of these women experienced uterine rupture (0.5%; 95% CI 0.1-0.9). One uterine rupture occurred during an induction of labor with Pitocin. All other uterine ruptures in this study were with spontaneous labor. All cases of uterine rupture included fetal heart rate changes, and all newborns survived without neurological impairment. Three ruptures were noted at 5-6 cm dilation, two after successful operative vaginal birth for decelerations and one at complete (Metz et al., 2013).

Ram et al. (2017) performed a retrospective cohort study on N=2,849 women. 90.7% of these women were successful in VBAC and 0.56% experienced uterine rupture. This study focused on gestational age and whether that impacts the likeliness of success. It concluded that the length of a pregnancy is not independently associated with failed TOLAC (Ram et al., 2017). In a cohort study of N=6,033 women by Lappen et al. (2015), 19 women (0.3%) had a uterine rupture. Four of these women were induced. Induction of labor was not found to be statistically significant in increasing the risk for rupture in this study (Lappen et al., 2015).

You et al. (2018) concluded that clinically, there were no predictions or preventions for uterine rupture, but the provider's timely awareness and management could have decreased maternal and neonatal mortality. In the study by You et al, (2017), N=37 women with uterine rupture were studied. The mean onset of rupture was 34.2+/- 0.9 weeks gestation. Twelve ruptures occurred at term and 18 occurred preterm. Seventeen of the 30 women required blood

transfusion. Twenty-two of the women presented with acute onset of abdominal pain and/or abnormal fetal heart rate and were taken to emergency cesarean section. Four of the ruptures were found postpartum, three of these were women with a prior cesarean, but one of the women had no previous uterine scar. Women with an unscarred uterus (n=6) did not have any risk factors for uterine rupture. Those with a scarred uterus (n=24) yielded morbidity (both  $p<0.5$ ). Overall, it was found that women with unscarred uteri are more likely to rupture at a greater gestational age than those who have a previous scar (You et al., 2016).

### **Neonatal Morbidity and Mortality**

Amongst adverse outcomes, neonatal outcomes were evaluated after uterine rupture by several studies (Boatin et al., 2017; Grunebaum, McCullough, Arabin, & Chervenak, 2017; Landon & Grobman, 2016; Mirteymouri et al., 2016; You et al., 2017). Mirteymouri et al. (2016) found neonatal intensive care admission and neonatal resuscitation in both VBAC and cesarean section were 6.8% and 57.1% respectively ( $p=0.002$ ). The most statistically significant difference in VBAC success versus failure was neonatal weight ( $P=0.007$ ). Fetal weight that ended in success was found to be 2940 grams +/- 768 grams and weight that was related to failure of TOLAC was 3764 grams +/- 254 grams. The study concludes that VBAC is a safe mode of delivery for both women and neonates (Mirteymouri et al., 2016). Infant weight is further evaluated in a following paragraph. Among the 124 ruptures found in the study by Landon & Grobman (2016) there were two neonatal deaths recorded which is a rate of 0.11 per 1000 TOLACs.

In a study by Metz published in September 2013, N=1,170 women attempted TOLAC. Data was compiled from 14 regional hospitals and took place over eight years. Complications in

these women included uterine rupture in six women (0.5%;95% CI 0.1-0.9). Shoulder dystocia occurred in 17 (1.8%;95% CI 1.0-2.7). Third and fourth-degree lacerations occurred in 79 (8.4%;95% CI 6.6-10.2). Operative vaginal birth occurred in 97 (10.3%;95% CI 6.6-10.2) (Metz et al., 2013).

### **Candidate Selection**

The studies in this review identified characteristics that either prohibited or improved a woman's chances of a successful VBAC including prediction calculators, Body Mass Index (BMI), gestational age, maternal age, and fetal weight (Abdelazim, Elbiaa, Al-Kadi, Yehia, Nusair, & Faza, 2014; Knight et al., 2013; Landon & Grobman, 2016; Lappen et al., 2015; Metz et al., June 2013; Metz et al., September 2013; Mirteymouri et al., 2016; Nkwabong et al., 2015; Ram et al., 2017; Tessmer-Tuck, 2012). Women with a prior vaginal birth had a higher chance for a successful VBAC (Metz et al., 2013; Nkwabong et al., 2015; Thisted et al., 2017). In fact, 86.7% of women had a successful VBAC when having history of vaginal birth in the Landon & Grobman (2016) study. VBAC success also continues to increase with each number of VBACs a woman has. Previous vaginal birth is protective against uterine rupture (95% CI, 0.43-0.90) when compared to women without previous vaginal birth (Landon & Grobman, 2016). Nkwabong et al. (2015) found that with prior vaginal birth, success of VBAC is 94.1%.

**Prediction tools.** The Grobman model is a VBAC success tool midwives and other practicing physicians can use to predict success of TOLAC and was evaluated in three studies (Metz et al., June 2013; Metz et al., September 2013; Tessmer-Tuck, 2012). The Grobman model is a tool that takes into account six variables including: BMI, reason for prior cesarean, age, race and ethnicity, prior vaginal birth, and prior successful VBAC. In a study completed by Metz et

al. (June, 2013), there were 5,445 women in which 3,120 were calculated to have a 70% chance or higher of successful TOLAC. When the Grobman model was used to choose women eligible for TOLAC, 85% of the women were successful in a VBAC. It was also noted that women who were managed by certified nurse midwives or who had previously had a vaginal birth were more likely to choose TOLAC (Metz et al., 2013). Metz et al. did a different research study published in September 2013 that looked into success rates and indications. In a study of N=1,170 women who attempted TOLAC and who were candidates based on the Grobman model; 80% (n=938) were successful. Of those women who were successful, 364 (31%;95% CI 27.9-34.3) had a previous vaginal birth.

There were five factors directly noted to impact increased success including history of vaginal birth, absence of recurrent indications for primary cesarean, age under 35, BMI <30, and having a higher bishop score. An Area Under the Curve (AUC) of at least 0.70 is considered to be an acceptable level of accuracy. Metz et al. (September, 2013) compared a model they built themselves with the Grobman model and found that the AUC of their model was 0.71 when compared with 0.65 ( $P= 0.004$ ). In conclusion, both the simple VBAC calculator created by the authors and the Grobman model have been found to be accurate assessments (Mets et al., September, 2013). Tessmer-Tuck et al. (2012) evaluated the Grobman model and found the Grobman model AUC to be 0.757 (95% CI, 0.713-0.801), which is comparable to the original publication of the Grobman model with claims to be 0.754 (95% CI, 0.742-0.766) (Tessmer-Tuck et al., 2012).

**Body mass index.** A woman's BMI is mentioned in a number of studies but is evaluated specifically in one study (Abdelazim et al., 2014). A total of N=122 women were studied in a comparative prospective study by Abdelazim et al. (2014). The study focused on the history of

maternal and obstetrical characteristics and a review of fetal weight, engagement of the fetal head, intrapartum membrane status, dilation, duration of labor, augmentation, mode of delivery, and birth outcome. It was found that BMI is significantly lower in successful VBAC at  $23.8 \pm 0.03$  versus  $26.2 \pm 0.02$  kg/m<sup>2</sup> in the unsuccessful group (Abdelazim et al., 2014). BMI >25, gestational age >40 weeks, and station of -2 or greater on arrival to the hospital were all found to be risk factors associated with unsuccessful TOLAC. Dilation of  $\geq 4$  cm on arrival to the hospital increased success (Abdelazim et al., 2014). Landon et al. (2016) concluded that chance of success for women with a BMI > 30 is lower than women with lower BMIs (68.4% vs 79.6%).

**Gestational age.** Gestational age and its effect on TOLAC success was evaluated in several studies (Abdelazim et al., 2014; Lappen et al., 2015; Ram et al., 2017). Abdelazim et al. (2014) found mean gestational age is significantly lower with success when compared to the unsuccessful group ( $37.5 \pm 0.4$  versus  $38.5 \pm 0.03$  weeks). Lappen et al. (2015) provided an analysis of induction of labor in TOLAC from 37-40 weeks. They found that induction of labor is more likely to end in a failed TOLAC than spontaneous labor from 37-39 weeks gestation but not for 40 weeks gestation (37 weeks 48.5% vs 34.4% OR 1.53; 95% CI 1.02-2.28, 38 weeks 47% vs. 33% OR 1.75; 95% CI 1.29-2.34; 39 weeks 45.6% vs. 29.8% OR 2.16; 95% CI 1.76-2.67). Gestational age should also not serve as an inclusion or exclusion criteria for TOLAC (Ram et al., 2018).

**Maternal age.** The mother attempting TOLAC has been found to be more successful if she is less than 30 years old (Knight et al., 2013; Tessmer-Tuck et al., 2014). Knight et al. (2013) found that women under 24 years old were 69.3% likely to have a successful VBAC, 24-34-year olds were 63.8% likely, and women over 34 years old were 59.3% likely ( $p < 0.001$ ). Tessmer-

Tuck et al. (2014) found that many factors were associated with VBAC success including age <30 years old (OR 1.53, 95% CI 1.00-2.36,  $p=0.049$ ). Nkwabong et al. (2015) disagreed in their study that evaluated N=4240 women in which 36 cases of TOLAC were evaluated. The mean maternal age of successful TOLAC was found to be 22-40 and mean maternal age for women who experienced a failed TOLAC was 22-35 ( $p=0.22$ ) (Nkwabong et al., 2015).

**Fetal weight.** Studies reviewed for fetal weight concluded that fetal weight greater than 4,000g increases risk of uterine rupture and failed TOLAC (Knight et al., 2013; Landon & Grobman, 2016; Mirteymouri et al., 2016; Nkwagong et al., 2015; Thisted et al., 2017). Landon et al. (2016) found success with <4000g to be OR 2.0 (95% CI 1.8-2.3) and Thisted et al. (2017) found failure rates for >4000g to be OR 2.96 (95% CI 1.26-6.91). In a retrospective descriptive study by Nkabong et al. (2016), N=4,240 births were evaluated. Among 138 women with birthweight of  $\geq$  to 3500 g, TOLAC was carried out in 36 of these women. There is noted to be an increased risk of uterine dehiscence with fetal weight >4000g. Of 444 women who had babies <3500g, 73.2% had successful VBACs. Among 138 women with babies >3500g, 26.1 attempted TOLAC. Thirty of these women had an elective repeat cesarean due to birth weight alone. It was found in the study that women who were more successful with birth weights >3500g were admitted in more advanced labor, 82.6% were still successful. Birth weight for successful TOLAC were 3773.4 +/- 203.1 (3518-4229) and birth weight for failed TOLAC were 3836.9 +/- 277.9 (3575-4520) with  $P=0.46$  respectively (Nkabong et al., 2016). Therefore, estimated birth weight should neither be an inclusion or exclusion criteria for TOLAC.

## Informed Consent

Two studies specifically studied counseling of women and women's knowledge of TOLAC in choosing delivery mode (Chinkam, Ewan, Koeniger-Donohue, Hawkins, & Shorten, 2016; Scaffidi, Posmontier, Bloch, & Wittmann-Price, 2014). In the study provided by Chinkam et al. (2016), women who were offered both ERCD and TOLAC felt more comfortable and satisfied with their decision. The study provided scripted counseling at the Boston Medical Center. Candidates for TOLAC, who were under the care of nurse-midwives, were enrolled in the program before 28 weeks gestation. They all received four scripted counseling sessions which gave women the information necessary to choose a birth option. Pre- and post-session questionnaires were given that asked for patient birth preference, information sources, and decision factors. An assessment was also done on each patient to determine knowledge of the risks and benefits of TOLAC and ERCD. Before scripted counseling, 70% of women felt they had enough information to make a delivery mode decision. After scripted counseling, 95% of women felt they had enough information ( $P=0.06$ ). Reasons for choosing ERCD included fear of vaginal complications, positive previous cesarean delivery, and convenience. Reasons for choosing TOLAC were personal importance of experiencing a vaginal birth and faster recovery. Of the study participants, 14 chose TOLAC and 8 chose ERCD. Of the 14 women who attempted TOLAC, 9 (64%) had a successful VBAC and 5 (36%) had an unscheduled repeat cesarean section (Chinkam et al., 2016).

Scaffidi et al. (2014) explored whether patients chose TOLAC or ERCD based on knowledge or lack of knowledge. Forty-five women 10-22 weeks gestation were surveyed on their knowledge of risks and benefits of the two delivery modes and their degree of self-efficacy related to their choice. Degree of self-efficacy was not significant ( $P=0.58$ ). Knowledge was

found to be a significant factor ( $P=0.03$ ). Women who scored at a higher level of knowledge chose TOLAC 55% of the time and ERCD 24% of the time. The chance of a woman with high knowledge choosing TOLAC was 3.9 times higher than (95% CI, 1.09-13.81) the chance of a woman choosing ERCD (Scaffidi et al., 2014).

### **Special Considerations**

Home birth versus hospital birth, ethnicity, pregnancy interval, cost of TOLAC versus ERCD, single and double layer closure, induction versus spontaneous labor, underdeveloped countries, and rural versus urban considerations were evaluated in this literature review (Abha & Chandrashekhar, 2014; Abdelazim et al., 2014; Gilbert, Grobman, Landon, Spong, Varner, Wapner, Sorokin, Sibai, Thorp, Ramin, & Mercer, 2013; Grunebaum et al., 2017; Knight et al., 2013; Kozhimannil, 2014; Landon et al., 2016; Lappen et al., 2015; Nkwabong et al., 2015; Rogers, Rogers, Kilgore, Subramaniam, & Harper, 2017; Singh & Shrivastava, 2015; Tessmer-Tuck et al., 2013; Thisted et al., 2017; You et al., 2015).

