CESAREAN RATE REDUCTION INTERVENTIONS IN THE UNITED STATES

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ABSTRACT

Objective: To identify gaps in current efforts to reduce the US' cesarean delivery rate and to propose additional interventions.

Background: 32% of all US births are by cesarean section. Health organizations have called for action to reduce the cesarean rate. Cesareans have benefits for mother and baby when medically indicated. However, 10% of cesareans are performed without indication. Cesarean sections expose women and their babies to increased health risks, a matter of public health importance since not all cesareans are medically necessary. Individual, interpersonal, social, and policy level factors influence delivery decisions. In the context of the socioecological model, each level offers an opportunity for intervention.

Methods: A PubMed literature search produced 12 articles meeting inclusion criteria for this review of existing US interventions to reduce cesarean rates. Six articles discussed hospital-based programs. Three articles evaluated different staffing models for labor and delivery units and their impact of cesarean rates. Two articles evaluate the impact of professional recommendations on trial of labor after cesarean (TOLAC) policy. One article assessed the impact of an insurance structure change away from traditional fee-for-service to voluntary managed care.

Results: Four of the hospital-based programs decreased elective early term cesareans prior to 39 weeks gestation through educational activities, standardized protocols, changes to scheduling policies. These programs did not address elective cesareans after 39 weeks. Studies of labor and delivery staffing models found laborists and midwives had lower cesarean rates compared to traditional private practice models. In California and New Mexico, availability and access to TOLAC declined after ACOG issued restrictive recommendations in 1999. Despite changes in the recommendations in 2010, vaginal birth after cesarean (VBAC) rates remained low.

Conclusion: Multifaceted approaches will be necessary to make sustainable reductions in the US cesarean birth rate. Future interventions need to expand existing hospital-based programs, restructure traditional labor and delivery staff models, promote evidence-based professional recommendations, and research the effectiveness of educational interventions targeted to pregnant women. Additional interventions should include campaigns to increase awareness and acceptability of midwives and doulas, improvements to physician education and training, and changes to insurance policies to allow for evidenced-based practices.

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1.0 INTRODUCTION

Despite calls from health and professional organizations for the reduction of cesarean sections since 1985, the rate of cesarean births has steadily increased in the United States (US). The cesarean section was once a rare procedure occurring only in dire situations, but now occurs in 32% of all US births. The cesarean birth rate varies across the US by state and region. The US has higher rates of cesarean births than other developed nations.

The cesarean section can be a necessary life-saving procedure. When medical and pregnancy complications arise, the risk of proceeding with a vaginal delivery may outweigh the risks of the surgical cesarean delivery. Maternal medical indications for cesarean include various placental abnormalities, uterine rupture, active infections especially vaginal infections, and uncontrolled medical conditions, such as diabetes and high blood pressure. Fetal medical indications for cesarean delivery include complications with the umbilical cord and fetal growth restriction. Additional medical indications are difficult labor, labor progression arrest, fetal distress, and maternal history of prior uterine surgeries. Poor positioning of the fetus and large fetal size are possible indications for a cesarean but neither automatically require a cesarean. Approximately 10% of US cesareans are not medically necessary. Poor positioning of the fetus and large

The procedure for cesarean sections involves a series of intricate steps from the administration of anesthesia to the final closure. Even when all the steps are carefully performed, complications can occur. Cesarean delivery exposes women and their babies to many health

risks. No data shows any benefits of cesarean sections when not medically necessary.¹⁵ When cesarean sections occur without medical indications, women and their babies are exposed to avoidable increased health risks. Rates of maternal morbidities and mortality are greater for cesarean deliveries than vaginal deliveries, even when looking at low-risk planned deliveries.^{5,16–20} Maternal morbidities include hemorrhage, postoperative infections, and surgical adhesions.^{16–20}

Compared to women who deliver vaginally, women who delivery by cesarean section also have lower rates of breastfeeding initiation and experience more difficulty breastfeeding.^{21,22} For future pregnancies, women with a previous cesarean are at significantly greater risk for placental abnormalities and complications resulting in a hysterectomy.^{19,23,24} Fetal risks associated with a cesarean delivery include fetal laceration, neonatal respiratory disorders, and changes to infants' microbiota.^{17,20,25–27}

Many health organizations have made recommendations regarding the need to reduce the prevalence of cesarean sections. In 1985, The World Health Organization (WHO) issued a recommendation stating that the ideal cesarean birth rate should be between 10-15% of all births. After examining global maternal and infant mortalities rates, the WHO determined that maternal or infant mortality globally did not increase when cesarean section rate rose higher that 15%. Now, the WHO advises against the procedure when not medically indicated. The American College of Obstetricians and Gynecologists (ACOG) also recommends vaginal delivery when there are no medical indications for cesarean. While ACOG does not explicitly endorse maternal requested cesarean delivery, it does state that such procedures should only be performed after the fetus has reached 39 weeks gestational age. ACOG also states that most women with a previous cesarean section are eligible to attempt to a vaginal birth after cesarean

(VBAC).³⁰ The US' *Healthy People 2000, 2010*, and *2020* objectives have called for a reduction in the cesarean birth rate.^{32–34} *Healthy People 2020* objectives focus on reducing cesareans in low-risk women with or without prior cesareans.³⁴ The objectives classify low-risk women as those giving birth to full-term singletons with a vertex presentation.³⁴

Factors at each level of the socioecological framework impact the mode of delivery decision for every US birth. Individual factors that contribute to high cesarean rates include increased maternal age, gestational age, excessive weight gain during pregnancy, and fears of childbirth.^{35–42} Contributing interpersonal factors include perceived pressure from a physician for a cesarean and cues from friends and family members' birthing decisions and experiences.^{39,40} US cultural norms approach childbirth as a medical event that normally occur in a medical setting and attended by a physician.^{43,44} The medicalized approach to birth, particularly with regards to cesarean births, offers a sense of control over an otherwise uncontrollable situation. Organizational factors that contribute to high cesarean rates include policies and pressures in hospitals that encourage quicker patient turnover.^{45,46} Malpractice concerns can influence physicians' decision to proceed with a cesarean section even if the decision is not supported by actual medical indications and the delivery could have resulted in a vaginal delivery.^{37,41,45}

This thesis examines the current literature on existing interventions, programs, and policies implemented to help reduce the cesarean rate for US women. A PubMed literature search resulted in 12 articles discussing the implementation of actual interventions in the US and the impact of those interventions on cesarean rates. Four intervention category types emerged from the 12 reviewed articles: hospital programs, staffing models, trial of labor after cesarean (TOLAC) policy impact, and insurance structures. Six articles discussed a variety of hospital-based programs that address physician practices for nonmedically indicated (elective) cesareans,

particularly prior to 39 weeks gestational age. Three articles discussed variations to hospital labor and delivery staffing models and their impact on cesarean delivery rates. The staffing model variations included the use of laborists, nurse-midwives, and doulas. Two articles evaluated the impact of ACOG recommendations and VBAC policies on the access to TOLAC and on VBAC rates. The final article discussed a program addressing insurance payment structure and its impact on cesarean rates.

This literature review reveals some of the limitations of and gaps in the current efforts to reduce cesarean rates. Professional recommendations can significantly impact the cesarean rate. 47,48 Future professional guidelines must be evidence-based and be supported with anticipatory guidance for implementation of recommendations into actual medical practices. Several of the hospital-based programs were effective in limiting elective deliveries prior to 39 weeks gestation, but these programs were adopted voluntarily and did not attempt to limit cesareans after 39 weeks. 49-52 Efforts need to be directed to implement such programs in every state and to expand the programs to limit elective cesareans even after 39 weeks gestation. Hospital staffing models and healthcare provider types can impact the rate of cesarean births. 7.16,53 Hospitals should restructure their traditional models for maternity care to include laborists and midwives to reduce cesarean section rates. Few of the reviewed interventions contained components directed at individual mothers, and none evaluated the effectiveness or impact of the educational materials on maternal attitudes and behaviors 50-52 Future research in the US will be necessary to evaluated the effectiveness of such efforts.

Additional areas of intervention to cesarean include increasing awareness, acceptability, and availably of midwives and doulas, improving physician education and training, and changing insurance policies to allow for evidenced-based practices. Health communication campaigns will

be necessary to increase awareness and promote positive perceptions midwives and doulas and the services they provide. As efforts increase public awareness and improve public perceptions, training programs will need to meet the likely increase in demand for doula and midwifery services. Insurance policies for the individual, providers, and hospitals need to provide coverage for evidence-based practices, such as TOLAC, VBAC, and services provided by midwives and doulas. Changes will be needed in physician education and training. Physicians need to have more formal training with alternative birthing techniques, such as using a vacuum or forceps, which can prevent the need for a cesarean section. Additional physician education and training needs to focus on the advantages of collaboration with midwives, to provide opportunities to learn about the midwifery approach to birth, and to build trust and respect between the two fields of practice. The implementation of interventions addressing these areas of concern would lead to a lower cesarean birth rate, reduce women's risks for maternal morbidities, and create a US cultural shift away from birth as a medical event to a natural process, that sometimes needs medical intervention.