**Homebirth.** Grunebaum et al. (2016) conducted a retrospective cohort study evaluating hospital VBAC compared to home VBAC from 2007-2014 through the National Center for Health Statistics. It was determined that neonates born at home during VBAC are ten times more likely to have a 0 or 1 Apgar score (risk of 11.24 per 10,000, 95% CI 4-20.39,  $P<0.0001$ ). The Apgar score is assigned to a baby at one minute and five minutes of life and reflects their transition. The scoring system is from 0-10 and evaluates tone, pulse, reflex, skin color, and respirations. Risk of neonatal seizures or severe neurologic damage occurs in 12.27/1000 (relative risk 11.19, 95% CI 5.13-24.29,  $p=0.0001$ ). Women with a planned home birth when attempting TOLAC had a tenfold or higher increased risk of poor outcomes when compared to

those who delivered in the hospital. The study concluded that TOLAC should strongly be recommended in the hospital setting (Grunebaum et al., 2017).

**Ethnicity.** Although ethnicity should not determine a woman's eligibility for TOLAC, it has been found that certain ethnicities are more likely to have a successful VBAC (Knight et al., 2013; Landon et al., 2016; Tessmer-Tuck et al., 2013). Women of Hispanic descent were found to be significantly more likely to have a successful VBAC than any other ethnicity (OR 6.56; 95% CI, 1.45-29.54) (Tessmer-Tuck et al., 2013). Knight et al. (2013) found that Caucasian women had a 65.5% chance of success, Asian women had a 60.6% chance of success, other races had 61.4% chance, and black women had the lowest chance of success at 50.4%, all  $p=0.001$  respectively. Landon et al. (2016) concluded that being Caucasian is an independent factor associated with VBAC success with an OR of 1.8; 95% CI 1.6-1.9.

**Pregnancy interval.** A shorter interval between pregnancies increases the risk of uterine rupture (Abdelazim et al., 2014; Nkwabong et al., 2015; You et al., 2015). You et al. (2015) found that in women who ruptured with a previous uterine scar, the average length between pregnancies was 43.3 +/- 9.1 weeks. Twenty-five percent of the n=37 women with uterine rupture had a pregnancy interval of less than 6 months (You et al., 2015). Women with less than two years between deliveries were found more unsuccessful in TOLAC when compared to the successful group (70.6% vs. 22.7%) (Abdelazim et al., 2014).

**Cost considerations.** The cost of VBAC versus ERCD was discussed in several studies (Gilbert et al., 2013; Landon et al., 2013; Rogers et al., 2017). In a prospective cohort study by Gilbert et al. (2013), the TOLAC strategy dominated the ERCD strategy with \$164.2 million saved and 500 Quality Adjusted Life Years (QALYs) gained per 100,000 women. QALY is a

measure of disease and the quality and quantity of life saved. One QALY equals one year of good health. There were six variables considered in this model that included: the chance of a uterine rupture and successful TOLAC with no prior vaginal delivery, stress urinary incontinence, and the cost of failed TOLAC, successful TOLAC, and ERCD. When the probability of TOLAC success was at the base value, 67.2%, TOLAC was preferred if the probability of uterine rupture was 3.1% or less. When the probability of uterine rupture was at or below 0.8%, the TOLAC strategy was ideal as long as the chance of success was 47.2% higher (Gilbert et al., 2013). A study done by Rogers et al. (2016) also supports that TOLAC is more cost effective than an ERCD for low-risk women and suggests that clinicians should encourage TOLAC for low-risk women from an economic perspective. Landon et al. (2016) found that TOLAC was cost effective even when probability of VBAC was as low as 43%.

**Induction versus spontaneous labor.** Induced labor has higher risk than spontaneous labor (Abha & Chandrashekar, 2014; Landon, 2008; Landon & Grobman, 2016; Lappen et al., 2015; Thisted et al., 2017). In a study by Landon & Grobman (2016), out of N=898 women who attempted TOLAC, n=52 used misoprostol and n=227 used prostaglandin gel. There were no cases of uterine rupture in this subgroup. Induction of labor as opposed to spontaneous labor in TOLAC is associated with a higher risk of failure. The risk of rupture with induction was found to be 1% and only 0.4% with spontaneous labor (Landon & Grobman, 2016). Inducing mothers before 40 weeks without allowing spontaneous labor to happen put them at an increased risk of rupture; however, induction did not increase the risk of infant morbidity (Lappen et al., 2015). Thisted et al. (2017) found significant risk for rupture when induction was done without a ripe cervix (aOR 2.65, CI 1.05-6.64) and when augmentation was used for more than one hour (aOR 2.03, CI 1.20-3.44).

When uterine rupture occurs during an induced labor, two factors to consider are drug type and dosage. Women can respond differently to the same dose of the same drug used. The risk of uterine rupture generally increases as the dosage increases (Landon, 2008). When broken down further by type of induction, results showed: 1.4% increase risk (N = 13) with any prostaglandins (with or without oxytocin); 0% with prostaglandins by themselves; 0.9% increased risk (n = 15) with no prostaglandins (includes mechanical dilation with a foley catheter with or without oxytocin); and 1.1% increased risk (N = 20) with oxytocin alone (Landon, 2008). A large study of women, N=33,699, attempting TOLAC showed that augmentation or induction of labor using Cytotec was associated with an increased risk of uterine rupture, compared with spontaneous labor (Landon, 2008). The results showed 1.4% for induction with prostaglandins with or without oxytocin, 1.1% for oxytocin alone, 0.9% for augmented labor, and 0.4% for spontaneous labor (Landon, 2008). The study determined that uterine rupture was not associated with a high or low bishop score. Studies also included results that showed a dose-response effect between increasing the risk of uterine rupture and a higher maximum dose of oxytocin. However, a clear threshold for rupture and the oxytocin dosage with TOLAC has not yet been established based on these studies (Landon, 2008). Furthermore, the studies suggest that Pitocin should not be used for induction without medical indication.

**Closure type.** Single layer closure versus double layer closure was evaluated for risk of rupture and success of VBAC (Tessmer-Tuck et al., 2014; Thisted et al., 2017). This refers to the type of surgical suturing that was used during the women's previous cesarean section to close her uterus. Thisted et al. (2017) found that neither single layer closure (OR 1.38, CI: 0.88-2.17) or double layer closure (OR 1.61, CI: 0.99-2.59) was significant when related to risk for rupture. Tessmer-Tuck et al. (2014) found that out of N=456 successful VBAC, n=386 were evaluated

for repair type.  $n=137$  had a single layer closure documented and  $n=153$  had double layer documented. Overall the study suggests that double layer closure is safer with a  $P$  value of 0.006.

**Underdeveloped countries.** A study by Singh and Shrivastava (2015) found that women in underdeveloped countries have 1,500 times greater risk of uterine rupture than women in developed countries. Laboring at home and using uncontrolled oxytocin held the greatest risk for uterine rupture (Singh & Shrivastava, 2015). The study took place at a medical facility in Raipur which is a tertiary hospital that received critical patients. Most of the patients they care for come in from rural area hospitals and maternity homes in a state of shock. The study had a total of  $N=11,323$  women,  $n=9,844$  were without prior low transverse cesarean section,  $n=1,479$  had a prior low transverse cesarean section. All women with a ruptured uterus were included in the study. Forty women experienced a rupture, 25 were in women with prior cesarean section and 15 were without. Therefore, risk of rupture with prior cesarean was 1.69% and without cesarean history was 0.152%. This study was not included in our statistical findings of success because it took place in an underdeveloped country. Kurtz and Picker found importance in including risk in underdeveloped countries and how that compares to developed countries. Much of the risk in underdeveloped countries includes poor oxytocin understanding, attempting home birth, and lack of resources to perform emergency cesarean sections.

**Urban versus rural.** Kozhimannil (2014) conducted a retrospective analysis of urban versus rural hospital differences. The sample study included  $N=7,188,972$  births, 6,316,743 in urban facilities and 837,772 in rural facilities. VBAC rates declined in rural (13.1%-5%) and in urban (18.8%-10.0%) hospitals. Odds of VBAC success were found to be 38% lower in rural facilities in 2002 (AOR 0.62; 0.60-0.65). VBAC odds then declined by 10% each year in urban

facilities from 2002-2010 (AOR 0.90; 0.90-0.91) and less rapidly for rural facilities (AOR 0.79; 0.78-0.81) with all results being  $P < 0.001$  respectively.

## **Chapter IV: Discussion, Implications, and Conclusions**

The purpose of this review was to analyze risks and benefits of TOLAC versus an ERCD for a low-risk woman and her fetus. Furthermore, the purpose was to assess TOLAC availability for women in rural communities that may lack resources that a larger facility has available. Twenty scholarly articles were chosen for analyses using the Johns Hopkins Research Evidence Appraisal Tool. The findings of this research revealed current trends in research regarding TOLAC versus ERCD and gaps in literature. Chapter four will explore the implications for nurse midwifery practice that is consistent with the research findings and analysis, including the recommended areas of focus and opportunities for future studies. In conclusion of this chapter, Imogene King's theory of goal attainment embraces patient advocacy and patient's right to informed choices and decisions, while helping women to attain certain goals in regards to decisions such as TOLAC.

### **Literature Synthesis**

The fundamental question that formed the foundation of this critical review was what are the real risks and benefits for a woman and her fetus when attempting TOLAC after a previous cesarean section in rural communities. VBAC is associated with less maternal morbidity and decreased risk of future pregnancy complications (Practice Bulletin No. 184 Summary, 2017). In the evidence researched, there has been a substantial decrease in the availability of TOLAC services in rural communities due to the lack of resources available such as surgical teams 24/7 (Practice Bulletin No. 184 Summary, 2017). Evidence shows that not all women are considered a good candidate for TOLAC and there are factors identified that can lead to a failed TOLAC.

When a woman is not considered a good candidate for TOLAC, there is an increased risk of maternal and perinatal morbidity, when compared with an ERCD. Assessing each individual woman's likeliness of a successful TOLAC is important to the outcome of the maternal and fetal well-being (Practice Bulletin No. 184 Summary, 2017). In order to reduce rural health disparities, further research is needed to understand acceptable conditions for performance of VBAC in rural areas.

### **Current Trends and Gaps in the Literature**

The data in the analysis of literature compares the rates of VBAC, the rates of ERCD, maternal and neonatal outcomes for both, ways to approach delivery when attempting TOLAC, and many additional special considerations. Gaps in literature include the lack of randomized controlled studies comparing maternal or neonatal outcomes between women attempting TOLAC and those undergoing an ERCD. None of the studies in this critical literature review evaluated time from onset of a complication to emergency cesarean section in respect to neonatal outcomes. Before considering the results of this analysis, it is important to note that the appropriate clinical and statistical comparison is by intention to deliver (TOLAC versus ERCD). Comparing outcomes from VBAC or repeat cesarean delivery after TOLAC with those from a planned repeat cesarean delivery is inappropriate because no one patient can be guaranteed VBAC, and the risks and benefits may be disproportionately associated with failed TOLAC.

Current gaps in the literature include the differences in results throughout these studies. For example, studies addressing the risks and benefits of TOLAC in women with more than one cesarean delivery have reported a substantial difference in the risk of uterine rupture, which is between 0.9% and 3.7% (Practice Bulletin No. 184 Summary, 2017). The studies in our

review have not reached consistent conclusions regarding how this risk compares with women with only one prior uterine incision. Results determined there was some increased risk in morbidity for women with more than one prior cesarean delivery. However, the absolute magnitude of the difference in these risks was small (2.1% versus 3.2% composite major morbidity) (Practice Bulletin No. 184 Summary, 2017). Retrospective cohort data has suggested the likelihood VBAC is similar for women with more than one previous cesarean section as it is for women with only one but has not been well studied (Practice Bulletin No. 184 Summary, 2017).

### **Implication for Midwifery Practice**

The cesarean birth rate in the U.S. was a low 4.5% in 1965, and up to 32% in 2015 (ACNM, 2017). Barber, Barber, Lundsberg, Belanger, Pettker, Funai, and Illuzzi (2011) analyzed the rates of primary and repeat cesarean section and determined that repeat cesarean rate is over 90% for women with a prior cesarean; many have speculated that much of the increase in cesareans has been driven by decreasing VBAC rates (Barber et al., 2011). However, much of the data coincides with other studies that reveal a steadily rising primary cesarean delivery rate (Barber et al., 2011). For primiparous, low-risk women (low risk includes having a single baby, being full term of more than 37 weeks, and the baby being vertex) the rate of cesarean section was 25.8% in 2015 (ACNM, 2017). The question becomes, why are these cesarean numbers so high and what can nurse-midwives do about it?

Regardless of socioeconomic status or insurance type, all women that are potential candidates should be encouraged to consider VBAC. VBAC services should be available for women in all geographic areas. (ACNM, 2017). To promote optimal outcomes for mothers and

their newborns, ongoing communication between midwifery and obstetric providers is essential to facilitate timely consultation, potential transfer of care and surgical intervention if necessary (ACNM, 2017).

The position statement by the American College of Nurse-Midwives says that every woman should be provided with safe care and every woman should have access to evidence-based information to guide their decision of whether to choose TOLAC with a successful VBAC or ERCD (ACNM, 2017). Certified nurse-midwives are able to provide this option and assess women for candidacy. Respect for patient autonomy also reflects on the conflict that even if a center does not offer TOLAC, such a policy cannot be used to force women to have cesarean delivery or to deny care to women in labor who decline to have a repeat cesarean delivery (Practice Bulletin No. 184 Summary, 2017). When conflicts arise between a woman's wishes and the provider, or facility policy, or both, careful explanation and, if appropriate, transfer of care to facilities supporting TOLAC should be used (Practice Bulletin No. 184 Summary, 2017).

VBAC rates were 11.9% in 2015, which is a large decrease from 28.6% in 1989 (ACNM, 2017). Success rate for women was 70% in 2015, which has been a consistent number over the years (ACNM, 2017). The position statement states, "...appropriate arrangements for medical consultation and emergency care should they become necessary" (ACNM, 2017). This statement does not provide evidence or hard numbers to define such terms of timing from the onset of need until cesarean section takes place.

ACOG recommends that TOLAC be attempted in facilities that can provide cesarean delivery for situations that are immediate threats to the life of the woman or fetus (Practice Bulletin No. 184 Summary, 2017). Even for some rural facilities, emergency cesarean sections

arise for women during labor or during inductions of labor. The American College of Obstetrics and Gynecology does say, however, when resources for emergency cesarean delivery are not available, it's recommended that obstetricians or other providers and patients considering TOLAC discuss the hospital's resources and availability of obstetric, pediatric, anesthesiology, and operating room staff (Practice Bulletin No. 184 Summary, 2017). ACOG states, "The decision to offer and pursue TOLAC in a setting in which the option of emergency cesarean delivery is limited should be carefully considered by patients and their obstetricians or other obstetric care providers" (Practice Bulletin No. 184 Summary, 2017). In these situations, the best choice for a woman is to refer her to a facility with available resources. Problems arise, however, for rural women where there is a long distance between delivery sites (Practice Bulletin No. 184 Summary, 2017). Each pregnant woman needs to look into the best birthing plan for her and her baby.

Although VBAC can be a safe option for many pregnant women, it isn't right for everyone. TOLAC is reasonable for women with one prior low transverse uterine incision (ACNM, 2017). TOLAC and VBAC have both risk and benefits for the pregnant women and the fetus. Uterine rupture is prevalent in 4.7/1000 with TOLAC and 0.3/1000 with ERCD. Risk of rupture is increased with various cesarean scar types and therefore women who have not had only a low transverse section are not candidates. The risk of maternal morbidity, including blood transfusion, neonatal intensive care admissions and mortality, are higher with ERCD versus VBAC (ACNM, 2017).

There are a few thoughts to consider when choosing TOLAC. Women with one previous cesarean delivery with an unknown scar type may also be candidates for TOLAC, unless there is high suspicion of a classical scar (Practice Bulletin No. 184 Summary, 2017). Induction of labor

is an option for TOLAC, although the increased risk of rupture and decreased likeness of success should be considered. In a large study of over 20,000 women discussed in the ACOG practice bulletin no. 184 (2017), uterine rupture was 0.52% for spontaneous labor, 0.77% for induced labor without prostaglandins, and 2.24% when prostaglandins were used. Recommendations from ACOG state that augmentation or induction of labor with oxytocin is reasonable to use in TOLAC. Cytotec should not be used for cervical ripening or labor induction on women with any previous uterine incisions for a full-term labor. External cephalic version is a safe option for women who plan a TOLAC (Practice Bulletin No. 184 Summary, 2017). Successful TOLAC is directly linked to age <30, BMI <30, prior successful VBAC, previous vaginal birth, and absence of recurrent indications for cesarean section (Tessmer-Tuck et al., 2014). However, current guidelines and recommendations state that no woman should be excluded from a TOLAC based solely on estimated fetal weight (Practice Bulletin No. 184 Summary, 2017). ACOG recommends that women offered TOLAC should be in hospitals capable of providing emergency care (Practice Bulletin No. 184 Summary, 2017).

A VBAC can provide health benefits for the mother and baby and help avoid potential risk factors associated with other birth interventions such as cesarean sections. Health advantages for women who receive a VBAC include avoiding surgery and having lower rates of hemorrhage, thromboembolism, infection, and shorter recovery period (Practice Bulletin No. 184 Summary, 2017). VBAC decreases the risk of maternal consequences related to cesarean birth including hysterectomy, bowel and bladder injury, transfusion, infection, and abnormal placentation (Practice Bulletin No. 184 Summary, 2017). ERCD and TOLAC also come with risks. Maternal morbidity related to TOLAC mostly occurs if an emergency cesarean is necessary. VBAC has less risk than an ERCD, but failed TOLAC is deemed riskier than an

ERCD. Therefore, each patient needs to be evaluated individually. Overall, the risk of uterine rupture after a previous low transverse cesarean section is reported at 0.5-0.9%. The most likely cause of uterine rupture is from a cesarean scar other than low transverse (Practice Bulletin No. 184 Summary, 2017).

### **Prediction Models for Vaginal Birth After Cesarean & Recommendations for Future Research**

Before any results of any analysis are considered, it is important to consider that the appropriate clinical and statistical comparison is by intended delivery mode (TOLAC versus ERCD). Comparing outcomes from VBAC or emergent repeat cesarean after TOLAC with those that have had a planned repeat cesarean delivery is impossible because VBAC can never be promised. Even though TOLAC rates have declined dramatically over the past several decades, the success rate of TOLAC has remained consistent at approximately 74% (NIH, 2010).

Fewer than 20% of women who would be candidates for a VBAC in the U.S. are attempting TOLAC (Thornton, 2018). There are many VBAC success predictor tools available to medical staff to score women for safety and chance of success, including the Grobman model and the Society for Maternal-Fetal Medicine (SMFM). The Grobman model is the most tested and used model in the U.S. The Grobman model and other tools are used by providers and patients to help make decisions about birthing safety. The prediction tools can be helpful in assessing patients but can produce both false-positive and false-negative results, so the tool is a screening device and not meant to be diagnostic (Thornton, 2018).

For those women who live in more rural communities, ACOG emphasized that their recommendations were not intended to restrict access to TOLAC and recognizes the difficulty of

providing emergency cesarean delivery (Metz, 2018). When these resources are limited, ACOG recommends that providers discuss the available options and resources at the planned birth facility with women who are considering TOLAC. The women's healthcare provider should provide her with the choice to either transfer to a higher-level facility or choose ERCD. Cesarean delivery in the U.S. currently exceeds 32% of all deliveries, which is a 53% increase from 1996-2006 (Tessmer-Tuck et al., 2014). Research is needed to develop scripted counseling for providers to give to their patients so that each patient receives the same evidenced-based information.

Low risk cesarean deliveries have been on the rise, specifically in rural facilities. From 2002-2010, cesarean rates for low-risk women increased from 12.9% to 15.5%, and 12.7%-16.1% in urban facilities (Kozhimannil, 2014). VBAC rates declined from 13.1% to 5% in rural hospitals and from 18.8% to 10% in urban hospitals. Non-indicated labor induction increased from 9.3% to 16.5% in rural hospitals and from 10.3% to 12% in urban hospitals. Non-indicated cesarean rates grew in both urban and rural facilities. Odds of a VBAC were 38% lower in rural hospitals versus urban hospitals in 2002. VBAC odds declined 10% each year in urban hospitals from 2002-2010 (Kozhimannil, 2014). Both rural and urban facilities are guilty of low-risk cesarean deliveries and medically non-indicated inductions. However, rural facilities were less likely to perform non-indicated inductions. Analysis of why facilities have chosen not to offer TOLAC is an area in need of research.

Each woman and each pregnancy are different and should be carefully addressed. The risk of uterine rupture when a woman has had more than one previous cesarean delivery is between 0.9 and 3.7% (Practice Bulletin No. 184 Summary, 2017). However, these risk percentages are very similar to women with one previous cesarean and therefore, ACOG says

that it is reasonable to consider a woman with two previous low-transverse cesarean sections for a TOLAC. Data for women with more than two previous cesarean sections are limited, and there are no current recommendations for this group from the American College of Obstetricians and Gynecologists (Practice Bulletin No. 184 Summary, 2017). In addition, it is unclear in the literature review why ethnicity is the cause of success versus failed TOLAC and further research is needed here.

### **Integration of Imogene King's Theory of Goal Attainment**

The root of King's work and theory reflects on the lack of professional language, anti-theoretical bias in the profession, nursing as a profession, and nursing not be adequately differentiated from other fields (Caceres, 2015). King's theory can be used to enhance communication and shared decision-making. The four basic principles to using the theory suggested by King include: goals are attained through interactions between provider and patient; the nurse-client must perceive one another and their motives accurately for this to occur; role expectation and performance must be coinciding; nurses must use their knowledge and skills to set goals with the patient, communicate information, and aid in the patient achieving their goals (Caceres, 2015).

With healthcare's increased emphasis on a woman's need, this theory may help improve the health and experience of women and their families (Caceres, 2015). Respect for patient autonomy refers to a woman's choice, while including informed consent and shared decision-making. If a facility does not offer TOLAC, a woman should not be forced to have a cesarean delivery, nor should care be denied if a woman in labor declines to have a repeat cesarean delivery (Practice Bulletin No. 184 Summary, 2017). Furthermore, the principle of respect for

patient autonomy, deems that patients should be allowed to accept increased levels of risk; however, patients should be clearly informed of the potential risk and what other management options exist (Practice Bulletin No. 184 Summary, 2017). King's work also provides us with the ability to assess the functional status of clients and to guide nursing practice to provide client-family-centered healthcare (Caceres, 2015).

## **Conclusion**

For this research and review, twenty scholarly articles were analyzed using the Johns Hopkins Research Evidence Appraisal Tool and statistically significant results found that low-risk women who have undergone a previous cesarean delivery should have the option of proceeding with a TOLAC delivery. A planned TOLAC may result in a VBAC or unplanned intrapartum cesarean delivery. Shared decision-making is a combination of factors that include: availability of TOLAC at the planned birth setting, probability of VBAC including prediction calculators, individual factors and scientific data on risks and benefits for delivery route, BMI, gestational age, maternal age, fetal weight, prior cesarean incision type, obstetrical history, personal values, preferences, past birthing experiences, and future pregnancy plans. ACOG emphasized that TOLAC in facilities that are able to perform an emergency cesarean delivery in the event of a situation that may cause an immediate threat to life of the woman or her fetus, was not intended to restrict access to TOLAC, especially in rural settings (Metz, 2019). The decision-making process has information, including risk assessment and an evidence-based approach that is shared with a woman at a level and pace that she can understand. The woman's preference should be honored whenever possible.

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## Appendix 1 – Literature Review Matrix

<b>Source:</b> Abdelazim, I. A., Elbiaa, A. A. M., Al-Kadi, M., Yehia, A. H., Sami Nusair, B. M., & Faza, M. A. (2014). Maternal and obstetrical factors associated with a successful trial of vaginal birth after cesarean section. <i>Journal of the Turkish German Gynecological Association</i> , 15(4), 245-249. doi: 10.5152/jtgga.2014.14104			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To find the maternal and obstetrical factors associated with successful TOLAC.</p> <p><i>Secondary Aim:</i> Compare BMI, GA, inter-delivery interval, estimated fetal weight, dilation on admission, station on admission, PROM, augmentation, labor length, Apgar scores, and birth weight with successful versus unsuccessful TOLAC.</p> <p><b>Sample/Setting:</b> N=122 women were eligible for TOLAC.</p>	<p>Study design: prospective comparative study quasi experimental</p> <p>Methods: Per hospital protocol women are eligible for TOLAC if they have had one previous low transverse cesarean section for nonrecurring cause (fetal distress, placenta previa, post-term pregnancy, failed induction, malpresentation, malposition), women without severe medical disorders (severe HTN, uncontrolled DM, liver disorders), singleton pregnancy, cephalic presentation, fetal weight estimated <math>\leq</math> 3.5 kg, adequate pelvis, absence of fetal or maternal sign of compromise.</p> <p>Instruments: Data from medical records was reviewed</p>	<p>TOLAC was successful in 88 (72.13%) of n=122 and 8 (9%) of those were births with instruments. TOLAC was unsuccessful in 34 (27.87%). Scar dehiscence was found in 1 (0.9%) cases and impending rupture was found in 1 (0.9%). Mean body mass index BMI was significantly lower in the successful TOLAC group compared to the unsuccessful group (<math>23.8 \pm 0.03</math> versus <math>26.2 \pm 0.02</math> Kg/m<sup>2</sup>), mean gestational age was significantly lower in the successful TOLAC group compared to the unsuccessful group (<math>37.5 \pm 0.04</math> versus <math>38.5 \pm 0.03</math> weeks), and duration of active labor was significantly lower in the successful TOLAC group compared to the unsuccessful group (<math>6.4 \pm 0.33</math> versus</p>	<p><b>Strengths:</b> -many factors evaluated including BMI, GA, inter-delivery interval, estimated fetal weight, dilation on admission, station on admission, PROM, augmentation, labor length, apgar scores, and birth weight.</p> <p><b>Limitations:</b> -sample size was low -study was done in a foreign country but the medical decision making is similar to the US so the study was chosen anyway.</p>

<p>Women were compared who were eligible for a TOLAC at a Kuwait hospital after meeting certain criteria per protocol. Singleton pregnancy and cephalic presentation was present for all 122 women and all labors were between 37-41 weeks gestation and had to have a spontaneous onset of labor.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b> Level II</p> <p><b>Quality:</b> High Quality</p>	<p>using Statistical Package for Social Sciences version 16.</p>	<p>8.4±0.22 hours); cervical dilatation on admission was significantly higher in the successful TOLAC group compared to the unsuccessful group (5.1±0.9 versus 4.0±0.7 cm)</p> <p><b>Conclusion:</b> TOLAC is safe and often successful when cases are selected individually and reviewed for features. BMI &gt;25 kg/m<sup>2</sup>, GA 40 weeks or greater, and vertex station of -2 or greater were all risk factors found associated with unsuccessful TOLAC.</p>	
<p><b>Author Recommendations:</b> They concluded that risk for uterine rupture is not increased by augmentation of labor. In carefully selected cases TOLAC is safe and often successful.</p>			
<p><b>Implications:</b> The mean BMI is lower in the successful TOLAC group, mean gestation age is lower, and duration of labor is lower. Each TOLAC should be evaluated individually for safety and possibility of success. Cervical dilation <math>\geq 4</math> on admission also increases rate of success. Encourage women to limit weight gain in pregnancy. Spinning baby's yoga to help fetal position prior to labor.</p>			