2.0 BACKGROUND

The cesarean section is one of the most common medical procedures performed in the US; over 1.28 million were performed in the US in 2014 alone. Throughout history, this now relatively routine procedure was nothing close to routine. The exact origins of the cesarean section are unclear but historical evidence shows instances of the procedure occurring in many cultures around the world. Records show cesarean sections occurring in China and Rome Before Common Era. 55,56

The name "cesarean" is often attributed to the Roman *Lex Caesarea*, Laws of Caesar, which stated that in the event of a pregnant woman's death, her infant should be removed from its mother's womb before her burial.⁵⁵ In instances where death occurred during childbirth and the removal process occurred almost immediately afterwards, the infant may have still been alive and able to live a normal life.⁵⁵ The general historical perception of cesarean section is that the procedure was extreme, traumatic, and predominately done only with the hope of saving the infant, not the mother.⁵⁵

As the western world improved anatomical knowledge during the Renaissance and Industrial Revolution, medical professionals made significant advances in surgical procedures.⁵⁵ During the 1800s, verified Western documentation of successful cesareans begins to appear. At first, the procedure occurred mostly in isolated locations in the US, as it did in Europe. Traditionally, midwives attended births, but as urbanization and utilization of urban hospitals

increased in the late 1800s and early 1900s, doctors more routinely attended births. Doctors in these urban hospitals developed and honed obstetrical and surgical skills, which allowed the cesarean to become a routine procedure in medically necessary situations. The development of anesthetics during this time also increased doctors' willingness to perform the procedure when necessary. While the surgery offered a chance to save both mother and baby, at the beginning of the 20th century, the risk of postoperative infections resulted in high maternal mortality rates. Improvements in sanitation, antiseptics, and infection prevention techniques, such as hand washing, led to decreases in the postoperative maternal mortality rate.⁵⁵

In the 1920s, doctors began to focus on the surgical techniques used for cesarean sections, refining them to reduce maternal morbidities and mortality.⁵⁵ From the 1930s onward, further improvements in anesthetics, antibiotics, and surgical techniques have increased the safety of cesareans, making it a modern life saving procedure for both mothers and babies.⁵⁵ The US approach to birth became increasingly medicalized. From 1940 to 1955, doctors increased their presence at childbirth from approximately 50% of all births to 99% of all births in the US.⁵⁵

As the safety of the cesarean section improved for the mother, physicians increasingly perform the procedure for the fetus' benefit.⁵⁵ Improved imaging technology, such as X-rays and ultrasounds, allowed physicians to view and diagnose potential delivery related risks for a fetus during pregnancy.⁵⁵ The introduction of fetal heart monitors in the 1970s offered real-time information about possible fetal distress during labor and delivery.⁵⁵ Today, the fetus is increasingly the focus of childbirth related interventions.⁵⁵ Though technologic advances around cesareans and childbirth improved safety for mothers and babies in the past, excessive use of high tech and modern intervention in childbirth could be placing mothers and their babies at risk.⁵⁵

2.1.1 Prevalence

The overall cesarean delivery rate is the number of births delivered by cesarean in a given time period, typically a year, per 100 births in the same given time. The cesarean section has become increasingly common in the US. In 1947, an estimated 2% of women gave birth by cesarean section, which was a fivefold increase over the cesarean rates of the 1920s.⁵⁷ At the time, the medical community perceived it as a common procedure.⁵⁷ By 1959, an estimated 5% of women in the US gave birth by cesarean section as physician training increased with the post-World War II baby boom.⁵⁸ The rate of cesarean births remained steady through 1965 at 4.5%.⁵⁹ The rate then steadily grew to 17.9% in 1981.⁵⁹

Professionals predicted that the rate would rise as the "once a section, always a section" norm prevailed despite recognition that VBAC was possible.⁵⁹ While the VBAC rate in 1970 was 2.2%, it increased to 6.6% in 1985.⁶⁰ Yet despite the increase in VBAC rates, the overall cesarean rate in 1985 rose to 22.7%.⁶⁰

Data collection regarding cesarean births began to highlight the cesarean rates in specific populations, particularly the cesarean delivery rate of low-risk women. As noted before, low-risk is defined as singleton, term (≥ 37 weeks gestation), and vertex presentation. Most studies and recommendations do not limit "low-risk" to nulliparous women, though some do.¹ The low-risk cesarean delivery rate is calculated by the number of low-risk births delivered by cesarean per 100 low-risk births in a given year. In 1998, the low-risk cesarean rate for women with no prior cesareans was 18%.³³ For low-risk women with prior cesarean births in 1998, the cesarean rate was 72% resulting in a VBAC rate of 28%.³³ Cesarean rates continued to rise until 2007, when the overall cesarean rate was 31.8%.¹ The low-risk cesarean rate for women with no prior cesarean rose to 26% and the rate for women with a previous cesarean rose to 91% in 2007.³³

Therefore, the VBAC rate for low-risk women in 2007 was 9%.³³ The US overall cesarean rate reached an all-time high of 32.9% in 2009.¹

Progress is being made in reducing the US' low-risk cesarean rate. Cesarean births among low-risk first pregnancies spiked to 28% in 2009 but by 2015 had been reduced to 25.8%. Despite the reduction, there is still room for improvement. Great variation in cesarean rates exist between states and regions across the country, from 22.8% in New Mexico to 38.8% in New Jersey in 2011. ^{2–5}

By comparison, the cesarean birth rate of other developed nations is much lower than the US.⁶ Between April 2013 and March 2014, England had an overall cesarean rate of 26.2%.⁶¹ The World Health Organization reported the 2014 overall cesarean rate was 32.3% for the North America region, including Canada, US, and Mexico, while the overall cesarean rate in Europe was 25%.⁶ In the same year, the cesarean rate in the US was 32.2%.¹ While the global rate of cesarean births is increasing for regions such as Africa, where increased access to cesarean sections could impact the maternal mortality rate, the increased cesarean rates in other regions including the US have not been shown to improve maternal outcomes.^{6,15,28,29}

While the ideal upper limit for a population's cesarean section rate is not known, elective cesarean sections are occurring.¹³ In Florida, among women without a previous cesarean, 8.8% of births were considered non-medically indicated prior to 39 weeks gestational age.¹³ Characteristics of the women receiving non-medically indicated cesareans include Non-Hispanic white, maternal age older than 35, and privately insured.¹³

Medicaid data show that non-medically indicated induction or cesarean sections occurred in 32.3% of all Medicaid births with 8.9% of all Medicaid births occurring as early non-medically indicated induction or cesarean sections. ¹² Estimates from Medicaid data suggest that

about 15 percent of all elective labor inductions occurring prior to 41 weeks gestation result in a cesarean delivery. Other estimates suggest that elective induction of labor increases the likelihood of cesarean delivery by 2.4 after adjusting for birth weight, maternal age, and gestational age. 62

2.1.2 Modern Surgical Process

The modern cesarean section is the most commonly performed surgical procedure in the US.⁵⁴ Many resources are required for this procedure, which must occur in a hospital with operating rooms and an obstetrician, an anesthesiologist, and support staff.⁶³ Physicians must perform each of the following procedures for a successful cesarean delivery.

Setting up appropriate anesthesia is the first step in the modern cesarean section. Four options are available for use: epidural block, spinal block, combined spinal-epidural block, and general anesthesia.⁶⁴ At least 95 percent of cesarean sections use epidural blocks and spinal blocks as anesthesia.⁶⁴ Epidural and spinal blocks allow the mother to remain awake through the procedure, while general anesthesia does not.⁶⁴ A spinal block uses a single injection of low-dose drugs into the spinal fluid around the spinal cord, while an epidural block uses a continuous stream of drugs that can be increased in duration and dosage to fit the circumstances.⁶⁴ General anesthesia uses a combination of intravenous drugs and gases introduced by tubes placed into the respiratory tract.⁶⁴ To reduce fetal exposure to general anesthesia, obstetricians minimize the amount of time between the initiation of general anesthesia and first incision to removal of the baby.⁶⁴

The modern cesarean section procedure is divided into five steps: incision into the abdomen, incision into the uterus, removal of the baby, repair and closure of the uterus, and

repair and closure of the abdomen.⁶³ A laparotomy, incision into the abdominal cavity, is made either midline vertically or transversely on the abdomen below the navel.⁶³ The most commonly used techniques for the transverse incision are the low Pfannenstiel, a slightly curved incision two to three centimeters above the top of the pubic bone, and the Joel-Cohen, a straight incision three centimeters below the highest point on the pelvic bone.⁶³ Both techniques require the incision to be a minimum length of 15 centimeters.⁶³ Blunt dissection, by hand instead of scalpel, of the tissue and muscle layers leading into the peritoneum enables the obstetrician to preserve muscle strength and ease recovery.⁶³ Studies suggest no significant outcome differences between blunt and scalpel dissections regarding mortality, infection morbidities, or blood transfusions.⁶³

For the incision into the uterus, known as a hysterotomy, a transverse incision is most common and preferable to a low vertical or classic incision.⁶³ Obstetricians can expand the uterine incision using a blunt technique to avoid injury to the baby.⁶³ Removal of the baby occurs quickly after the hysterectomy and rupture of the amniotic sac.⁶³ After clamping the umbilical cord, the physician will remove the placenta from the uterus through the incision, either by manual extraction or by spontaneous separation.⁶³

The closure process contributes to most of the time needed for the procedure, as incision and removal of the baby take approximately fifteen minutes of the one hour procedure.⁶³ The physician closes the uterus with dissolvable sutures.⁶³ Sutures are used to close the fascia layer while generally the rectus muscle layer is not sutured to reduce postoperative discomfort.⁶³ If the subcutaneous layer is greater than two centimeters, the layer is closed with absorbable sutures, otherwise the layer remains unsutured.⁶³ One of two techniques is used to close the skin: suturing or stapling.⁶³ Staples reduce the procedure time and are removed within a week of the procedure, while the sutures dissolve weeks after the procedure.⁶³

2.1.3 Medical Indications for Cesarean Section

Pregnancy and childbirth are not without risk for a woman or her baby. Complications do occur that require surgical intervention. The cesarean section can be a life-saving procedure for both the mother and the baby. Also, some medical conditions that are not directly related to pregnancy may justify the use of cesarean section to reduce negative health risks. In these instances, the potential complications of a cesarean delivery are less than a vaginal delivery.

Medical indications for a cesarean delivery include some maternal complications and some fetal complications. Placenta abnormalities where the placenta attaches too deeply to the uterus (i.e. placenta accrete, placenta increta, and placenta percreta) are indicators for a cesarean delivery. Similarly, cesarean section is necessary for placenta previa, a condition with low placental uterine attachment resulting in coverage of the cervix impeding vaginal delivery. In cases of uterine rupture, the procedure is necessary to avoid maternal and fetal mortality. Maternal infections, such as active genital herpes and human immunodeficiency virus (HIV), are indicators for cesarean since the procedure has a greater probability of preventing fetal exposure to the infection than vaginal delivery. Uncontrolled maternal medical conditions, such as diabetes, high blood pressure, or preeclampsia, may result in the need for immediate delivery by cesarean section.