<b>Source:</b> Grünebaum, A., McCullough, L. B., Arabin, B., & Chervenak, F. A. (2017). Serious adverse neonatal outcomes such as 5-minute apgar score of zero and seizures or severe neurologic dysfunction are increased in planned home births after cesarean delivery. <i>PLoS One</i> , 12(3). Retrieved from <a href="https://search.proquest.com/docview/1879179415">https://search.proquest.com/docview/1879179415</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To examine the occurrence and risks of 5-minute Apgar score of zero and neonatal seizures or serious neurologic dysfunction in all women with a history of prior cesarean delivery for planned home birth VBAC.</p> <p><i>Secondary Aim:</i> While comparing occurrence and risks of 5-minute Apgar score of 0 and neonatal seizures or serious neurologic dysfunction in hospital VBAC and hospital cesarean deliveries for term normal birth weight infants in the United States from 2007-2014.</p> <p><b>Sample/Setting:</b> A cohort study taken from National Center for Health</p>	<p>Study design: Cohort study</p> <p>Methods: The home birth variable on the Standard Certificate of a Live Birth was used to help distinguish between the planned on unplanned home birth. This would compare the carefully planned home birth from the emergency unplanned home birth.</p> <p>Instruments: All statistical data was conducted in OpenEpi.</p>	<p>Women with a planned home birth VBAC had about a 10-fold and higher increase in adverse neonatal outcomes compared to hospital VBACs and hospital cesarean deliveries. Planned home VBACs had a significantly higher incidence and risk of 5-minute Apgar score of 0 of 1 in 890 (11.24/10,000, relative risk 9.04, 95% confidence interval 4-20.39, <math>p &lt; 0.0001</math>) compared to hospital VBACs. Hospital delivery VBACs were associated with non-significant increase in 5-minute Apgar of 0 and a non-significant decrease in neonatal seizures when compared to hospital repeat cesarean deliveries.</p> <p><b>Conclusion:</b> This study showed that planned home vaginal deliveries of women with prior cesarean delivery are associated with significantly and markedly increased neonatal risk of a 5-minute Apgar score of 0, and neonatal seizures or serious neurologic dysfunction when</p>	<p><b>Strengths:</b> Large sample size for both hospital and home birth deliveries. This study was also conducted over an 8-year period and contains the most comprehensive and reliable dataset available in the United States.</p> <p><b>Limitations:</b> Data on seizures or neonatal neurologic dysfunction are less than other data included. Not all states participate in birth certificate data, so all applicability to US states is not proven. Data according to the CDC does not prove whether the 5-minute Apgar score of 0 was a stillbirth during the antepartum or</p>

<p>Statistics NCHS, of the US Centers for Disease Control CDC birth certificate data for 2007-2014. Women had one or more prior cesarean deliveries and included women who had a successful vaginal birth after trial of labor after cesarean TOLAC, at home and in the hospital, a planned repeat cesarean delivery in the hospital, as well as a repeat cesarean delivery after a failed TOLAC in the hospital.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>High</p>		<p>compared to hospital deliveries of women with prior VBACs or repeat cesarean delivery in the hospital.</p>	<p>intrapartum period.</p>
<p><b>Author Recommendations:</b> ACOG recommends that women should be offered a TOLAC in hospitals capable of providing emergency care, because of lower maternal risks. AGOG also recommends that women with a prior history of cesarean delivery are contraindicated for home birth TOLAC, because of the risks such as uterine rupture or other complications. Clinical implications show that the absolute risk for uterine rupture in women undergoing TOLAC has been reported to be between 0.5 and 4% or 1 in 200 to 1 in 250.</p>			
<p><b>Implications:</b> This study provided good information and provided a large study sample.</p>			

<b>Source:</b> Boatin, A., Adu-Bonsaffoh, K., Wylie, B., & Obed, S. (2017). Evaluating facility-based decision-making in women with a prior cesarean delivery and association with maternal and perinatal outcomes. <i>Maternal and Child Health Journal</i> , 21(9), 1845-1852. Retrieved from <a href="https://search.proquest.com/docview/1931554144">https://search.proquest.com/docview/1931554144</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> In a resource limited facility, the objective was to describe facility-based decision making for women with one prior cesarean delivery. <i>Secondary Aim:</i> To determine maternal and perinatal outcomes.</p> <p><b>Sample/Setting:</b> A study was conducted for women with one prior cesarean delivery at Korle-Bu Teaching Hospital in Ghana. N = 1247 women. Groups consisted of: 1) Trial of labor after cesarean TOLAC under supervision, 2) emergency repeat cesarean delivery EMCD, and 3) non-emergent</p>	<p>Study design: Retrospective cohort study. Method: During a period of 1 year from January-December of 2011, record of women with one prior cesarean delivery were analyzed. Comparison of potential differences of the women's sociodemographic status, antenatal attendance, obstetrical history, mode of delivery, and maternal and perinatal outcomes. All women were entered into a clinical database that showed basic information and the outcomes.</p> <p>Instruments used: All statistical calculations were performed with STATA version 13. P value of &lt; 0.5 was considered significant. Maternal and</p>	<p>The study included 12% or 1247 deliveries with 1 prior cesarean delivery of a total of 10,503 deliveries during the year of 2011. Maternal and perinatal outcomes included 46 women or 3.7% experienced one or more adverse maternal outcomes. With no maternal deaths. Twelve or 1% of the women experienced uterine rupture. None of the women induced experienced uterine rupture during this time. Ninety women or 7.2% experienced one or more adverse perianal outcomes. In the entire cohort, 4.2% experienced perinatal mortality.</p> <p><b>Conclusion:</b> For women triaged to emergent repeat cesarean delivery EMCD at admission,</p>	<p><b>Strengths:</b> Three distinct management strategies were observed for this setting compared to the typical two-option framework. The clinicians managing delivery in this population are faced with a different set of decisions.</p> <p><b>Limitations:</b> This included the inability to evaluate the factors that determined the triage decision into these three groups. Also, there was no information on the clinical condition of the pregnant women or the fetus upon arrival to the facility, potential admission or intervention at another facility, or women's preferences or provider preferences. Furthermore, women presenting in labor and immediately directed to CD are different from those allowed to labor under supervision and those offered non-emergent CD, and bear increased rates of adverse outcomes.</p>

<p>repeat cesarean delivery RCD.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>Good</p>	<p>perinatal complications were compared across the 3 groups using Chi square or Fisher's exact tests. The odds of adverse maternal or perinatal events were evaluated using unconditional logistic regression models.</p>	<p>they are different when compared to women that are allowed a trial of labor after cesarean TOLAC or when they are offered a non-emergent repeat cesarean delivery RCD. In the future, these women should be considered a separate group for analysis in a similar setting.</p>	
<p><b>Author Recommendations:</b></p> <p>Facility-based management in a resource-limited setting. Women triaged to emergency repeat cesarean delivery fared worse. This study demonstrates the importance of their consideration as a separate group; therefore, three different management groups were included in this study.</p>			
<p><b>Implications:</b></p> <p>This study was conducted in Ghana. We were trying to stick with studies that were conducted in the United States, but birth outcomes are similar in other countries including Ghana.</p>			

<b>Source:</b> Chinkam, S., Ewan, J., Koeniger-Donohue, R., Hawkins, J. W. and Shorten, A. (2016). The effect of evidence-based scripted midwifery counseling on women's choices about mode of birth after a previous cesarean. <i>Journal of Midwifery &amp; Women's Health</i> , 61: 613–620. doi: 10.1111/jmwh.12466			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> The purpose of this study was to evaluate how scripted counseling by nurse-midwives would affect the decision making and choice for woman to do a TOLAC versus an elective repeat cesarean birth (ERCB). <i>Secondary Aim:</i> discusses scripted counseling and if it is useful</p> <p><b>Sample/Setting:</b> All women in the study were receiving care from a midwife and had all had a previous cesarean delivery. 2012 and 2013 were the study years and the women were enrolled after 28 weeks' gestation. 22 women participated and 20 finished the study. The study was conducted at a Boston Medical</p>	<p><b>Study design:</b> This is a qualitative design. Quasi-Experimental.</p> <p><b>Methods:</b> A scripted counseling packet was used to inform women about birth choices. There were 4 scripts to use during prenatal visits. Iterative consensus approach was used in developing the scripts. Personal orientation was given to each midwife in order to be consistent. A before and after intervention study was given to patients. Patients were given questionnaires.</p> <p><b>Instruments:</b> Pre and post questionnaires included birth preference, information sources, and decision factors.</p>	<p>95% of women thought they had enough information to make a choice after the intervention where only 70% felt like they did before the intervention. Reasons for choosing ERCB included being afraid of vaginal complications, positive prior cesarean, and convenience. Reasons for choosing TOLAC was personal importance of vaginal birth, and faster recovery. All woman were able to make a birth decision after counseling whereas 20% were undecided prior to counseling. 64% had TOLAC, 36% chose ERCB. 64% had successful</p>	<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• Consistent scripted training for all midwives using the intervention.</li> <li>• Outcomes were streamlined in the way that all woman were happy with their informed decision.</li> <li>• Many factors were identified for reasons for choosing birth routes which makes the study well rounded.</li> </ul> <p><b>Limitations:</b> -Not a lot of racial diversity due to 4 languages chosen to participate. -Low sample size.</p>

<p>Center. Eligibility depended on having one previous LTCS, single pregnancy, vertex presentation, and ability to speak and read English, Spanish, Cape Verdean Creole, or Haitian. The first visit also had to be prior to 28 weeks.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level II</p> <p><b>Quality:</b></p> <p>Good quality</p>		<p>VBAC while 36% had another unscheduled cesarean.</p> <p><b>Conclusion:</b> Having scripted prenatal visits and education regarding TOLAC versus ERCB helps women make a birth decision and feel more informed. The intervention had no effect on TOLAC rate but woman were more satisfied with their decisions.</p>	
<p><b>Author Recommendations:</b> Further work is needed to adapt scripted decision counseling to support woman for more diverse cultural groups.</p>			
<p><b>Implications:</b> I would have liked to know the reasons that the women who had attempted TOLAC and ended up having an unscheduled repeat cesarean section. Take home from this article is that by educating our patients well on their option of either a TOLAC or ERCB makes them feel more comfortable and happier with their decision. It also makes it easier for them to make a decision. There are many factors and reasons why a woman chooses different birth options.</p>			

<b>Source:</b> Dorthe, L. A., Thisted, Mortensen, L. H., Hvidman, L., & Krebs, L. Operative technique at caesarean delivery and risk of complete uterine rupture in a subsequent trial of labour at term. A registry case-control study. <i>PLoS ONE</i> , 12(11). Retrieved from <a href="https://doi.org/article/doi/10.1371/journal.pone.0198749">https://doi.org/article/doi/10.1371/journal.pone.0198749</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Estimate the relation of single-layer closure and the risk of uterine rupture in a trial of labor after previous cesarean section. <i>Secondary Aim:</i> Other pre-labor and intrapartum risk factors for complete uterine rupture in trial of labor after cesarean section at term.</p> <p><b>Sample/Setting:</b> All women (n = 39 742), from a Danish Medical Birth Registry from 1997-2008 with a singleton pregnancy at term and a trial of labor after cesarean section.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p>	<p><b>Study design:</b> Population-based case-control study.</p> <p><b>Methods:</b> A 10-digit personal identification code was given to Danish citizens to link registries and medical records. Data was taken from January 1997 to December 2008.</p> <p><b>Instruments:</b> Data was entered into the computer system and analyzed using STATA. STROBE guidelines were used for reporting of the study.</p>	<p>The study included 175 cases and 272 controls. There appeared to be no association between single-layer closure and uterine rupture (aOR 1.38, CI: 0.88-2.17). Risk factors included: induction with an unfavorable cervix, epidural, augmentation by oxytocin for more than 1 hour, and birth rate &gt; or = 4000 grams. The risk of uterine rupture was reduced by previous vaginal delivery and inter-delivery interval of more than 24 months.</p> <p><b>Conclusion:</b> Single-layer uterine closure did not seem to be significantly associated to uterine rupture during trial of labor after cesarean. Major</p>	<p><b>Strengths:</b> Use of validated data. Large number of cases included. There was a strict definition of uterine rupture. Also, the inclusion of only complete uterine ruptures.</p> <p><b>Limitations:</b> There was a large amount of missing data. This included the use of angle sutures and locked versus un-locked sutures.</p>

<p>Level I</p> <p><b>Quality:</b></p> <p>Good</p>		<p>risk factors for uterine rupture included: induction of labor with an unfavorable cervix, birth weight &gt; or = 4000, and indicators of prolonged labor.</p>	
<p><b>Author Recommendations:</b> When recording all missing data as double-layer closure, they found a shift towards an association between uterine rupture and single-layer closure.</p>			
<p><b>Implications:</b> This study was randomized and did use controls.</p>			

<b>Source:</b> Gilbert, S. A., Grobman, W. A., Landon, M. B., Varner, M. W., Wapner, R. J., Sorokin, Y., Sibai, B. M., Thorp, J. M., Ramin, S. M., Mercer, B. M. (2013). Lifetime cost-effectiveness of trial of labor after cesarean in the United States. <i>Value in Health</i> , 16(6), 953-964. Retrieved from <a href="https://www.clinicalkey.es/playcontent/1-s2.0-S1098301513018706">https://www.clinicalkey.es/playcontent/1-s2.0-S1098301513018706</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To estimate the cost-effectiveness of trial of labor after cesarean TOLAC. <i>Secondary Aim:</i> Evaluate long-term effects and outcomes.</p> <p><b>Sample/Setting:</b> Women eligible for this study had a singleton, term vertex gestation (at or beyond 37 weeks gestation), and one prior low-transverse incision without a prior vaginal delivery (n = 14,682). After all exclusions due to certain criteria in pregnancy, this left a total of n = 9,454 women. The number of women that had a TOLAC were n = 4,253 and then women that had emergency repeat cesarean delivery ERCD were n = 5,201.</p>	<p>A Markov model was used to compare TOLAC and ERCD. This method was developed for a hypothetical cohort that had no contraindications to a TOLAC. Pieces of information that were collected from each study and sample chosen included probabilities such as: cerebral palsy, stress urinary incontinence, cost data, and qualified adjusted life years (QALYs). The primary outcome included cost-effectiveness that was measured as a marginal cost per QALY gained, with a \$50,000 threshold per QALY used to define cost-effectiveness.</p> <p><i>Instruments used:</i> Quality of Well-Being classifications system.</p>	<p>The TOLAC strategy dominated the ERCD strategy with \$164.2 million saved and 500 QALYs gained per 100,000 women. There were 6 variables considered in this model that included: the probability of uterine rupture and successful TOLAC among women with no prior vaginal delivery, the frequency of stress urinary incontinence, and the cost of failed TOLAC, successful TOLAC, and ERCD. When the probability of TOLAC success was at the base value, 67.2%, TOLAC was preferred if the probability of uterine rupture was 3.1% or less. When the probability of uterine rupture was at a base value,</p>	<p><b>Strengths:</b> The study was large and taken from many United States hospital registries.</p> <p><b>Limitations:</b> The group of women did not include women who were undergoing labor inductions, but instead it was predicated on women in spontaneous labor and included probabilities of success and uterine rupture. Another group of women that were not incorporated were women that had expectant management beyond 40 weeks gestation. The analysis was not able to incorporate any potential marginal impact on fertility by mode of delivery, such as early miscarriages or ectopic pregnancies. This was because the study included hospital deliveries with a gestational age greater than or equal to 20 weeks gestation or resulting in an infant weighing 500 grams or more.</p>

<p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>High</p>		<p>0.8%, the TOLAC strategy was preferred as long as the probability of success was 47.2% or more.</p> <p><b>Conclusion:</b> According to baseline circumstances, TOLAC was less expensive and more effective than an ERCD when long-term consequences are considered, when the likelihood of success is 47.2% or more. For 100,000 women with one prior low-transverse cesarean delivery, choosing TOLAC for the second child was the most cost-effective choice.</p>	
<p><b>Author Recommendations:</b> It was suggested that ERCD could be associated with higher rates of childhood asthma and lower rates of breastfeeding. Also, if TOLAC was desired in future pregnancies, this could reduce overall rates of cases of hysterectomy and placenta accreta.</p>			
<p><b>Implications:</b> Many of the hospitals these patients were taken from were teaching hospitals and may not be representative of all settings in the United States healthcare system.</p>			

<b>Source:</b>			
<p>Grantz, K, Gonzalez-Quintero, V., Troendle, J., Reddy, Uma, M., Hinkle, S., Kominiarek, M., Zhaohui, L., Zhang, J. (2015). Labor patterns in women attempting vaginal birth after cesarean with normal neonatal outcomes. <i>American Journal of Obstetrics and Gynecology</i>, 213(2), 226.e6. doi: 10.1016/j.ajog.2015.04.033</p>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b>  <i>Primary Aim:</i>            Describe labor patterns in women with TOLAC with normal neonatal outcomes.</p> <p><i>Secondary Aim:</i>            To examine each interval centimeter of dilation for TOLAC when compared to spontaneous or induced labor in 2,892 multiparous women with TOLAC and 56,301 nulliparous women between 37.0-41.6 weeks gestation.</p> <p><b>Sample/Setting:</b>            The study was completed in 12 US centers from 2002-2008. The sample size is large. The final sample size was decreased to 2,892 women undergoing TOLAC who had one previous</p>	<p>Study design:            Quasi experimental</p> <p>Methods:            Data was gathered from medical records. Two comparisons were made with labor progression including pattern of labor comparing duration and cervical dilation and interval-censored time interval of cervical dilation from one centimeter to the next by calculating the 95% of traverse times. P-values were adjusted for maternal age, race, BMI, insurance, epidural, and oxytocin.</p> <p>Instruments:            Chi-square test was used for categorical variables or Wilcoxon rank-sum test was used for continuous variables.</p>	<p>Labor was induced in 23.4% of TOLAC and 44.1% of nulliparous women (P&lt;.001). Cesarean delivery rates were 57.7% in TOLAC versus 19% in nulliparous women (P&lt;.001). Oxytocin was used in 52.4% of TOLAC versus 64.3% of nulliparous women with spontaneous labor (P&lt;.001) and 89.8% of TOLAC versus 91.6% of nulliparous women with induced labor (P=.099). TOLAC had lower max doses of oxytocin compared to nulliparous (median 90<sup>th</sup> percentile:6 mU/min vs 12 mU/min). Median (95%) labor duration for TOLAC versus nulliparous women with spontaneous labor from 4-10 cm was 0.9 (2.2) hours longer (P=/.007). For</p>	<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• Large sample size.</li> <li>• Long time span studied.</li> <li>• -The study compared both induced and spontaneous labors.</li> </ul> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>• Relatively high cesarean delivery rate in TOLAC which creates a selection bias due to intrapartum censoring.</li> <li>• Labor graphs were only including TOLAC success and not those who ended up in a repeat cesarean.</li> <li>• -The study does not discuss adverse outcomes for the groups.</li> </ul>

<p>cesarean and no previous vaginal delivery and 56,301 nulliparous women. Excluded were births that had Apgar's &lt;7, multiple gestations, abnormal presentations, fetal anomalies, and stillbirths. Women had to be in labor between 37.0 and 41.6 weeks gestation and had to have a single gestation.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level II</p> <p><b>Quality:</b></p> <p>Good Quality</p>		<p>women who were in spontaneous labor patterns were very similar for TOLAC versus nulliparous labor length. Induced labor length for TOLAC was 1.5 hours longer using the median. For women who achieved VBAC labor patterns were slower than nulliparous women.</p> <p><b>Conclusion:</b> Labor duration for TOLAC is slower than nulliparous when compared in induced labor. Spontaneous labor was very similar for TOLAC and nulliparous women.</p>	<ul style="list-style-type: none"> <li>• Women attempting TOLAC have had previous labor, and increased age when compared to nulliparous women.</li> </ul>
<p><b>Author Recommendations:</b> By helping physicians understand the appropriate rates of progression at different points in labor may help manage labor. Understanding that TOLAC labors may progress more slowly is important when deciding for or against a repeat cesarean section.</p>			
<p><b>Implications:</b> TOLAC spontaneous labors were slightly slower to progress to 7 cm dilation and those who were induced were slower to progress to 8 cm when compared to nulliparous labors. Labor progressed similarly after 7-8 cm for both groups of women.</p>			

<b>Source:</b> Knight, H. E., Gurol-Urganci, I., Meulen, J. H., Mahmood, T. A., Richmond, D. H., Dougal, A., Cromwell, D. A. (2013). Vaginal birth after caesarean section: A cohort study investigating factors associated with its uptake and success. <i>International Journal of Obstetrics and Gynecology</i> 121(2) p. 183-192. doi: 10.1111/1471-0528.12508			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To investigate the demographic and obstetrical factors that lead to a TOLAC and VBAC and the success rate of vaginal births after a cesarean birth. <i>Secondary Aim:</i> To evaluate whether ethnicity, age, reason for first cesarean and other factors are related to success of a VBAC.</p> <p><b>Sample/Setting:</b> 143,970 women were in the cohort, 75,086 attempted a VBAC. The sample was all women aged 15-45 years old and who had a first labor that ended in a live cesarean delivery. The setting took place at an English national health service. The first cesarean birth had to take place between April 2004 and March 2011 in order to be in the</p>	<p><b>Study design:</b> The study was a cohort descriptive study.</p> <p><b>Methods:</b> A hospital data base was used. All woman ages 15-45 who had a first cesarean delivery between April 2004 and March 2011 and who were pregnant again prior to the end of March 2012. All of the delivery methods were looked at including vaginal, elective cesarean, and emergency cesarean. If women were not given a choice of delivery type for any reason they were excluded from the study such as breech baby or multiple birth. Logistic regression models were used in order to adjust the effect of maternal demographic and clinical risk factors and the reason for primary cesarean births.</p> <p><b>Instruments:</b> The instrument used to get all of the information was the Hospital Episode Statistics database in English acute hospitals.</p>	<p>143,970 women were in the cohort. 52.2% of those attempted a VBAC for their second birth. Younger women and those that were non-white and less fortunate had a higher rate of attempting VBAC's. 63.4% of those who attempted a VBAC had a successful vaginal birth. Younger women who were white had higher success. Black women had a noticeable low success rate. Women who had emergency cesarean sections as their first delivery type had a lower success at a VBAC. Woman who</p>	<p><b>Strengths:</b> -Large sample size -Long study time period of 8 years -All deliveries are in English acute hospitals, so no bias is present -All factors were taken into account and measured such as maternal age, age from last child, first cesarean reasoning, and maternal risk factors. -The study involved all ethical backgrounds</p> <p><b>Limitations:</b> The study was unable to account for BMI, tobacco use, and maternal height. There is also a potential risk that medical interventions were coded wrong and therefore left error in the database.</p>

<p>study. The VBAC had to take place before the end of March 2012.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level III</p> <p><b>Quality:</b></p> <p>Good Quality</p>		<p>had failed induction of labor also had a low rate of success.</p> <p><b>Conclusion:</b></p> <p>Just over half of all women given the choice between a repeat cesarean and a VBAC attempted a VBAC. 2/3 of those women who attempted a VBAC were successful.</p>	
<p><b>Author Recommendations:</b></p> <p>The choice to attempt a VBAC affects hundreds of thousand woman each year in the world. Women of nonwhite race are more likely to fail at a VBAC. Women who have a first cesarean due to an emergency are also more likely to fail. The information in this study is recommended to be used to improve selection for VBAC deliveries.</p>			
<p><b>Implications:</b></p> <p>Women who had emergency cesarean sections as their first delivery type had a lower success at a VBAC. Woman who had failed induction of labor also had a low rate of success. The rate of success for TOLAC resulting in VBAC was approximately 63%.</p>			

<p><b>Source:</b></p> <p>Kozhimannil, K. <i>Rural-urban differences in childbirth care, 2002-2010, and implications for the future.</i> doi: 10.1097/MLR.0000000000000016</p>			
<p><b>Purpose:</b></p> <p><b>Primary aim:</b></p> <p>Measure differences in obstetric care in rural and urban hospitals</p> <p><b>Secondary aim:</b></p> <p>examine trends over time between rural and urban hospitals</p> <p><b>Sample/Setting:</b></p> <p>n=7,188,972 total births, n=6,316,743 urban and 837,772 rural births.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level II</p> <p><b>Quality:</b></p> <p>Good Quality</p>	<p><b>Study design:</b></p> <p>Retrospective analysis</p> <p><b>Methods:</b></p> <p>The NIS databases were searched between 2002 and 2010. There was a 20% random sample of hospitals from the target population studied.</p> <p><b>Instruments:</b></p> <p>ICD-9 codes were used to reflect measures of low-risk cesarean and vaginal birth after cesarean without medical indication and labor induction without medical indication</p>	<p><b>Results:</b></p> <p>From 2002-2010 cesarean rates for low-risk women increased from 12.9% to 15.5% and 12.7% to 16.1% in urban facilities. VBAC rates declined from 13.1% to 5% in rural hospitals and from 18.8% to 10% in urban hospitals. Non-indicated labor induction increased from 9.3% to 16.5% in rural hospitals and from 10.3% to 12% in urban hospitals. Non-indicated cesarean rates grew in both facilities. Odds of a VBAC were 38% lower in rural hospitals versus urban in 2002. VBAC odds declined 10% each year in urban hospitals from 2002-2010.</p> <p><b>Conclusion:</b></p> <p>Both urban and rural hospitals are guilty of low-risk cesarean rates increasing and non-medically indicated inductions. Rural hospitals had a higher</p>	<p><b>Strengths/Limitations:</b></p> <p>-large sample size</p> <p>-compared urban to rural</p> <p><b>Limitations:</b></p> <p>-NIS data did not contain information to distinguish nulliparous or 37-39 week GA.</p> <p>-Some hospital notes were not available for review.</p> <p>-no explanation for results</p>

		incidence of non-indicated inductions.	
<p><b>Author Recommendations:</b></p> <p>Provide evidence-based care consistently to all maternity patients. All hospitals both rural and urban should follow the same safety guidelines.</p>			
<p><b>Implications:</b></p> <p>This study leads to quality improvement programs and clinical management protocols in both rural and urban hospitals. Reducing the rate of first-time cesareans was an overall goal. There is no explanation as to why the author thinks the study results were this way. Need to look into when the 39-week rule was put into place.</p>			