Medical indicators for cesarean section include some fetal complications. In cases where the umbilical cord extends through the cervix prior to delivery (i.e. cord prolapse), cesarean is necessary to avoid the cord being pinched during the vaginal labor and delivery process, which cuts off nutrients and oxygen to the fetus.^{7,9} Fetal growth restriction, with or without concurrent maternal conditions, may indicate the need for delivery prior to full-term via cesarean section.⁸

Medical indications that require some clinical judgment for whether or not a cesarean section is necessary include difficult labor, labor progression arrest, fetal distress, and maternal history of prior uterine surgeries. Difficult labor, dystocia, can be attributed to maternal physical limitations such as pelvic abnormality, deformities, or a relative small size. Labor progression arrest is failure of cervical ripening or failure in fetal descent. When fetal monitoring indicate distress, immediate delivery by cesarean is advised to prevent reduced oxygen to the fetus. Labor induction and augmentation are associated with uterine hyperstimulation, uterine contractions occurring too frequently or too long, creating fetal distress.

A history of previous surgeries to a mother's uterus may increase a woman's risk of uterine rupture and other complications from vaginal labor and delivery.⁶⁶ Previous uterine surgeries include a myomectomy, removal of uterine fibroids, or a hysterotomy, any incision in the uterus including cesarean sections.^{7,8} The degree of scarring from prior surgeries indicates the level of risk a woman could experience during a vaginal delivery versus a cesarean delivery.⁶⁶ Having a previous cesarean delivery is not an immediate medical indication for another cesarean section. Most women whose previous cesarean had a low-transverse incision are able to have a VBAC following TOLAC.³⁰

Macrosomia, a condition characterized by a large fetus measuring more than eight pounds 13 ounces, can result in the need for cesarean delivery when the mother's pelvis cannot safely accommodate birth. 9,10 But according to ACOG, suspected fetal macrosomia is rarely a true indicator for cesarean delivery; instead, suspected macrosomia may prompt a discussion with the mother about a potential elective cesarean delivery. The annual rate of birth attendants indicating suspected macrosomia for cesarean section is increasing at a higher rate than the

clinical incidence of macrosomia. 10 The macrosomia indication may be cited more often than necessary, thus resulting in potentially unnecessary cesarean deliveries.

Poor positioning of the fetus can also result in the need for cesarean delivery, especially for multiple gestation. While the ideal positioning for vaginal birth is the vertex position, head first through the cervix and vaginal canal, vaginal delivery is possible in a breech, buttocks first, position. Some physicians will cite breech position as indication for cesarean, but this presentation does not inherently require a cesarean section. In twin gestations, vaginal delivery is possible and recommended if the first fetus is in a vertex presentation and the second fetus is in either a vertex or breech position. Despite the recognition that such presentation conditions can allow for successful vaginal delivery of twins, physicians do not always offer the option for vaginal delivery and instead present a cesarean section as the preferred method.

Studies have concluded that approximately 10% of all cesarean sections in the US are medically unnecessary. 12–14 Determining the percent of truly medically necessary cesareans is difficult. One study concluded that routine medical obstetric interventions, such as epidurals, labor induction, and fetal heart monitoring, significantly contributed to the rate of medically indicated cesareans. For instance, routine continual fetal heart monitoring attributes to an estimated 12.6% of cesareans sections which would be avoided if using alternative monitoring methods such as intermittent auscultation. Referred to as the cascade of interventions, the introduction of each additional medical intervention increases risks of a medical indication, such as labor progression arrest or fetal distress. 67,68

2.1.4 Risks Associated with Cesarean Section

While a cesarean section is necessary in some cases to prevent maternal and infant death, there are no data showing benefits of cesarean sections when not medically necessary.¹⁵ As with all medical procedures, potential risks exist for the patient. Cesarean section is no exception.

The risk of postpartum maternal mortality for a cesarean delivery is 13.3 per 100,000 births while the risk of postpartum maternal mortality for vaginal delivery is 3.6 per 100,000.⁵ Even in low-risk planned deliveries, the rate of severe maternal morbidity or mortality was 2.7% for cesarean deliveries compared to 0.9% for vaginal deliveries.⁵ During and shortly after the cesarean procedure, a woman's risk of postpartum hemorrhage, postoperative infections, venous thromboembolism, and mortality is greater compared to a woman who gives birth vaginally.^{16–20} The procedure could also result in the formation of adhesions and other surgical injuries.^{19,20}

Anesthesia is a necessity for cesarean sections, but anesthesia related complications can lead to increased maternal morbidities and death.⁶⁴ Epidurals increase the risk of drug toxicity for mother and fetus if the epidural drugs enter the bloodstream.⁶⁴ Because of maternal and fetal physiology, general anesthesia during cesarean deliveries poses greater potential risks of airway concerns and patient awareness during the surgery than general anesthesia for other populations.⁶⁴ One study of the 56 anesthesia related deaths over a five year period showed no statistically significant difference in maternal mortality between general or regional (epidural or spinal blocks) anesthesia.⁶⁴

Cesarean delivery is associated with other risks, such as postoperative puerperal infections, even after receiving routine antibiotic use with the procedure.^{63,69} Generally, women recovering from a cesarean delivery have longer hospital stays than women with vaginal deliveries.⁷⁰ While most studies have concluded that cesarean delivery is not a predictor of

postpartum depression in the general population, some studies have found an association for women with strong preference for vaginal delivery.^{71–76}

There is also a notable relationship between cesarean delivery and lower rates of breastfeeding initiation and maintenance.²¹ Women experience more breastfeeding difficulties, such as delayed or limited milk production, following cesarean deliveries compared to vaginal deliveries.^{21,22} The anesthesia drugs and the mother's natural stress response can impact not only the hormone levels needed for milk produce production but the hormone levels in the milk itself.^{21,77} During the first five days postpartum, the volume of milk produced after cesarean delivery has been found to be significantly (p< 0.05) less than the volume after vaginal delivery.²² Breastfeeding within the first hour of life is associated the higher rates of breastfeeding maintenance after leaving the hospital.^{21,77} Cesarean deliveries often delay maternal and child skin-to-skin contact and thus delay the opportunity to initiate breastfeeding in the first hour of life.^{21,77}

Cesarean sections can increase the risks for maternal morbidities in subsequent pregnancies. The risk of placental abnormalities, such as placenta previa and placental abruption, and complications resulting in the need for hysterectomy increases in a pregnancy following a previous cesarean birth. 19,23,24 A systematic review found an odds ratio of 1.48-3.95 for placenta previa after a previous cesarean delivery compared to a previous vaginal delivery. 19 After adjusting for maternal factors such as age and smoking habits, the adjusted odds ratio for placental abruption in pregnancies following a previous cesarean is 1.40 (CI 95%, 1.36-1.45). 23 There is a dose response relating to each additional cesarean a woman experiences with increasingly higher risks of developing serious complications and morbidity outcomes. 19 A systematic review found that the odds ratio for a hysterectomy increases from 0.7-2.14 for

women with one previous cesarean to 1.4-7.9 for women with one or more previous cesareans.¹⁹ The odds ratio for a hysterectomy increased to 3.8-18.6 for women with two or more previous cesareans.¹⁹ Especially when performed if not medically indicated, cesareans pose a risk for the woman's future reproductive health.

Cesarean delivery also increases risks for the infant. Fetal laceration is one risk. Estimations for fetal laceration range from 0.1% to 3.1% of all cesarean sections.²⁵ Neonatal respiratory morbidity is also a risk of elective cesarean delivery, especially before the onset of labor.^{17,20,25} The possible neonatal respiratory morbidities include several disorders such as transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), and persistent pulmonary hypertension (PPH), all of which inhibit a newborn's ability to breathe properly.²⁵ While respiratory complications may resolve on their own, respiratory morbidities can require treatments such as oxygen therapy and mechanical ventilation.¹⁷

The risk of neonatal respiratory morbidities increases significantly if the procedure occurs before 39 weeks gestation.¹⁷ The odds of an infant experiencing respiratory morbidity are 3.7 at 37 weeks gestation, 3.0 at 38 weeks gestation, and 1.9 at 39 weeks gestation for infants delivered through elective cesarean compared to infants delivery through vaginal delivery.²⁰ In one study of over 33,000 births between 37 and 42 weeks, infants delivered by cesarean prior to labor onset were nearly seven times (OR 6.8, 95% CI 5.2 – 8.9) more likely to develop RDS or TTN than infants delivered vaginally.²⁵ While tests can guide an assessment of gestational age and fetal lung maturity, the tests can be inaccurate in detecting the presence of respiratory disorders.⁷⁸

The microbiota of infants born via cesarean delivery differ from the microbiota of infants born via vaginal delivery. 25-27 Maternal vaginal fluids during vaginal births provide infants with

a microbiome that is not provided in a cesarean birth.^{26,27} The changes in the microbiota may impact an infant's immune system's response to environmental exposures.²⁷ These changes in immune response could lead to higher risks of disease, such as asthma, allergies, and autoimmune disorders.²⁷ The extent and impact of changes to a newborn's microbial biosphere are still being studied, though studies have found associations between cesarean delivery and increased risk of asthma, allergies, immunity deficiencies, and obesity.^{25–27}

2.1.5 Cost

Cesarean delivery is much more expensive than vaginal delivery, especially for the individual.⁷⁹ In 2010, the average labor, birth, and hospital stay for a cesarean delivery cost \$12,739 while vaginal delivery cost \$9,048 for individuals with private health insurance.⁷⁹ These expenses do not include any additional expenditures for management and care of any complications that occur from cesareans. Adverse outcomes and complications have substantial cost implications for labor and delivery systems as well as health insurers.⁸⁰ Overuse of cesareans is a significant expense and can weaken the effectiveness of health care systems with limited resources, by diverting time and staff resources into a resource intensive procedure.¹⁵ By diverting medical resources such as obstetricians, anesthesiologists, and operating rooms to nonmedically necessary procedures, time and resources are not able to be used on other patients.

2.2 OFFICIAL RECOMMENDATIONS ABOUT CESAREAN SECTIONS

Several leading health organizations have made recommendations regarding the need to reduce the prevalence of cesarean sections. Each health organization has a different focus for its approach to reduce cesarean deliveries. The WHO approaches cesarean sections from a global perspective and recommends that cesareans occur only when medically necessary. The US' *Healthy People 2020* objectives serve as guidelines to improve health efforts and focuses on reduction of cesarean births for low-risk women, with or without prior cesareans. The ACOG focuses on physicians' interactions with patients and recommends that physicians encourage vaginal delivery unless otherwise medically indicated.