<b>Source:</b>			
Landon, M. B., MD, Grobman, W. A., MD, MBA. (2016). What we have learned about trial of labor after cesarean delivery from the maternal-fetal medicine units cesarean registry. <i>Seminars in Perinatology</i> , 40(5), 281-286. doi: 10.1053/j.semperi.2016.03.003			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b></p> <p><b>Primary Aim:</b></p> <p>Assess risks of uterine rupture and neonatal and maternal morbidity associated with TOLAC when compared to elective repeat cesarean.</p> <p><b>Secondary Aim:</b></p> <p>compare risks between TOLAC and elective repeat CS.</p> <p><b>Sample/Setting:</b></p> <p>Women who had a TOLAC (n=17, 898) and women who had a repeat cesarean (n=15,801) were included in the study. The study took place from 1999-2002 at 19 academic medical centers.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p>	<p><b>Study design:</b></p> <p>Quasi experimental</p> <p><b>Methods:</b></p> <p>Labor and delivery logbooks and databases were screened daily at each medical center by trained nurses. Neonatal data was collected up to 120 days after delivery. Additional data was collected for all NICU admissions. Maternal and perinatal outcomes were compared.</p> <p><b>Instruments:</b></p> <p>Pregnancy registry and labor and delivery logbooks and data bases.</p>	<p>Success rates for TOLAC: 73.4%. If a woman had a previous vaginal birth, there was a 86.7% success rate. (95% CI 3.8-4.5, p&lt;0.001). VBAC success also increases with each number of VBACs per woman.</p> <p>Uterine rupture risk: 0.69%, 124 symptomatic ruptures. In this particular study there was no increased risk if more than one previous cesarean although other studies show 3-fold risk. Previous vaginal birth is protective against uterine rupture (95% CI, 0.43-0.90) when compared to women without previous vaginal birth. Induced labor risk factor is higher than spontaneous labor (OR 2.86; 95% CI, 1.75-4.76) nearly 3-fold for induction versus spontaneous labor. This study found no cases of uterine rupture when misoprostol (n=52) and prostaglandin gel (n=227) was used alone for induction. Rate of rupture with oxytocin was 0.4%.</p> <p>Risk with TOLAC: 2 neonatal deaths among 124 ruptures = 0.11 per 1000 perinatal death rate. Perinatal hypoxic brain</p>	<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>-introduces Grobman model which is a standard of care recognized nationwide.</li> <li>-large sample size.</li> </ul> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>-the study did not compare oxytocin doses with rupture association</li> </ul>

<p><b>Strength:</b> Level II</p> <p><b>Quality:</b> High Quality</p>	<p>injury happened in 6.2% (7 infants). Endometritis 2.9% (1.8% with repeat CS), transfusion 1.7% (1% with repeat CS), hysterectomy 0.2% (0.3% with repeat CS), maternal death 0.02% (0.4% with repeat CS). The risk of accrete increases with each previous cesarean (0.24% with the first, 0.57% with 3<sup>rd</sup>, 2.33% with 5<sup>th</sup> and so on. These risk factors were very similar to those who had elective repeat cesarean sections as well.</p> <p>Term pregnancies with uterine rupture results:</p> <p>Neonatal death 1.8%, admission to NICU 40.4%, 5 min Apgar <math>\leq 5</math> 14%, umbilical artery pH <math>\leq 7</math> 33.3%. n=114 total uterine ruptures/17,898 TOLAC's.</p> <p><b>Conclusion:</b></p> <p>The total risk of serious adverse events (perinatal death or HIE) at term is 1 per 2000 TOLACS. When you add risk of maternal hysterectomy from uterine rupture the risk is 1 in 1250.</p>	
<p><b>Author Recommendations:</b></p> <p>TOLAC should continue to be an option for most women with prior cesarean delivery.</p>		
<p><b>Implications:</b> The overall rupture risk in this study was 0.69%. The maternal complications were very similar and actually the risk for hysterectomy and maternal death are higher in elective repeat cesarean sections. There were 114 uterine rupture and of those 2 infants died, 46 were admitted to NICU, and 7 had hypoxic-ischemic encephalopathy. There were 0.4% risk of rupture with spontaneous labor and 0.9% risk with augmented labor and 1% chance with induced labor.</p>		

<b>Source:</b> Lappen, J. R., Hackney, D. N., & Bailit, J. L. (2015). Outcomes of term induction in trial of labor after cesarean delivery: Analysis of a modern obstetric cohort. <i>Obstetrics and Gynecology</i> , 126(1), 115. Retrieved from <a href="http://www.ncbi.nlm.nih.gov/pubmed/26241264">http://www.ncbi.nlm.nih.gov/pubmed/26241264</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To evaluate outcomes of induction of labor with expectant management in woman attempting trial of labor after cesarean (TOLAC). To determine if induction of TOLAC has an increased risk versus a spontaneous labor.</p> <p><b>Sample/Setting:</b> Term labors 37-40 weeks including both high and low risk woman. All had history of one previous cesarean. 6,033 women were attempting a TOLAC. 1,626 were inductions and 4,407 of them had spontaneous labor.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p>	<p>Study design: Data analysis quantitative study.</p> <p>Methods: Primary outcome was failed TOLAC. Secondary outcomes measured were hysterectomy, transfusion, ICU transfer, VTE, death, 5-minute Apgar less than 5, pH of the cord blood less than 7, asphyxia, hypoxic ischemic encephalopathy, and neonatal death.</p> <p>Instruments: Instruments used were medical record data analysis.</p>	<p>Percentages below are the amount of failed TOLAC from induction versus spontaneous labor.</p> <p>37 weeks gestation 48.5% compared with 34.3% adjusted OR with 95% CI. 38 weeks gestation 47% compared with 33% 95% CI. 39 weeks 45.6% compared with 29.8%, 95% CI. 40 weeks 37.9% compared to 29.4% 95% CI. 39-week induction had a maternal morbidity risk increase with 95% CI and 37-week NICU admissions was also increased with a 95% CI. Induction itself did not increase neonatal morbidity.</p> <p><b>Conclusion:</b></p>	<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>-Large and reliable data set from multicenter U.S. cohort of laboring woman which also represents general population.</li> <li>-Strict inclusion/exclusion data selection.</li> <li>-Study measured all maternal and neonatal outcomes.</li> </ul> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>-Retrospective nature of data.</li> <li>-Not all induction factors were able to take into consideration such as Bishop score.</li> <li>-Study did not include data for woman who had already had a successful VBAC.</li> </ul>

<p>Level II</p> <p><b>Quality:</b></p> <p>Good Quality</p>		<p>Induction of labor opposed to spontaneous labor in a TOLAC situation is associated with a higher risk of failed TOLAC. Induction was associated with increased risk of failed TOLAC at 37-39 weeks but not at 40 weeks gestation. Induction was not associated with an increased risk of neonatal morbidity.</p>	
<p><b>Author Recommendations:</b></p> <p>Induction of labor for women with one prior cesarean delivery when compared to spontaneous labor is associated with an increased risk for failed TOLAC. The study results should not alter current obstetrical practice.</p>			
<p><b>Implications:</b></p> <p>Overall the study mentions a 57% success rate for TOLAC deliveries. By inducing moms before 40 weeks and not allowing natural spontaneous labor to take place there is an increased risk for failed TOLAC. Induction did not increase infant morbidity.</p>			

<b>Source:</b> Mirteymouri, M., Ayati, S., Pourali, L., Mahmoodinia, M., & Mahmoodinia, M. (2017). Evaluation of maternal- neonatal outcomes in vaginal birth after cesarean delivery referred to maternity of academic hospitals. <i>Journal of Family and Reproductive Health</i> , 10(4), 206-210. Retrieved from <a href="https://doaj.org/article/c900053f69cf46658af15ff568c91eae">https://doaj.org/article/c900053f69cf46658af15ff568c91eae</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To evaluate complications to mother and neonate with VBAC.</p> <p><i>Secondary Aim:</i> To identify factors of successful VBAC including birth weight, BMI, maternal age, PPH, breastfeeding rates.</p> <p><b>Sample/Setting:</b> Eighty women between 2014-2015 with a previous cesarean delivery who qualified for TOLAC were included in the study. The women could not need induction so all were spontaneous labors. The study took place at Mashhad University. Patients were followed 6 weeks post-delivery.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p>	<p><b>Study design:</b> Quasi experimental</p> <p><b>Methods:</b> Written consent was gathered from those who participated. Excluded from the study included previous classical incision, history of uterine surgery, uterine anomalies, macrosomia, and more than one previous CS.</p> <p><b>Instruments:</b> Qualitative variable compared with chi-square and fisher exact tests. Quantitative data were tested for normality (Kolmogorov-Smirnovtest), differences were analyzed by T-test, Wilcoxon and Mann-Whitney tests. Significance level was considered as 0.05 in all tests.</p>	<p>VBAC success rate was 91.2%. PPH occurred in 2.7% of VBAC and 1.3% CS. There were no maternal or neonatal death. 7 cases needed repeat cesarean 7 due to failure to progress and 2 for fetal distress. There were no uterine ruptures, dystocia's, or neonatal tachypnea. There were some complications that required NICU admission and neonatal resuscitation were 6.8% in VBAC and 57.1% in CS (p=0.002). Birth weight in successful VBAC was 2940 grams +/- 768 grams and unsuccessful TOLAC was 3764 +/- 254 grams (difference</p>	<p><b>Strengths:</b> -compared many areas of success and failed TOLAC -The study was conducted in an academic hospital so the numbers should be comparable to US.</p> <p><b>Limitations:</b> -small sample size -no control group present</p>

<p><b>Strength:</b></p> <p>Level III</p> <p><b>Quality:</b></p> <p>Good Quality</p>		<p>p=0.007). Mean maternal admission duration for VBAC was 1 +/- 0.1 days and CS was 2 +/- 0.4 days (p=0.001). Breastfeeding rates were 95.8% with VBAC compared to 42.9% with CS (p=0.002).</p> <p><b>Conclusion:</b> There was no uterine rupture out of 80 women studied. TOLAC should be available to women who have had previous cesarean delivery.</p>	
<p><b>Author Recommendations:</b> Vaginal delivery should be a choice for women with previous cesarean section.</p>			
<p><b>Implications:</b> The study was a small sample size. However, it compared its successful VBAC rate to other studies and the numbers were somewhat comparable. Other studies had success rates of 61-87%, although we do not know where those studies took place. The study did prove that a lower birth weight had a higher success rate for VBAC.</p>			

<b>Source:</b> Metz, T. D., Stoddard, G. J., Henry, E., Jackson, M., Holmgren, C., Esplin, S. (2013). How do good candidates for trial of labor after cesarean (TOLAC) who undergo elective repeat cesarean differ from those who choose TOLAC? <i>American Journal of Obstetrics and Gynecology</i> , 208(6), 458.e6. doi: 10.1016/j.ajog.2013.02.011			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To compare women who were good candidates for TOLAC who had repeat cesareans with those that chose TOLAC.</p> <p><i>Secondary Aim:</i> To compare midwifery to family practice providers to see if TOLAC was chosen more in a specific provider group.</p> <p><b>Sample/Setting:</b> Fourteen regional hospitals over 8 years of time was studied. Women had one previous cesarean delivery. The total study included 5,445 women. 3,120 women were calculated to be a good TOLAC candidate. Of this group, 925 chose TOLAC. Deliveries</p>	<p><b>Study design:</b> This is a retrospective cohort study Quasi design.</p> <p><b>Methods:</b> Women who had a 70% chance or better of a successful VBAC as rated on a published nomogram were considered good candidates.</p> <p><b>Instruments:</b> The Grobman model was used at the first prenatal visit to predict success of VBAC.</p>	<p>The final study included 2,195 women who chose elective repeat cesarean (70.4%) and 925 (29.7% who chose TOLAC. All women in the study were considered having 70% chance or greater of successful VBAC using the Grobman model. 0.05;95% CI, 0.02-0.12; P=&lt;.001 indicated that decisions about repeat cesarean vs TOLAC within the same facility were more alike than between facilities. Women who were managed by CNM or had a previous vaginal birth were more likely to choose</p>	<p><b>Strengths:</b> -Study includes both community and tertiary centers. -No bias of results because all women had primary and cesarean section and a subsequent birth in the hospitals studied (no outside information).</p> <p><b>Limitations:</b> -The study is homogeneous because most participants were Caucasian and had a normal BMI. -The study heavily relied on physician training in using the Grobman model and TOLAC scoring could differ based on their results.</p>

<p>studied were from 2000-2008.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level II</p> <p><b>Quality:</b></p> <p>Good Quality</p>		<p>TOLAC.</p> <p>Women who had a family practice or who were obese were less likely to choose TOLAC.</p> <p><b>Conclusion:</b></p> <p>Less than 1/3 of women who are numerically decided as a good candidate actually chose TOLAC.</p> <p>Physician influence was linked to choose.</p>	
<p><b>Author Recommendations:</b></p> <p>Women who are good candidates for TOLAC but undergo repeat cesarean differ in demographics, patient prior experiences, and physician counseling.</p>			
<p><b>Implications:</b></p> <p>Why a woman chooses TOLAC is heavily influenced by personal experience and physician counseling. Women under midwifery care were more likely to choose TOLAC. Women who are obese and under family medicine providers are more likely to choose a repeat cesarean.</p>			