2.2.1 World Health Organization

During the April 1985 WHO meeting in Fortaleza, Brazil, the WHO presented a list of health recommendations. The WHO stated that the ideal cesarean section birth rate should be between 10-15% of all births in any population.¹⁵ While this has been the standard, many recognize the limited data used to justify the upper limit of 15%.¹⁵ Eight studies analyzed data on populations' cesarean rates and maternal and infant mortality rates without adjusting and found a strong inverse relationship between cesarean rates of 9%-16% and declines in maternal and neonatal mortality.²⁸ But when investigators adjusted those study results for Human Development index (HDI) and Gross Domestic Product (GDP) per capita, the relationship disappeared.²⁸ Similar conclusions were made in a second study for the WHO looking at data from 159 countries.²⁹ The conclusion and recommendation therefore from the WHO is that while cesarean birth rates above 16% do not reduce maternal or infant mortality, cesarean birth rates higher than 16% are not

associated with increased mortality rates. ^{15,28,29} While the studies did investigate maternal and infant mortalities, they did not assess the morbidities associated with higher cesarean rates, such as increased placental abnormalities and neonatal respiratory disorders. ^{28,29} While a maximum rate has not been pinpointed, the WHO still recommends that cesareans occur only when medically necessary. ¹⁵

The WHO's conclusion that the 15% cesarean section rate cap is no longer appropriate was based on mortality rates alone, not adjusting for morbidity or economic factors that may contribute to a continued desirability for lower cesarean rates. Since the WHO analysis looks across countries with various levels of development and extreme variations in socioeconomic factors, the WHO's general observations and recommendations may not reflect the needs of the US population. Despite the limited evidence of the global impact of cesarean rates greater than 30% on maternal and infant morbidity and mortality, medically unnecessary cesarean sections still pose an increased health risk to mothers and their newborns and strain medical resources. 12,13,15,68,80

2.2.2 Healthy People 2020

At the beginning of each decade, starting in 1979, the US' Office of Disease Prevention and Health Promotion produces a list of objectives intended to prioritize and guide health improvement efforts for the US.³⁴ Health objectives are made through a consensus of governmental organizations, public health organizations, and individuals.³⁴ These objectives are referred to as Healthy People objectives. An objective calling for the reduction of the cesarean birth rate appears in *Healthy People 2000, 2010*, and 2020.^{32–34}

For *Healthy People 2000*, the overall cesarean delivery rate target was 15% with a target of 12% for women without a prior cesarean and 65% for women with a previous cesarean.³² By 1998, the overall cesarean rate decreased from 24.4% in 1987 to 22.5%.³² The main contributing factor was reduction among women with previous cesareans from 91.2% in 1987 to 69.3% in 1998.³² During that same period of time, women experiencing their first cesarean delivery decreased from 17.4% in 1987 to 15.6% in 1998.³²

From *Healthy People 2000* to *Healthy People 2010*, the objectives shifted focus from reducing the general cesarean delivery rate to focusing on reducing cesarean deliveries for low-risk women.^{32,33} Despite *Healthy People 2010*'s call for a reduction to 15% for low-risk women with no previous cesarean from 18% in 1998, the final year 2007 saw a rise to 26.5% cesarean rate for low-risk women.³³ Similarly for low-risk women with prior cesarean births, the cesarean rate increased from 72% to 91% despite the target reduction to 63%.³³

Healthy People 2020's Maternal, Infant, and Child Health Objective 7 also calls for a reduction in cesarean births among low-risk women.³⁴ Based on 2007 data, 26.5% of low-risk women with no prior cesarean birth and 90.8% of low-risk women with at least one prior cesarean birth gave birth via cesarean section.³⁴ The Healthy People 2020 target improvement is more conservative than previous objective targets, 10% reductions in both categories of women, thus the targets are 23.9% of women with no cesarean history and 81.7% of women with a cesarean in their history.³⁴

2.2.3 American College of Obstetricians and Gynecologists

ACOG is a nonprofit professional organization whose mission is to improve women's health by producing practice guidelines and educational materials.⁸¹ The organization is recognized as the

leading obstetric organization in the US. Committee Opinions are recommendations from ACOG that include assessments of emerging issues in obstetric practice.⁸¹ The Committee Opinions are regularly reviewed, updated, and replaced as required by practice advances and new data.⁸¹ Practice Bulletins and guidelines reflect evidence-based recommendations on techniques and clinical management issues.⁸¹ While ACOG is a respected organization, it is important to recognize the organization's potential biases toward practices that are beneficial for or protective of physicians and their practice decisions. ACOG's Opinions and Bulletins touch on several aspects of cesarean sections.

ACOG Committee Opinion Number 559 issued in April 2013, and reaffirmed in 2015, recommends that providers counsel and advise their patients that vaginal delivery is appropriate in cases without maternal or fetal medical indications and to recognize that cesarean sections without medical indication is not advisable for women desiring future children.³¹ The lack of effective pain management plans should not be the primary motivator for a cesarean delivery and physicians should make efforts to provide options to their patients.³¹ While not explicitly rejecting the option for maternal requested cesarean delivery, the Committee Opinion states that the procedure should be performed only after 39 weeks gestational age.³¹ ACOG Committee Opinion Number 578 issued in November 2013, and reaffirmed in 2016, addresses general elective surgery and patient choice.⁸² It echoes the recommendations presented in Opinion Number 559 and provides steps for balancing maternal autonomy, providing accurate information of risks, addressing concerns about childbirth, and encouraging vaginal delivery unless medically indicated.⁸²

ACOG has a complicated history regarding its Practice Bulletins and Committee Opinions for VBAC. At times the recommendations were very restrictive, conforming to the

norm of "once a cesarean, always a cesarean." Previous ACOG Bulletins cautioned strongly against TOLAC and VBAC and instead highlighted risks of uterine rupture. This advisory did not take into account that induction of labor during TOLAC is associated with increased risk of uterine rupture and decreased the likelihood of successful VBAC. A 2001 study found the rate of uterine rupture in women with prior cesareans during spontaneous labor was 0.52%, during induction without prostaglandins was 0.77%, and during induction with prostaglandins was 2.24%.

ACOG issued the current standing Practice Bulletin Number 115 in August 2010 and reaffirmed the bulletin in 2015.³⁰ Practice Bulletin number 115 replaces the 2004 Practice Bulletin Number 54 and 2006 Committee Opinion Number 342.30 Number 115 addresses VBACs through TOLAC as an alternative to a planned repeat cesarean delivery. The recommendation states that most women with one previous low-transverse incision cesarean delivery should be offered TOLAC with the intention for a VBAC.³⁰ Practice Bulletin Number 115 also allows for the option of TOLAC for some women with two previous low-transverse cesareans and women carrying properly positioned twins and one previous cesarean.³⁰ The recommendation clearly states that, after counseling on the risks and benefits of TOLAC or elective repeat cesarean delivery and proper documentation of this in the medical records, the decision for TOLAC resides with the patient. The bulletin advises, based on consensus and expert opinion, that TOLAC should occur in facilities and with staff immediately available and capable providing emergency care.³⁰ The bulletin also strongly advises against using misoprostol for cervical ripening or labor induction in patients with prior cesareans or other uterine surgery due to the drug's significantly increased risk of uterine rupture.³⁰

2.3 SOCIOECOLOGICAL FACTORS FOR HIGH RATES

Many factors influence the decision to proceed with a cesarean rather than a vaginal delivery. The American culture around births, the healthcare system, and individual beliefs and biases of pregnant women and their health care providers all contribute to current high rates of cesarean births in the US. Women do not make their decisions for mode of delivery in isolation. The social ecological approach proposes multiple levels of influence on health behaviors and decisions. This approach also emphasizes the importance of each level's influence and impact on the other levels in the framework. Therefore, women's birthing decisions are influenced by individual, interpersonal, social, and policy level factors.

2.3.1 Individual – Maternal Factors

In the US, the chances for cesarean births are higher as gestational and maternal age increases and if the mother is non-Hispanic black, when compared to non-Hispanic white and Hispanic mothers. Theorized contributing factors for the well-documented higher rate for African American women include possible increased medical indications in the population, preference for cesarean delivery, or increased racial clustering toward local hospitals that have higher rates of cesarean. Excessive weight gain in pregnancy has also been associated with higher rates of cesarean births. Experience of one or more significant stressful life events, such as death of a parent, separation or death of partner, or death of another child prior to conception or during the pregnancy are associated with increased risk of cesarean deliveries. Previous research suggests that significant life stressors can impact physiological and behavioral responses that result in pregnancy complications associated with higher risks for cesareans.