<b>Source:</b> Metz, T. D., Stoddard, G. J., Henry, E., Jackson, M., Holmgren, C., & Esplin, S. (2014). Simple, validated vaginal birth after cesarean delivery prediction model for use at the time of admission. <i>Obstetric Anesthesia Digest</i> , 34(3), 158-159. doi: 10.1097/01.aoa.0000452171.33118.65			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To create a tool for predicting the likelihood that a TOLAC will be successful after one previous primary cesarean.</p> <p><i>Secondary Aim:</i> To prove that the success of TOLAC heavily depends on the admission Bishop score.</p> <p><b>Sample/Setting:</b> Fourteen regional hospitals intermountain from 2000-2008. Inclusion criteria included one cesarean and one subsequent delivery. The pregnancy had to be singleton pregnancies and only the delivery immediately following a cesarean section was counted. Women also had to have an admission cervical exam to be included. There was a large sample size</p>	<p>Study design: Retrospective cohort.</p> <p>Methods: A score of &lt;10 had a success rate &lt;50%, a score of more than 16 had a success rate of &gt;85%.</p> <p>Instruments: Summary of the calculator tool: Bishop score plus, 4 points for previous vaginal birth, 2 points for BMI &lt;30, 3 points if primary cesarean was not because of recurring indication, 2 points if maternal age &lt;35.</p>	<p>Of the 1,170 women who underwent TOLAC the success rate was 80% (n=938). Of those 364 (31%;95% CI 27.9-34.3) had a previous successful vaginal birth prior to cesarean. 6 women (0.5%;95% CI 0.1-0.9) had uterine rupture. One was postdating and being induced with oxytocin and the other 5 were spontaneous labors. Three of those was at 5-6 cm dilation. One at complete, and two after operative vaginal deliveries. None of the ruptures needed hysterectomy. All newborns survived without apparent neurological impairment. Other complications with successful VBAC were shoulder dystocia in 1.8% (n=17; 95% CI 1.0-2.7). 3<sup>rd</sup>/4<sup>th</sup> degree laceration 8.4% (n=79; 95 CI 6.6-</p>	<p><b>Strengths:</b> -98.7% accuracy of classification found on manual review of charts so the study was accurate. -results were verified in an independent cohort. - Large sample size.</p> <p><b>Limitations:</b> The study relied on nurse documentation. Sample is mostly Caucasian, married, and insured patients. Unable to account for physician counseling, labor management, or patient preference. The study does not account for inductions.</p>

<p>of 5,445 women who met the criteria, 1,170 underwent TOLAC. All women had a previous primary cesarean section.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level III</p> <p><b>Quality:</b></p> <p>Good Quality</p>		<p>10.2). Operative vaginal birth 10.3% (n=97; 95% CI 6.6-10.2). 5 variables associated with success include history of vaginal birth (OR 2.7, 95% CI 1.8-4.1), absence of recurrent indication for primary cesarean (OR 2.0, 95% CI 1.3-3.1), &lt;35 years old (OR 2.0, 95% CI 1.1-3.4), BMI &lt;30 (OR 1.6, 95% CI 1.1-2.4) and each point of Bishop score (OR 1.3, 95% CI 1.2-1.4).</p> <p><b>Conclusion:</b></p> <p>This is a simple, validated tool that can predict the TOLAC success rate at the time of admission. It should not be used to exclude women from attempting a TOLAC.</p>	
<p><b>Author Recommendations:</b></p> <p>The TOLAC success tool should not rule out women from attempting a TOLAC if they do not have a score above a certain number it is solely a reliable tool to predict success.</p>			
<p><b>Implications:</b> Women with a successful VBAC have less morbidity than women undergoing an elective repeat cesarean section. Women who have elective repeat cesarean have less morbidity than those of failed TOLAC's. Models or tools to predict the success rate of a TOLAC are important to incorporate into care. Risk of cesarean deliveries includes operative risks and abnormal placentation. Delivery outcome strongly influences how women delivery in subsequent pregnancies. Ripened cervix's have a much high rate of a successful VBAC.</p>			

<b>Source:</b> Nkwabong, E., Fomulu, J. N., & Djomkam Youmsi, F. L. (2016). Trial of labor after cesarean section among women with unique lower segment scarred uterus and fetal weight >3500 g: Prognostic factors for a safe vaginal delivery. <i>Journal of Obstetrics and Gynaecology of India</i> , 66(Suppl 1), 202. Retrieved from <a href="http://www.ncbi.nlm.nih.gov/pubmed/27651604">http://www.ncbi.nlm.nih.gov/pubmed/27651604</a>			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Evaluate outcome of TOLAC with fetal weight &gt;3500 g.</p> <p><i>Secondary Aim:</i> Compare other indications such as previous vaginal birth, maternal age, apgar score and gestational age.</p> <p><b>Sample/Setting:</b> 4240 deliveries studied during the time period of March 1, 2012-February 28, 2015 in India. 582 women had unique scarred uterus (13.7%), 444 birthweight &lt;3500 g (76.3%), and 138 with birth weight &gt;=3500 g.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p>	<p>Study design: Retrospective descriptive study</p> <p>Methods: Medical records of women who had a baby &gt;3500 g were analyzed. A women was eligible for a TOLAC if she had previous low transverse scar, adequate pelvis, vertex presentation, fetal weight estimated to be &lt;3500 g, and if her previous cesarean was &gt;12 months ago. Therefore, the study looked at all TOLAC but only included those who had a birth weight &gt;3500g. P=the women who are estimated to have previous cesarean scar and have babies &gt;3500 g=10%.</p> <p>Instruments: SPSS 20.0. Fisher's exact test was used to compare variables. P&lt;0.05 was considered statistically significant.</p>	<p>Primary: The mean birth weight was 3789.3 g. Out of 36 women studied, 75% (27) had a successful TOLAC. Women with prior vaginal delivery had a higher success rate than women who had never had vaginal birth (94.1 vs 63.1%, P&lt;0.044). 444 women with birth weight &lt;3500 g 73.2% had successful TOLAC, 119 (26.8% had repeat cesarean (37 elective, 82 emergent). Among the 138 women with birth weights &gt;=3500 g, TOLAC was done in 36 cases (26.1%), and elective CS or emergent CS in 102 (73.9%). Only 30 cases were repeat elective due to birth weight alone.</p> <p>Secondary results: 36 TOLAC with birth weight &gt;= 3500 g, 23 (63.9%) were admitted in advanced labor, 19 (82.6%) had a successful TOLAC, 13 (36.1%) came in early labor with 8 (61.5%) having successful TOLAC. Mean maternal age was 22-40, parity mean was 1-5, gestational ages from 36-42. Apgar scores for the 36 deliveries mean 1 min-</p>	<p><b>Strengths:</b> -All studied women were spontaneous labors -The study was done in a hospital with similar medical capabilities as the United States.</p> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>TOLAC was not carried out for women who were anticipated to have fetal weight &gt;=3500 g so the success numbers may have been much higher.</li> <li>Women were only allowed TOLAC if birth weight was estimated at &lt;3500 g or if they were admitted late in labor.</li> </ul>

<p>Level II</p> <p><b>Quality:</b> Good Quality</p>		<p>8.08<math>\pm</math>0.9 (ranged 5-9), and 5 min mean 9.4<math>\pm</math>0.7 (ranged 7-10).</p> <p><b>Conclusion:</b> Birthweight &gt;3500 g can be successful with TOLAC especially if admitted in advanced labor or with successful previous vaginal deliveries. Maternal age &gt;30 years is associated with higher failure rates. Previous vaginal delivery gives a woman 94.1% chance of successful TOLAC.</p>	
<p><b>Author Recommendations:</b> To reduce the CS rate globally cesarean sections should be offered even if estimated fetal weight is <math>\geq</math>3500 g as long as there are not any other disqualifying criteria. There is an increased risk of uterine dehiscence with fetal weight &gt;4000 g. &gt;3500 g is not a contraindication of TOLAC.</p>			
<p><b>Implications:</b> Of the 9/36 women who needed an emergent cesarean section, one was due to partial uterine rupture. This was in an infant 4117 g. Other indications for failed TOLAC were cephalopelvic disproportion in 6 cases, and uterine pre-rupture symptoms in 3 (abd pain, Bandl's ring, tachycardia). Many women with fetal birth weights &gt; 3500 g had successful TOLAC. Estimated birth weight alone should not rule out TOLAC.</p>			

<b>Source:</b> Ram, M., Hirsch, L., Ashwal, E., Nassie, D., Lavie, A., Yogeve, Y., & Aviram, A. (2018). Trial of labor following one previous cesarean delivery: The effect of gestational age. <i>Archives of Gynecology and Obstetrics</i> , 297(4), 907-913. doi: 10.1007/s00404-018-4677-9			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Assess neonatal and maternal outcomes with a trail of labor after previous cesarean TOLAC.</p> <p><i>Secondary Aim:</i> What are the effects of gestational age, and does this change the maternal or neonatal outcomes.</p> <p><b>Sample/Setting:</b> Eligible women sample of N = 2849 women, with TOLAC at a single, referral, university-affiliated medical center, between 2007-2014. Eligible women had one previous uterine scar as a result of prior lower-segment transverse cesarean delivery of a singleton, uncomplicated pregnancy at 37-41 completed weeks gestation. Exclusions were women at gestational age &lt;37</p>	<p><b>Study design:</b> Non-Experimental, retrospective cohort study.</p> <p><b>Methods:</b> The main outcomes included mode of delivery, rates of VBAC (normal or operative vaginal delivery), and uterine rupture.</p> <p><b>Instruments:</b> Statistical analysis was done by using a SPSS software. Univariable analysis was done to compare categorical data by using Fisher's exact test (x squared). A significant result was considered a <math>p</math> value &lt;0.5. A multivariable logistic regression analysis was used to adjust for potential confounding variables such as: maternal age &gt;35, previous vaginal delivery, induction of labor, the use of epidural, the presence of meconium, and birth</p>	<p>The overall VBAC rate was 90.7% with 16 cases (0.56%) of uterine rupture. Those rates did not seem to differ for gestational age group. For each gestational age group, the rate of operative vaginal delivery was higher for ongoing pregnancy. But for 38 and 39 group, it was statistically significant (14.7 vs. 10.6%; <math>p &lt; 0.5</math>, and 16.1 vs. 12.2%, <math>p &lt; 0.5\%</math>, respectively). For 39-week ongoing pregnancy group, postpartum hemorrhage was found to be significantly higher (3.3 vs. 1.4%; <math>p &lt; 0.01</math>). In regards to adverse composite maternal outcomes, there were no differences. In regards to individual outcomes or adverse composite neonatal outcomes, there</p>	<p><b>Strengths:</b> There was a consistent and uniform protocol for patient selection and management. The validation of the success rates for TOLAC were shown by the results. This study also answers a real-life consulting issue- what are the consequences of not delivering at a certain gestational age, in the presence of a uterine scar?</p> <p><b>Limitations:</b> This study did not have selected variables such as BMI or indication for previous cesarean delivery. This study was from a single institution which may limit the findings.</p>

<p>weeks and &gt;41 + 6 weeks to try to avoid potential confounders that may be related to pre-term or post-term deliveries.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>Good</p>	<p>weight &gt;4000 grams. Data regarding maternal characteristics, pregnancy and neonatal outcomes were obtained from the birthing unit computerized database.</p>	<p>were no differences. In regards to gestational age, it was not found to be independently associated with any of the pre-specified outcomes.</p> <p><b>Conclusion:</b></p> <p>In conclusion, among women at gestational term, of whom have had a single previous cesarean delivery, gestational age at delivery was not found to be an independent risk factor for TOLAC success or uterine rupture. With regards to being for or against TOLAC, gestational age alone will not serve as an argument.</p>	
<p><b>Author Recommendations:</b></p> <p>The study could be compared to other studies that include all births &gt;24 weeks gestation and a study population of more than just one institution. This may influence the consultation given by different physicians and different departments.</p>			
<p><b>Implications:</b></p> <p>Because gestational age cannot be changed, there is no manipulation of the independent variable. Gestational age is predefined making this study non-experimental. Observing what happens is best with this research. VBAC rates were about 90%, the incidence of uterine rupture was 0.56%, and gestational age at delivery did not affect maternal or neonatal outcomes.</p>			

<b>Source:</b> Rogers, A., J., MA, Rogers, N. G., MD, Kilgore, M. L., RN, MSPH, PhD, Subramaniam, A., MD, MPH, Harper, L. M., MD, MSCI. (2016). Economic evaluations comparing a trial of labor with an elective repeat cesarean delivery: A systematic review. <i>Value in Health</i> , 20(1), 163-173. doi: 10.1016/j.jval.2016.08.738			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Evaluate the cost effectiveness of a trial of labor after cesarean TOLAC or an elective repeat cesarean section ERCD. <i>Secondary Aim:</i> What are the clinical and economic ramifications of both.</p> <p><b>Sample/Setting:</b> The data bases of EMBASE, MEDLINE, CINAHL, Cochrane library, EconLit, and the Cost-Effectiveness Analysis Registry without language, publication, or date restrictions in October 2015. Studies that were included were 1) being primary research, 2) comparing TOLAC versus</p>	<p>Study design: A systematic review Method: This review was developed using the Preferred Reporting Items for Systematic reviews and Meta-Analysis for protocols. Data was registered in the PROSPERO database. The CHEERS checklist was employed, which was used to offer guidance as to which components were essential. Studies were scored based on completely satisfy (1), partially satisfy (0.5), or do not satisfy (0), with a maximum of 24 points.</p>	<p>There were 310 studies reviewed, with 7 studies included in the systematic review. There were 4 studies that concluded that TOLAC was dominant over ERCD. Only 1 study found ERCD to be dominant. Two studies found that TOLAC was most costly, but it offered more benefit and was cost-effective from a population perspective when one considers societal willingness to pay for better outcomes. Cost effectiveness was found to be on a high likelihood of TOLAC success, low risk of uterine rupture, and low relative cost of TOLAC compared to ERCD.</p> <p><b>Conclusion:</b> For low-risk women with one previous cesarean section, the study lends support to the cost-effectiveness of TOLAC when compared to ERCD</p>	<p><b>Strengths:</b> The study included a strategy that incorporated itemized resource utilization, labor duration, professional wages and benefits, and a range of costs including administrative, operational, and capital costs.</p> <p><b>Limitations:</b> Studies that were chosen were limited to only women with low transverse uterine scars, who had no contraindications to labor. These results are only generalizable to profile of women with a higher TOLAC success likelihood and a low risk of uterine rupture. Data on maternal and infant outcomes often only have information for the actual rather than the intended route of delivery. Short-term outcomes were assessed and the studies did not include the impact of the TOLAC versus the</p>