Elective induction of labor increases the risk of cesarean delivery prior to 39 weeks gestation or in women whose cervixes have not softened and are not ready for dilation and delivery. ⁸⁶ Even if women scheduled induction with the intention of a vaginal delivery, induction of labor increases the chances of a cesarean delivery that might have been avoidable. ⁵⁰ Though generally induction of labor increases the risk of a cesarean delivery, for gestational ages of 41 weeks or more induction of labor actually decreases the risk of a cesarean delivery. ^{39,87,88}

Cesarean section upon mother's request accounted for approximately 3% of all first-time US cesarean deliveries in 2011.¹⁴ Many women with low-risk pregnancies are under the impression that a cesarean delivery is safer than a vaginal delivery, when in fact cesarean delivery can put a mother's health at greater risk than vaginal delivery.^{4,41,45,87} When women have a low perceived severity of cesarean delivery, women are more inclined to seek this significant surgical procedure despite the lack of medical indications.^{40,45} Due to an increased risk of placental abnormalities in later pregnancies and potential maternal morbidities, women with previous cesarean births are less likely to deliver vaginally in subsequent pregnancies.^{5,19,23,24,38,45} But as previously addressed, a previous cesarean section is not inherently a medical indication for another cesarean section and VBAC following TOLAC is actually encouraged.^{30,38,45,66}

Fear of vaginal delivery and the labor process may also lead women to request an otherwise elective cesarean.^{39–42} Tokophobia, the fear of labor and childbirth, particularly referring to labor contractions is a strong predictor of a woman's preference for a cesarean delivery.⁴⁰ Women with family histories of negative obstetric outcomes are more likely to express concern and worry about their own labor and delivery.⁴⁰ Some women want to avoid

short-term urinary incontinence and other side effects of vaginal birth, but often they underestimate the severity of the risks associated with a cesarean section.⁴

2.3.2 Interpersonal – Friends, Family, and Physician Interactions

People close to a pregnant woman can have strong influence over her mode of delivery preferences. Many women take decisional cues from friends and family members discussing their own delivery experiences.⁴⁰ After hearing negative birthing experiences, women are more inclined to desire an alternative birth.⁴⁰

Despite the majority of women expressing a preference of a vaginal birth, nearly a third of all births in the US are by cesarean.⁸⁹ One study's findings suggest that as many one out of every five women perceived pressure to go forth with a cesarean delivery.³⁹ Since physician preferences have been found to strongly influence patients' decision making, it is not surprising that women who perceive pressure from their doctors had increased likelihood of cesarean deliveries.^{37,39,40,90} When asked about perceived pressured, women whose previous pregnancy resulted in a cesarean section were 3.64 more likely to report perceived pressure to proceed again with a cesarean deliveries.³⁹ Perceived pressure for a cesarean delivery could therefore be a significant contributor to the lower rate for attempted VBAC, despite the lack of any medical indications to have a cesarean.³⁹ Physicians with histories of high cesarean delivery rates were likely to continue to have high rates.^{37,91}

2.3.3 Community – Cultural Norms and Values

Generally in the US, people view childbirth as a dangerous event that requires technological intervention in a medical setting.⁴⁴ In the US, the vast majority of childbirths take place in hospitals while attended by highly skilled physicians and obstetricians. In 2014, a physician attended 90% of all US births.⁴³ In the same year, certified nurse midwives attended only 8% of US births.⁴³ Hospitals are often viewed as the only safe location for birth, yet according to the National Birth Center Study II, birthing centers, even when including women transferred to the hospital, experience fewer maternal or neonatal mortalities than hospitals serving the same populations.⁹²

The US' medicalized approach to birth reflects the common desire to control an otherwise uncontrollable situation. Cesarean deliveries can offer a sense of control during childbirth. Some actions by both mothers and physicians exemplify this desire. For physicians, a cesarean delivery allows for advance scheduling which can result in a better workload balance throughout the day, could reduce fatigue or possible sleep deprivation, and allows for improved personal work-life balance. 37,45,52 In an Arizona study, physicians were found to be significantly more likely to perform cesarean deliveries on weekdays, particularly Friday, and during daytime hours and less likely to perform them on weekends or at night. 37

For pregnant women, cesarean births can allow for control over her own schedule. She can plan when her maternity leave will begin, to maximize the benefit, and arrange to have her social support available for the birth and post-birth period. One study found that pregnant women who were employed full time were nearly twice as likely to have an elective cesarean than women who were not working during pregnancy. It was noted that this cross-sectional

comparison could not determine causality or if other factors aside from demographic and employment factors were the reason for the association.⁹⁰

2.3.4 Organization and Policy – Hospitals and Insurances

The current healthcare system relies heavily on controlling health situations with physical intervention, through medication, procedures, or major surgery. Labor and delivery are two situations that are not easily timed or controlled without medical interference. An institution's staffing structure, timetables for scheduling operating rooms, and availability of resources, such as labor room space, can all contribute to the decision to move forward with a cesarean delivery. There are also some financial considerations for institutions and health care providers to see cesarean deliveries as beneficial, whether or not they are medically necessary. The progression and longer use of room space, resulting in a lower patient turnover rate and reduced profits.

The US' malpractice legal system also contributes to healthcare decisions to rush to cesarean sections. In order to avoid even the possibility of complications, physicians will choose to move forward with a cesarean as opposed to proceeding with labors that are not progressing as desired.^{37,41,45} The increase of cesarean deliveries with an indication of "nonreassuring fetal status," despite a relatively stable number of high risk pregnancies, may be an indication of over precaution due to potential legal ramifications.^{45,46}

'Defensive medicine' is the modification of medical practices in order to avoid possible litigation.⁹³ When observing national trends in primary cesarean rates and VBAC rates and malpractice insurance premiums from 1991 to 2003, one study concluded that there is a statistically significant association between malpractice pressure and mode of delivery with a

positive association between average malpractice premiums and rates of total cesarean section (β = 0.15, p = 0.02) and primary cesarean section (β = 0.16, P = 0.009), with a negative association between the rate of VBAC (β = -0.35, P = 0.01). The study also concluded that there are lower rates of VBAC and higher rates of cesareans in states with high malpractice premiums compared with states with lower premiums. 94

A 2010 study's examination of the impact of Florida's obstetric malpractice claims on physicians' cesarean practices found that, after controlling for clinical risk factors, there was no variation in physician cesarean practices in response to litigation. While the study did not find an association between malpractice claims and cesarean rates, the study used data from 1992-2000 and recognized that an examination of more recent data could come to a different conclusion. On the other hand, even with a reduction in an association after controlling for market and hospital variations, a 2007 Texas study found that a statistically significant increase in natal malpractice lawsuits against physicians and hospitals led to more cesarean sections.

The quantification of perceived litigation or malpractice pressures is not a clear process. Two studies attempted to moreover these pressures through malpractice premiums and actual malpractice claims but did not try to quantify the physician's risk perceptions of litigation and malpractice. 93–95 Such risk perceptions may better predict "defensive medicine" practice resulting in unnecessary cesarean deliveries. While associations can be made from these measures, the relationship and causation still need to be further examined.

3.0 METHODS

Reviewing existing interventions can help us to understand the US' approach to reducing cesarean section. The purpose of this literature review is to assess current interventions to reduce cesarean births in the US. A Pubmed database search using the terms "approach," "policy," "strategy," "program," "intervention," "prevention," "doula," or "midwife" combined with a search for "cesarean section" or "VBAC" yielded 7939 articles. Restrictions on the search included limiting articles to English, human subjects, and singleton pregnancy. Restrictions also limited articles to interventions performed in the US and articles published between 2007 to 2016. These limitations narrowed the search to 240 articles. The search timeframe was selected to focus on articles published after the cesarean rate increases during the mid-1990s to the peak in 2009. By concentrating on this specific timeframe, this review could evaluate the interventions that could have curtailed the preceding rise in cesarean sections and later reduced the cesarean rate.

Of the 240 articles produced from this search, 109 articles were excluded for irrelevance to the topic, referring to reduction of cesarean-related infections, management of complications, early preterm deliveries, or individual case studies. Abstracts of the remaining 131 articles were individually reviewed. An additional 61 articles were excluded for discussing various epidemiological trends in birth related rates without an associated intervention. Fifty-seven

articles were excluded for being summaries of contributing factors to high frequency of cesarean sections and opinion pieces. One article was a duplicate.

The 12 remaining articles were studies comparing variations of cesarean rates following a program implementation, policy change, or structural adjustment. The data extraction guidelines developed during the review process. The guidelines included descriptions of the intervention, setting of the intervention, and cesarean rates before and after the intervention or in comparison with the standard of care. Articles included in this review were on the actual implementation of a program, intervention, or policy, not simply the recommendation or proposal for a new intervention. Articles had to provide a comparison of cesarean rates before and after the implementation of a program, intervention, or policy change or a comparison with a comparable standard of care.

4.0 RESULTS

Twelve articles met the literature review criteria. After reviewing the selected article, four intervention themes emerged. As displayed in Table 1, the article topics were placed into four overarching categories: hospital programs, staffing models, TOLAC policy impact, and insurance structures. Six articles discussed hospital-based programs and interventions that influenced physician practices and hospital policies and reduced non-medically indicated cesarean births. Most programs focused on reducing cesareans prior to 39 weeks gestational age. Three articles discussed the impact of changes to hospital staffing structures on cesarean rates. Staffing models used a combination of obstetricians, nurse-midwives, and doulas. Two articles discussed policy and recommendation impacts on the availability and access to TOLAC, which directly impacts the VBAC rate. One article discussed changes in insurance payment structure and their impact on cesarean rates.

Table 1. List of Cesarean Interventions Reviewed

Article Title	Authors	Year	Setting	Intervention Description	Outcome		
Intervention: Hospital Programs							
The perinatal quality	Berrien, et al.	2014	North Carolina	A program to decrease elective	Percent of elective early		
collaborative of			201	deliveries before 39 weeks of	term deliveries declined		
North Carolina's 39			33 hospitals	gestation	from 24% to 16% over a		
weeks project: a				*physician educational	9-month time period.		
quality			Including: most	components such as in-person			
improvement			academic and	learning sessions and weekly	Elective early term		
program to decrease			tertiary centers,	newsletters	deliveries declined from		
elective deliveries			regional centers,	*regional meetings to share	2% to 1.1% of all		
before 39 weeks of			and rural	strategies to achieve program goals	delivers		
gestation. ⁴⁹			community	*an exchange of recent literature			
			hospitals	*monthly webinars discussing			
				challenges, successes, and practice			
			Annual delivery	updates.			
			volume: 100-more	*changes to hospital policies			
			than 7,000	including consensus agreements,			
				peer-review processes, and			
				implementation of a "hard stop"			
A statewide	Donovan, et al.	2010	Ohio	A program to decrease elective	Percent of elective early		
initiative to reduce				deliveries before 39 weeks of	term deliveries declined		
inappropriate			20 hospitals	gestation	from 25% to 3.2% over		
scheduled births at				*promotion of best practices for	a 1-year time period.		
36(0/7)-38(6/7)			Including	determining medical indications			
weeks' gestation. ⁵⁰			hospitals in the 6	*adherence ACOG scheduling			
			major	standards			
			metropolitan areas	*educational awareness for			
			of the state	healthcare providers and women			
				about risks and benefits of early			
			Accounting for	term births			
			47% of the state's	*development of a "culture of			
			births	safety" based on departmental and			