<p>ERCD, and 3) providing information on the relative cost of each course of action.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>High</p>		<p>for most scenarios. Ultimately, clinicians should seek to encourage a trial of labor for low-risk women, from a population-based and economic perspective. Education and patient preference should continue to direct decisions on the planned mode of delivery.</p>	<p>ERCD decision on neonatal outcomes.</p>
<p><b>Author Recommendations:</b></p> <p>The cost incurred by hospitals, and thus passed on to payers in the health system, is generally considered to be greater for an ERCD due to higher resource use and longer average hospital stay.</p>			
<p><b>Implications:</b></p> <p>While the optimum mode of delivery after a previous cesarean delivery is dependent on a variety of individual characteristics and the indications for the primary cesarean birth. Clinical consensus is that a trial of labor after cesarean TOLAC is generally a safe alternative to an elective repeat cesarean delivery ERCD for most women.</p>			

<b>Source:</b> Scaffidi, R. M., Posmontier, B., Bloch, J. R., & Wittmann-Price, R. (2014). The relationship between personal knowledge and decision self-efficacy in choosing trial of labor after cesarean. <i>Journal of Midwifery &amp; Women's Health</i> , 59(3), 246-253. doi: 10.1111/jmwh.12173			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> To explore the effect of knowledge regarding the risks and benefits of trial of labor after cesarean TOLAC and elective repeat cesarean delivery ERCD on the decision for the mode of delivery in pregnant women who have had a prior cesarean delivery. <i>Secondary Aim:</i> To explore how the level of decision self-efficacy affected the decision for mode of birth during a subsequent delivery.</p> <p><b>Sample/Setting:</b> A sample of 45 pregnant women between 10-22 weeks gestation (n = 45), with a prior history of cesarean delivery.</p>	<p>Study design: Cohort design</p> <p>Methods: A 14-item management scale was used to assess the knowledge and expectations of each women's degree of knowledge about the risks and benefits for both ERCD and TOLAC. The first 3 questions assessed the participant's "extremely low decision self-efficacy." A score of 100 indicates "extremely high self-efficacy." Bandura's theory of self-efficacy was a guided framework for this study. The Decision Self-Efficacy scale was used to measure each woman's degree of decision self-efficacy with regard to making a decision about the mode of birth for their present pregnancy. Data was entered twice into the Statistical Package for the Social Sciences version 19.0. Chi-square tests were used to compare</p>	<p>Results showed that more women intended to have an ERCD (n = 25, 55.6%) versus a TOLAC (n = 20, 44.4%). Knowledge scores showed a minimum score of 0 to a maximum score of 13 (mean [SD], 5.20 [3.29]) for the whole cohort. Scores for the self-efficacy ranged from 61.36 to 100 on the 11-item instrument (mean [SD], 89.78 [11.57]) for the whole cohort. The mean (SD) decision self-efficacy score for women who chose TOLAC was 39 (5.29; range 27-44) and for those who chose ERCD the mean score was 39.92 (4.99; range 29-44). Knowledge scores for women who chose ERCD ranged from a minimum of 0 to a maximum of 10 (mean [SD], 4.64 [2.94] median 5) and for women who chose TOLAC, knowledge scores ranged from 0-13 (mean [SD], 5.90 [3.64]; median 7).</p>	<p><b>Strengths:</b> This study informed women with information on the risks and benefits of TOLAC versus ERCD. Women were supplied with complete and accurate information.</p> <p><b>Limitations:</b> Time constraint and lack of funding left this study with a small number of participants. The use of the knowledge scale did not have data on reliability and validity. Another limitation included self-selection bias in the recruitment of the participants for this study.</p>

<p>Data was taken from 3 antenatal care centers with a tertiary medical center located in a mid-Atlantic state from August 2011 to March 2012.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>Good</p>	<p>categorical demographic variables and t tests were used to compare continuous and ordinal variables. The level of significance was set at the alpha level of 0.05. Logistic regression was employed using the SAS software package.</p>	<p><b>Conclusion:</b></p> <p>Clinical expertise and patient preference, combined with evidenced-based care and best available research findings. Women must be adequately informed with information obtained from reliable research, then patient preference can be considered. Women must be fully aware and knowledgeable about the risks and benefits of both TOLAD and ERCD. This will lay the foundation for informed decision making and allow TOLAC to be an option that women will feel confident choosing as their mode of delivery.</p>	
<p><b>Author Recommendations:</b></p> <p>Future research should investigate other factors that influence the decision-making process for mode of delivery. A qualitative research design or mixed-method approach could provide a more comprehensive understanding of what women experience and what factors they consider during the decision-making process.</p> <p>This study determined women’s choice between 10-22 weeks gestation and further research could suggest re-evaluation at 36 weeks gestation.</p> <p>Comparisons could include intended mode of delivery with actual mode of delivery.</p>			
<p><b>Implications:</b></p> <p>Women were well informed regarding the risks and benefits associated with TOLAC and ERCD. This may have helped increase the numbers of participants who opted for TOLAC.</p>			

<b>Source:</b> Singh, A., & Shrivastava, C. (2015). Uterine rupture: Still a harsh reality. <i>The Journal of Obstetrics and Gynecology of India</i> , 65(3), 158-161. doi: 10.1007/s13224-014-0551-2			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Determine incidence, etiology, management, maternal, and fetal outcome and to evaluate trends and recommended preventable measures.</p> <p><b>Sample/Setting:</b> All women who had uterine rupture in Pt. J.N.M. Medical College Raipur between January 2012 and August 2013. There was a total of n=11,323 deliveries, n=9,844 without prior cesarean and n=1,479 with prior cesarean section.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b> Level II</p> <p><b>Quality:</b> Good Quality</p>	<p><b>Study design:</b> Prospective cross-sectional study</p> <p><b>Methods:</b> All women who were brought to this tertiary hospital were evaluated for cause and history. History was taken from patient or attendant. Operative findings, and detailed history of treatment was documented. Post-operative follow up was done for 6 months after discharge.</p>	<p>N=11,323 deliveries total that were studied. Of those 40 cases ruptured, 25 in women with prior cesarean and 15 without prior cesarean. Women with prior cesarean rupture was 1.69% and women without cesarean was 0.152%. Overall incidence of rupture was 0.35%. Risk factors of rupture: 92.5% labor at home, 52.2% injudicious oxytocin use, 44% unjustified VBAC trial, Bladder injury was found in 20%. Extension to cervix was 46.66%, blood transfusion in 92.5%, Perinatal mortality was 85%, maternal death 2.5%.</p> <p><b>Conclusion:</b> Women have 1,500 times higher risk for rupture even without</p>	<p><b>Strengths:</b> -large sample size -compared developed to developing countries -rupture was compared from previous cesarean to no uterine scar on many aspects</p> <p><b>Limitations:</b> -study was not done in the US and does not reflect our numbers -the article is short and doesn't give a lot of detail</p>

		<p>previous cesarean and 1.7 times with previous cesarean section in underdeveloped countries. Laboring at home and using uncontrolled oxytocin were the greatest risks for rupture in this study.</p>	
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<b>Source:</b> Tessmer-Tuck, J. A., El-Nashar, S. A., Racek, A. R., Lohse, C. M., Famuyide, A. O., & Wick, M. J. (2014). Predicting vaginal birth after cesarean section: A cohort study. <i>Gynecologic and Obstetric Investigation</i> , 77(2), 121-126. doi: 10.1159/000357757			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Develop a model to predict VBAC success.</p> <p><i>Secondary Aim:</i> To compare the model with Grobman model and see if the upper Midwest is comparable.</p> <p><b>Sample/Setting:</b> This study was done at the Mayo clinic, Rochester, Minnesota from January 2000-May 2010. Exclusion criteria were IUFD, multiple gestation, preterm birth, and elective repeat cesareans. 599 women were in the study.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p> <p><b>Strength:</b> Level III</p> <p><b>Quality:</b></p>	<p><b>Study design:</b> This is a Quasi designed study.</p> <p><b>Methods:</b> Every woman who met criteria signed a form whether their chart could be accessed for research. There were 20,184 deliveries from January 2000-May 2010. 2,635 of those had one prior cesarean section. The final cohort after exclusion criteria included 599 women.</p> <p><b>Instruments:</b> The study was a historical cohort of electronic medical records.</p>	<p>Of the final 599 women studied, 456 (76%) had a successful VBAC. VBAC success had younger age, lower BMI, higher parity, were Caucasian, had a prior vaginal delivery, prior successful VBAC, and more than 2-layer suture closure of their cesarean delivery. The AUC was 0.757 (95% CI, 0.713-0.801). The AUC for the final model was 0.723 (95% CI, 0.680-0.767).</p> <p><b>Conclusion:</b> Successful TOLAC is directly linked to age &lt;30, BMI &lt;30, prior successful VBAC, previous vaginal delivery, and absence for</p>	<p><b>Strengths:</b> -The study was conducted in the upper Midwest and gives us a good example of our current population -there is some racial diversity included -Large sample size -Model is comparable to those in the past which show accuracy (Grobman model)</p> <p><b>Limitations:</b> -low racial diversity -unable to control women being in the study which could lead to bias</p>

Good Quality		recurrent indication for CS. Hispanics have lower success than Caucasian women. African American's have lower success than Caucasians but higher than Hispanics.	
<p><b>Author Recommendations:</b> TOLAC is a reasonable choice for women, overall success rates of VBAC are about 75% with complications in less than 1% of them. Each woman should be evaluated and counseled individually for risk and success likeliness.</p>			
<p><b>Implications:</b> Cesarean rated in the US currently exceed 32% of all deliveries. This is a 53% increase over 10 years (starting 1996). Factors that are directly associated with successful TOLAC are Maternal age &lt;30, being Caucasian, BMI &lt;30, prior vaginal birth, prior VBAC, and not having recurrent indication for cesarean.</p>			

<b>Source:</b> You, S., Chang, Y., & Yen, C. (2018). Rupture of the scarred and unscarred gravid uterus: Outcomes and risk factors analysis. <i>Taiwanese Journal of Obstetrics &amp; Gynecology</i> , 57(2), 248-254. doi: 10.1016/j.tjog.2018.02.014			
<b>Purpose/Sample</b>	<b>Design (Method/Instruments)</b>	<b>Results</b>	<b>Strengths/Limitations</b>
<p><b>Purpose:</b> <i>Primary Aim:</i> Assess maternal and fetal outcomes and consequences of uterine rupture. <i>Secondary Aim:</i> Assess risk factors for patients who have had rupture at the lower-segment or non-lower-segment scarred, or unscarred gravid uterus.</p> <p><b>Sample/Setting:</b> There were 30 patients (n = 30), assessed and treated at Linkou Chang-Gung Memorial Hospital, a tertiary referral center. These patients were taken from November 2004 to July 2017.</p> <p><b>Johns Hopkins Evidence Appraisal:</b></p>	<p>Study design: Retrospective cohort</p> <p>Methods: Detailed clinical information was taken from chart reviewing. Normality testing of data distribution was performed with Kolmogorov-Smirnov test. The incidences were presented in this study as a percentage. Nonparametric test, such as Mann-Whitney U test and Kruskal Wallis test, were used to compare the variances in maternal characteristics, risk factors, and outcomes of the lower-segment or non-lower segment scarred uterus, and the unscarred uterus. SPSS for Windows was used to perform statistical calculation.</p>	<p>Mean onset of rupture was at 34.2 + or – 0.9 weeks gestation. Twelve occurred at term and 18 occurred preterm. There were 4 fetal demises. There were 24 transfers to neonatal intensive care units. There were 17 maternal blood transfusions without maternal mortality. Twenty-two patients presented with acute abdominal pain and/or abnormal fetal heart tracing and these were managed with an emergent cesarean section. There were 4 uterine ruptures that were found postpartum following a vaginal delivery. Three of these were trials of labor following a previous cesarean section and 1 was an unscarred uterus. Two of the 4 was followed with a hysterectomy. Those with an unscarred uterus n = 6 without any identifiable risk factors ruptured in later gestation and were associated with larger</p>	<p><b>Strengths:</b> The study compared both scarred and unscarred uteri.</p> <p><b>Limitations:</b> There was found to be no data for uncomplicated vaginal deliveries or cesarean sections after uterine surgeries. This meant that the incidences of uterine rupture occurred in the 3 groups was unobtainable.</p>

<p><b>Strength:</b></p> <p>Level I</p> <p><b>Quality:</b></p> <p>Good</p>		<p>fetal birthweights. Compared to those with a scarred uterus n = 24 (both p &lt; 0.5) and both yielded morbidities. Rupture timing between non-lower-segment scar n = 14 and lower-segment scar n = 10 were not found to be significantly different.</p> <p><b>Conclusion:</b> There was a widespread rupture of gravid uterus that occurred after 30 weeks gestation with remarkable morbidity. Unscarred uterus could rupture in later gestation than the scarred ones without identifiable risk factor. Acute abdominal pain, apart from uterine contraction or the suspicious fetal heart rate tracing is the key to timely rescue and successful management.</p>	
<p><b>Author Recommendations:</b> Clinically, there were no prediction or prevention for uterine rupture, but the provider's awareness and timely awareness and timely management could decrease maternal and neonatal mortality.</p>			
<p><b>Implications:</b> The sample size was very small, and the time frame was very long. The study did however compare uterine rupture and many different characteristics such as scarred uterus and unscarred uterus.</p>			