Table 1 Continued

				quality meetings addressing the	
				topic	
A multistate quality	Oshiro, et al.	2013	California,	A program to decrease elective	Percent of elective early
improvement progra			Florida, Illinois,	deliveries before 39 weeks of	term deliveries declined
m to decrease			Texas, and New	gestation	from 27.8% to 4.8%
elective deliveries			York	*creation of a hospital quality	over a 1-year time
before 39 weeks of				improvement team	period.
gestation. ⁵¹			24 hospitals	*use of an implementation guide	
			_	and toolkit including:	
			Included	*strategies for establishing hospital	
			academic,	scheduling policies	
			governmental,	*standardize inductions and	
			nonprofit and for	cesarean scheduling forms	
			profit hositals in	*implementation of 'hard stop'	
			metropolitan and	scheduling process	
			nonmetropolitan	*conduct professional education	
			areas	*provide patient education material	
Decreasing elective	Oshiro, et al.	2009	Utah and Idaho	A program to decrease elective	Percent of elective early
deliveries before 39	,			deliveries before 39 weeks of	term deliveries declined
weeks of gestation in			9 hospitals	gestation	from 28% to less than
an integrated health			· · · · · ·	*creation of a leadership team:	10% over a 6-month
care system. ⁵²			Urban facilities	Women and Newborn Clinical	period.
				Integration Program Team	F
				* an extended education series	
				detailing the morbidities associated	
				with early term deliveries	
				*scheduling review of cesareans	
				prior to term by department chair	
				or attending perinatologist	
				policy change and intervention.	
				*patient education brochure about	
				the new policy	
				the new poney	

Table 1 Continued

Induction rates and	Yamasato, et al.	2015	Hawaii	A policy limiting elective	Elective inductions:
delivery outcomes				inductions with the intention of	Prior to policy = 4.8%
after			1 hospital	reducing cesarean deliveries.	After policy = 3.8%
a policy limiting			_	*prevents elective inductions prior	Elective cesarean
elective inductions. ⁸⁶			Urban hospital	to 39 weeks gestation	deliveries:
				*prevent elective inductions for	Prior to policy = 0.9%
			Annual delivery	39-40 weeks gestation with a	After policy = 0.1%
			volume:	cervix that is not ready for dilation	No significant change in
			approximately	or delivery	overall induction and
			6,000		overall cesarean
			,		deliveries rates
Reduction of	Grunebaum, et	2013	New York	A patient safety program	Decline in hospital
cesarean delivery	al.			including:	cesarean rate from
rates after			1 hospital	* a clear chain of communication	41.6% in 2004 to 32.7%
implementation of a			_	protocol	in 2012
comprehensive			Academic hospital	*standardized low-dose oxytocin	
patient			center	labor induction and augmentation	
safety program. ⁶⁵				protocol	
				*elimination of misoprostol use	
				*oxytocin initiation checklist	
				*retraining and certification on	
				electronic fetal monitoring	
				interpretation	
				*staffing changings to include an	
				obstetric patient safety nurse, a	
				laborist, physician assistants, and a	
				dedicated gynecology attending	
				*a ban on elective cesarean	
				delivery and induction prior to 39	
				weeks gestation	
Intervention type: Staf	fing models				
Implementation of a	Iriye, et al.	2013	Nevada	Three different labor and delivery	Cesarean rate for low-
laborist program and	-			staffing models	risk nulliparous women

Table 1 Continued

evaluation of the effect upon cesarean delivery. 16			1 hospital Tertiary hospital with no residency or midwife program Annual delivery volume: approximately 4,500-5,000	*traditional private practice *community laborist practice: community physicians for 24-hour coverage for unassigned patients *full-time laborist practice: physician team dedicated to inpatient care on distinct weekly shifts, covering both patients without an assigned physician and patients whose physician was unavailable	during: Traditional private care practice = 39.2% for a 16-month time period Community laborist = 38.7% for a 15-month time period Full-time laborist = 33.2% for a 2 year time period		
A hospital-based doula program and childbirth outcomes in an urban, multicultural setting.	Mottl-Santiago, et al.	2008	Massachusetts 1 hospital Urban, academic, tertiary care center	Four birth attendant staffing models women: *physician without a doula *physician with a doula *midwife without a doula *midwife with a doula	Cesarean section rate for primiparous women over a 7-year period Physician = 27% Physican and doula = 25% Midwife = 18% Midwife and doula = 15%		
Two practice models in one labor and delivery unit: association with cesarean delivery rates. ⁷	Nijagal, et al.	2015	California 1 hospital Community hospital	Two staffing models *traditional private care model *combined midwife/laborist model: a 24-hour in-hospital team led by the midwife made up of one certified nurse-midwife and one laborist physician	Cesarean section rate over a 6-year period Traditional private care practice = 31.6% Combined midwife/laborist model = 17.3%		
Intervention type: TOLAC policy impact							
A survey of access to trial of labor in California hospitals in 2012. ⁴⁷	Barger, et al.	2013	California 243 hospitals	Change in ACOG practice recommendations *ACOG Practice Bulletin Number 5 in 1999 – restriction of TOLAC to hospitals fully equipped to	% of hospitals NOT offering TOLAC 2003-2004 = 26% (n=63)		

Table 1 Continued

Diminishing availability of trial of labor after cesarean delivery in New Mexico hospitals. ⁴⁸	Leeman, et al.	2013	New Mexico 22 counties	immediately provide emergency care *ACOG Practice Bulletin Number 115 in 2010 – recommend TOLAC occur in facilities capable of emergency deliveries Change in ACOG practice recommendations *ACOG Practice Bulletin Number 5 in 1999 – restriction of TOLAC to hospitals fully equipped to immediately provide emergency care *ACOG Practice Bulletin Number 115 in 2010 – recommend TOLAC occur in facilities capable of emergency deliveries	2011-2012 = 42.8% (n=104) % of counties offering TOLAC 1998 = 100% (n=22) 2003 = 40.9% (n=9) 2008 = 31.8% (n=7) 2012 = 59.1% (n=13)
Intervention type: Insu		• • • • •			
Impact of the HealthChoice	Misra	2008	Maryland	* Implementation of the Medicaid HealthChoice managed care pay	Cesarean rate before and after program
Program on				structure	implementation
Cesarean Section					HealthyChoice:
and Vaginal Birth					1995 = 18.77%
after C-Section					2000 = 20.94%
Deliveries: A					Private insurance:
Retrospective					1995 = 23.33%
Analysis. ⁷⁰					2000 = 25.6%

4.1 EXISTING INTERVENTIONS

4.1.1 Hospital Programs

Different hospital-based programs have been developed to address the excessive cesarean birth rate. Four articles discussed statewide programs to prevent elective cesarean deliveries prior to 39 weeks gestational age, in accordance with ACOG recommendations.

North Carolina implemented a statewide voluntary intervention targeting hospital policies and individual physician practices. The nine-month intervention included physician educational components such as in-person learning sessions and weekly newsletters, regional meetings, exchange of recent literature, and monthly webinars discussing challenges, successes, and practice updates.⁴⁹ The 33 hospitals in this program also made changes to policies including consensus agreements, peer-review processes, and implementation of a "hard stop," a policy limiting physicians' ability to schedule cesareans without indication or review.⁴⁹ The proportion of elective cesarean deliveries declined from 24% to 16% of all 36 and 38 weeks gestation births over the study's nine month time period, beginning in 2009 to 2010.⁴⁹

In Ohio, a one year state-wide intervention focused on reducing early term elective cesarean deliveries.⁵⁰ 20 hospitals participated in the program.⁵⁰ The interventions promoted by the program included promotion of best practices for determining medical indications, adherence to ACOG scheduling standards, education on awareness for healthcare providers and women about risks and benefits of early term births, and development of a "culture of safety" based on

departmental and quality meetings addressing the topic.⁵⁰ This intervention saw elective scheduled cesarean deliveries decline from 25% of total early term births to less than 5%.⁵⁰

Both the Ohio and North Carolina interventions allowed for individual hospitals to choose the order in which initiatives were implemented to adjust for hospital nuanced needs.^{49,50} One limitation from the statewide programs was the focus on preventing early term cesarean deliveries, but not on preventing elective cesarean delivery once the pregnancy reached 39 weeks.^{49,50} The Ohio intervention, in fact, saw a rise in the number of scheduled cesarean births for full-term deliveries during the intervention.⁵⁰

A similar initiative to address elective early term deliveries took place in 24 hospitals in five states.⁵¹ Each hospital created a hospital quality improvement team to lead the program.⁵¹ Following a training seminar, each hospital received an implementation guide and toolkit including strategies for establishing hospital scheduling policies, standardizing induction and cesarean scheduling forms, implementing a 'hard stop' scheduling process, conducting professional education, and providing patient education material.⁵¹ Over the one year implementation period, monthly rates of elective early term deliveries decreased from 27.8% in January 2011 to 4.8% December 2011.⁵¹

While other similar initiatives were adopted with little resistance from healthcare providers, an intervention to limit early term cesarean deliveries in nine Utah and Idaho hospitals saw significant resistance.⁵² The result was an extended education series detailing the morbidities associated with early term deliveries to increase awareness about the issue until there was enough interest and support to move forward with the implementation of policy changes and intervention.⁵² After gaining support from healthcare providers, the program introduced other

parts of the intervention and saw cesarean birth baseline percentages near 28% reduced to less than 10% for all elective early term deliveries over a 6-month period of time.⁵²

A Hawaiian hospital evaluated the impact of a policy limiting elective inductions in accordance with ACOG recommendations with the intention of reducing cesarean deliveries.⁸⁶ The policy change occurred in 2011 and prevents elective inductions prior to 39 weeks gestation and elective inductions for 39-40 weeks gestation with a cervix that is not ready for dilation or delivery.⁸⁶ While the policy resulted in a decrease in overall elective inductions and elective cesareans prior to 39 weeks in the year following the policy change, there were no significant changes in the overall rates of inductions or cesarean deliveries.⁸⁶

In one New York study, investigators looked at changes in a hospital's cesarean delivery rate after implementation of a patient safety program that was initially created because of concerns of liability and litigation.⁶⁵ While it was labeled as a patient safety program, the program is better characterized as a standardization of the hospital's practice to reflect evidence-based practices. Between 2003-2009, the hospital introduced new practice standardizations, protocols, training, and staffing changes to increase patient safety.⁶⁵ With the program in place, the hospital's cesarean rate decreased from 41.6% in 2004 to 35.1% in 2010, to 32.7% in 2012.⁶⁵ The creation of a standard low-dose oxytocin labor induction and augmentation protocol was a significant aspect of the program, since high-dose oxytocin is associated with uterine hyperstimulation.⁶⁵ Since uterine hyperstimulation limits oxygen to the fetus and leads to fetal distress, high-dose oxytocin leads to an otherwise avoidable medical indication for cesarean delivery.⁶⁵ The program also required retraining and certification on electronic fetal monitoring interpretation to more accurately determine if a fetus was in distress.⁶⁵ The hospital also implemented a ban on elective cesarean delivery prior to 39 weeks gestation in 2009, though the

number of such cases was low even prior to the ban.⁶⁵ The program saw not only a decrease in the overall cesarean rate but in litigation cases.⁶⁵

4.1.2 Staffing Models

Several articles produced in the initial search discussed hospital staffing models and practice structures and touted the merits of models other than the traditional American obstetric and gynecologic practice model for labor and delivery.^{7,16,53,96–98} Three articles evaluated the impact of hospital staffing models on the rate of cesarean births in comparison to other labor and delivery staffing models.^{7,16,53}

In the traditional American obstetric and gynecologic private practice model for labor and delivery, physicians provide services to both inpatient laboring mothers in the hospital and outpatient clients in separate offices. 7,16,97 Because this model requires and allows for physicians to make labor management decisions from their outpatient offices or even their homes, the physicians typically are not physically present for much of a woman's progression through labor, often arriving for the delivery and more emergent situations requiring their physical presence. 7,16,97 While each hospital arranges its own staffing, generally a hospital creates a call schedule to cover patients without an assigned physician in addition to the care of its own patients. 7,16,97 Many variations on the laborist model, also referred to as an obstetric and gynecologic hospitalist, exist with various labels, yet all of the laborist models share the core principle of having a 24-hour physician physically present at the labor and delivery hospital without any outpatient duties. 7,16,97

Iriye et al.'s article analyzed one hospital's transition through three different labor and delivery scheduling practices: traditional private practice, community laborist practice, and full-

time laborist practice.¹⁶ The community laborist care model relied on community physicians for 24-hour coverage for unassigned patients who would have been covered by the traditional on-call physicians. The full-time laborist care model involved a four-member physician team dedicated to inpatient care on distinct weekly shifts, covering both patients without an assigned physician and, upon request, other physicians' patients. The full-time laborist program significantly decreased cesarean rates for nulliparous low-risk women.¹⁶ The traditional practice's cesarean rate was 39.2% while the full-time laborists had a cesarean rate of 33.2% a significant difference (p<.01).¹⁶ When adjusted for clinical and demographic maternal variables (adjusted OR, 0.77; p< .001), the laborist group still significantly reduced the odds of a cesarean birth, and therefore the practice's cesarean rate.¹⁶

Similarly, Nijagal et al.'s article compared the traditional private care model with a combined midwife/laborist model in one hospital's labor and delivery unit.⁷ The midwife/laborist model utilized one certified nurse-midwife and one laborist physician on a 24-hour, in-hospital team led by the midwife.⁷ There were significant differences in the models' patient populations including age, ethnicity, and insurance type, despite both models practicing in the same hospital.⁷ After adjusting for confounding maternal medical and demographic variables, women in the traditional private practice had higher odds risk of cesarean delivery for indications requiring providers' clinical judgment compared to women in the midwife/laborist model (28.1% vs 15.6%; adjusted OR, 1.69; 95% CI, 1.21–2.37).⁷ Compared to the 17.3% of all midwife/laborist model births, 31.6% of all the traditional private care births were cesarean deliveries (adjusted OR, 2.11; 95% CI, 1.73–2.58).⁷ Women with the traditional private practice were significantly more likely to undergo induction of labor and receive an epidural compared to women in the midwife/laborist model.⁷

At Boston Medical Center, all women delivering at the hospital, whether receiving care from a physician or a midwife, were eligible to work with a doula, a nonmedical professional provider of one-on-one emotional and informational support for pregnant women, starting at the beginning of their third trimester.⁵³ Women with doulas did have lower cesarean rates overall but the presence of doulas did not make a statistically significant difference. Instead, there was a statistically significant difference in cesarean rates based on who was the woman's primary birth attendant. Women with a midwife provider had cesarean rates of 15% with and 18% without a doula significantly (adjusted p-value 0.05) lower compared to 25% with and 27% without a doula for women who had a physician provider.⁵³

4.1.3 Compliance with Vaginal Birth After Cesarean Recommendations

Two studies investigated the impact of ACOG recommendations on the availability of TOLAC and VBAC rates in California hospitals and New Mexico counties. ^{47,48} In 1999, ACOG issued Practice Bulletin Number 5, which restricted TOLAC to hospitals fully equipped to immediately provide emergency care and 24-hour in-hospital anesthesia. ^{47,48} In 2010, ACOG's replacement Practice Bulletin Number 115 recommends that TOLAC occur in facilities capable of emergency deliveries but states that this component of their recommendation is not scientifically supported, instead, informed by consensus. ^{47,48}

A New Mexico study found 22 counties with maternity care units.⁴⁸ In 1998, all 22 counties had units that offered TOLAC, but in 2003 only 40.9% of the counties offered TOLAC.⁴⁸ By 2008, 31.8% of the New Mexico counties had a unit offering TOLAC, but following the 2010 change in ACOG recommendations the percent of counties offering TOLAC increased to 59.1% in 2012.⁴⁸ Obstetricians, family practice physicians, and midwives in New

Mexico hospitals that did not offer TOLAC identified anesthesia availability, hospital policy, medical malpractice policies, malpractice cost, and obstetric surgeon availability as the primary barriers to offering TOLAC.⁴⁸ These barriers are particularly pronounced for providers in rural hospitals and maternity units.⁴⁸ New Mexico's annual VBAC rate declined from 36.9% in 1996 to 12% in 2006 and saw a slight increase to 16.3% in 2012.⁴⁸

Unlike in New Mexico, the change in ACOG guidelines in 2010 did not improve accessibility to VBAC in California.⁴⁷ The California study found that 42.8% (n=104) of California hospital policies did not allow for TOLAC in 2011-2012, a significant increase from 26% in 2003-2004.⁴⁷ The California VBAC rate was 8.2%.⁴⁷ The study also found that 11.3% of California obstetrical residency programs were in hospitals that did not allow for TOLAC.⁴⁷ Investigators suggests that physicians may not be adequately exposed to and trained on TOLAC and VBAC case management during their residency program, which may impact their willingness to provide the service after residency.⁴⁷

Both studies found a range of hospital characteristics that influenced the likelihood of women having access to TOLAC and therefore VBAC. 47,48 Both studies also found that even when hospitals or maternity care units had a policy to permit TOLAC, the hospitals did not necessarily have physicians willing to provide TOLAC. 47,48 Strict interpretations of the recommendation by hospitals or physicians can result in little change in actual clinical practice from previous recommendations. Interpretation of "immediate availability" varies drastically between hospitals and maternity care units. 47,48 The strict interpretation is that a physician must be present through the entire labor with anesthesia and an operating room availability at a moment's notice. This is difficult for most facilities, resulting in physicians being unwilling to offer TOLAC or VBAC despite the fact that most women are eligible candidates. 47,48

4.1.4 Insurance Structure

Insurance payment structures may provide incentives for or against cesarean sections. Managed care organizations have an incentive to reduce utilization of unnecessary services, such as elective cesareans, whereas fee-for-service does not have such an incentive. One study looked at the impact of a policy shift in Maryland's Medicaid program on cesarean and VBAC rates. Prior to the implementation of the HealthChoice managed care structure, the state had used the traditional fee-for-service model. The study concluded that even though the cesarean rate in Maryland increased between 1995 and 2000, it was less for the Medicaid population than the privately insured population. VBAC rates decreased for both populations during the observed times.

5.0 DISCUSSION

5.1 GAPS IN EXISTING INTERVENTIONS

Factors at each level of the socioecological framework contribute to high cesarean birth rates. While some existing interventions made efforts to address multiple of levels of the socioecologial framework, most interventions only addressed a single level. In this review, most interventions occurred at the hospital level. This is understandable since it is often the highest level of change without involving outside regulation. But the WHO warns against holding individual hospitals to an absolute ideal cesarean reduction rate since hospitals serve different populations with varied risk factors. Therefore, future interventions should extend beyond individual hospital programs. An examination of the limitations and gaps in existing interventions will indicate areas for future efforts to reduce elective cesareans.

5.1.1 Implementation of Recommendations

The California and New Mexico TOLAC policy assessments show how a single-level intervention, such as the 1999 Practice Bulletin Number 5 and 2010 Practice Bulletin Number 115, can dramatically impact on health services and the cesarean rate. 47,48 Both studies' results indicated that substantial changes in accessibility to TOLAC followed the ACOG Practice Bulletins and suggested that some polices can be difficult to revise. 47,48 Both articles discussed

the role of recommendations interpretation, which can lead to wide variations in their implementation.^{47,48} To address this, future recommendations need to be precise in the language used and continue to provide anticipatory guidance with the Practice Bulletins.

A professional organization's recommendation, in this instance ACOG, is not able to immediately produce changes in physician or hospital practices. Even when a hospital policy reflects the ACOG practice bulletins, individual physicians may not change their practice.⁴⁷ The studies did acknowledge some contributing factors to physicians' unwillingness to offer TOLAC.^{47,48} Those included malpractice insurance coverage, unwillingness to adjust personal schedules, and lack of training for TOLAC management.^{47,48} It is important that individual hospitals have policies that reflect evidence-based recommendations from professional organizations. But professional organizations, hospitals, and public health stakeholders must collaborate to create supportive environments for healthcare providers to act on the professional practice guides.

The New York hospital patient safety program is an excellent example of incorporating ACOG's evidence-based recommendations into a program to standardize hospital protocols. ⁶⁵ By incorporating those recommendations into standard practices, the program allowed the hospital to reduce the rate of cesarean births and avoid unnecessary medical intervention. ⁶⁵ The program did not just make changes to protocols, but also supported its changes with appropriate training and additional staff. ⁶⁵ One study concluded physicians' treatment styles and decision making process for determining course of care are more strongly influenced by interventions at higher levels such as hospital-level changes and national recommendations than residency training programs or change in peers' treatment styles. ⁹⁹ While hospital and professional influences result in more significant changes in physician treatment

styles, it is imperative that interventions at these levels provide opportunities for practitioners to learn and adjust their individual treatments to more accurately reflect evidence-based practices to avoid unnecessary cesareans and therefore reduce the cesarean rate.

5.1.2 Expansion of Programs

Despite the effectiveness of the hospital-based programs to delay elective early term deliveries in multiple states, two program limitations should be addressed and improved.^{49–52} Currently, hospitals and states with these programs only participate voluntarily, and the programs do not extend their efforts to reduce elective cesareans after 39 weeks gestation. The evidence suggests mandating that hospitals participate in these programs would further reduce unnecessary cesareans in the US.

By 2014, various hospitals in ten different states had implemented programs restricting early term deliveries.¹² These programs would be beneficial if implemented in all states. Efforts need to expand the existing hospital-based programs across state lines and to all maternity hospitals. While each state's implementation will have variations, organizers can learn from the challenges faced and barriers overcome by previous states.

After expanding the programs addressing elective early term cesarean deliveries to all hospitals, the programs should move to reduce elective cesareans beyond the 39 weeks gestation age. While the risk of some neonatal morbidities declines by 39 weeks gestation, a cesarean section is still a major surgery with increased risk for maternal morbidities. Programs invoking a "hard stop" scheduling approach should use criteria to reflect the evidence-based recommendations for gestational age. Standardized protocols that reflect the evidence would also increase patient safety, as shown in the New York patient safety program. ⁶⁵ The programs would

need to continue providing educational components for the providers to compliment the changes to the hospital protocols.

5.1.3 Hospital Staffing: Laborists and Midwives

Healthcare provider staffing models can impact the rate of cesarean births.^{7,16,53} While each hospital has to allocate its personnel resources as efficiently as possible, hospitals should consider including laborists and midwives into their models for maternity care.

Laborists offer an improvement for obstetrician staffing structures because they provide continual surveillance and increase team coordination and management.¹⁶ As discussed earlier, physician convenience plays a critical role in labor and delivery decisions that may ultimately lead to unnecessary medical interventions and cesarean sections.^{37,45,52} The main argument against a laborist staffing structure is the potential risk of discontinuity of care since physicians are working on stricter shift hours with potentially more doctors transferring responsibility of care.¹⁶ Use of one-on-one birthing attendants remains the most recommended to avoid discontinuity of care during the birthing process.¹⁴

When physicians collaborate with midwives, cesarean rates decrease.^{7,53} Since the midwife model of birth focuses on the normalcy of birth, normal births can and should managed by midwives. Efforts should be made to increase the availability of midwives to attend low-risk births and rely on obstetricians as specialists for high-risk or complicated pregnancies. The main assumption made about implementing such collaborations between midwives and physicians is the willingness of physicians to relinquish their general monopoly as service providers for pregnant women. Interventions will be necessary to address this issue and will be discussed later in this paper.

5.1.4 Interventions Directed Toward Mothers

Of the programs, models, policies, and interventions reviewed in this paper, few indicated any direct efforts to intervene with mothers regarding cesarean deliveries. Three of the hospital-based programs mentioned an education based component directed toward mothers. Only two programs specified an education component that involved brochures and posters. None of the studies discussed an evaluation of the impact, acceptability, or effectiveness of this component of the hospital programs.

Cesarean reduction interventions targeted directly to pregnant women have unfortunately been minimally effective in the few studies available. A 2011 review of non-clinical interventions to reduce cesarean rates found six studies that intervened directly with pregnant women. None of the interventions occurred in the US. The interventions were a relaxation education program, a prenatal education with support program, a series of birth preparation classes, a computer-based decision aid, an intensive group therapy program, and decision-aid booklets. Only the relaxation education program and birth preparation classes had any significant reductions in cesarean rates. Future research in the US could determine if interventions such as birthing classes could address some mothers' fears around labor and delivery and encourage vaginal delivery.

Interventions to reduce cesarean rates should involve pregnant women, as some of the hospital programs did. Programs need an evaluation of these efforts to better understand their effectiveness. While interventions targeted directly to mothers may be effective for some women, systemic interventions targeted at changing the US approach to birthing and the healthcare providers will be necessary for drastic changes.

5.2 ADDITIONAL AREAS FOR INTERVENTION

Most interventions addressing cesarean birth rates focus on institutional level changes and recommendations from professional organizations. Expansion of such programs could see steady declines in low-risk cesarean birth rates, but gaps in interventions still remain. The primary focus for future intervention is increasing public awareness, acceptability, and availability of midwives and doulas. Efforts will be targeted at all levels of intervention. Opportunities to reduce such barriers include changes in insurance coverage and physician education.

5.2.1 Acceptability and Availability of Midwives and Doulas

The presence of midwives and doulas, despite their distinctly different roles in the birthing process, is associated with better maternal and neonatal health outcomes, reduced medical costs, and reduced cesarean birth rates. As shown in the Boston study, attendance by a midwife, whether or not assisted by a doula, resulted in a lower cesarean rate.⁵³ Despite the benefits and effectiveness of midwives as independent service providers, much of the US public has limited knowledge about midwives and hold generally negative perceptions of them.⁴⁴ Health communication campaigns will help promote more positive perceptions of modern midwifery practices. As efforts increase public awareness and improve public perceptions of midwives and doulas, career opportunities and training programs will need to meet the likely increase in demand for their services.

Campaign efforts could target a variety of target populations, such as pregnant women, physicians, healthcare providers, and the general public. Campaigns directed at pregnant women should provide awareness of and educational information about the variety of birthing attendants

available and the benefits of each. Campaign efforts from individual hospital systems and programs where physician and midwife collaborations are well established would be most effective. But in areas where physicians monopolize the care of pregnant women, independent organizations such as professional organizations and public health agencies should champion health campaigns for pregnant women to seek doulas for support services and midwives for birthing attendants.

It is important to recognize that as health campaigns and programs promote the benefits of doulas and midwives, the availability of properly trained midwives and doulas must meet the demands. Based on responses to a US nationally representative Listening to Mothers III survey, 5.9% of women had a doula while 27.3% of women wanted but did not have a doula. Compared to women who did not have a doula, those who had a doula showed a reduction in odds of cesarean delivery (adjusted OR:0.41, 95% CI, 0.18-0.96) and of an elective cesarean delivery (adjusted OR:0.17, 95% CI, 0.07-0.39), after adjusting for maternal characteristics such as age. Compared to women who did not want a doula, women who desired a doula but did not have one had higher odds of cesarean delivery (adjusted OR:1.48, 95% CI, 1.00-2.19) and of an elective cesarean delivery (adjusted OR:1.73, 95% CI, 1.10-2.73). This study concluded that wanting a doula was not inherently a characteristic of women with lower cesarean risks and that doula services could have a significant impact for women at higher risk of a cesarean delivery. The study also highlights the need for increased availability of doula services and the need for efforts to reduce the barriers that might prevent women from using their services.

5.2.2 Insurance – Personal and Professional

The insurance payment structure should be taken into consideration for interventions to reduce cesareans. In order to help eliminate a potential barrier to access, patient insurance policies should have expanded service coverage to all maternal healthcare and support providers, including midwives and doulas. This insurance coverage change would be especially beneficial for those with limited financial resources who could not independently afford the services of a midwife or doula. Insurance coverage should support payments to midwives and doulas for services provided, whether it be in a hospital, birthing center, or a planned home birth. Professional organizations and healthcare providers, including physicians and midwives, should work with insurance companies to create individual health, practitioner malpractice, and hospital insurance policies in a timely manner that reflect and allow for evidence-based practices instead of allowing the malpractice insurance industry to create medical practices, especially regarding VBAC and TOLAC policies.

5.2.3 Physician Education and Training

While some of the hospital-based programs involved an educational component for healthcare providers, some interventions need to focus directly on physician education and training, particularly for obstetricians. Two areas are critical to reducing physicians' reliance on cesarean sections: alternative techniques and appreciation of the midwifery approach.

According to an ACOG Consensus Opinion, improved physician training and familiarity with alternative birthing techniques, such as using a vacuum or forceps, could help reduce the reliance on cesarean births.⁴ For instance, operative vaginal delivery techniques, such as using a

vacuum or forceps, have been shown to have no significant difference in mortality compared to cesarean deliveries and do not include the same morbidities associated with cesarean sections, such as future increased risk of placental abnormalities.⁴ Yet despite the potential benefits of these techniques, the rates of such births have greatly decreased and fewer physicians receive proper training to perform them.⁴ Additionally, properly training healthcare providers in the manual rotation of fetal positioning to more favorable positions would also be able to reduce the use of cesarean sections.^{4,102} Interventions for physician education and training are needed to provide alternative birthing options for potentially avoidable cesareans.

Additional physician education, workshops, and training need to focus on the advantages of collaboration with midwives and on building trust and respect between the two fields of practice. Physicians, particularly obstetricians, may feel tension working with midwives. ⁹⁶ Early exposure to midwife practices during medical school and residency can help foster trust, respect, and willingness to collaborate between physicians and midwives. ⁹⁶ By intervening and educating physicians about the benefits of the midwifery approach to the birthing process, they can gain appreciation for minimizing medical interventions during a normal birthing process. Additional interventions could address physicians' attitudes toward midwives.

6.0 CONCLUSION

Currently in the US, nearly one in three births are by cesarean section.¹ While the cesarean rate did briefly decline in the early 1990s, the rate steadily rose until it peaked in 2009 at 32.9%.¹ As discussed in this thesis, medical indications for cesareans can be clear, such as uterine rupture, placental abnormalities or umbilical complications, while other indications can involve nuanced clinical judgment, such as labor progression arrest and fetal distress.^{7,9,10} Other maternal medical indications for cesarean include uncontrolled medical conditions, such as diabetes and high blood pressure, and active infections, such as HIV and genital herpes.^{7–9}

Cesarean sections can be life-saving for both the mother and baby when medically indicated, but it is still a major surgical procedure with its own risks. Each step of the procedure, from anesthesia to the closing sutures, presents an opportunity for complications. No data support medical benefits of the procedure without medical indication, instead the procedure increases the risk of otherwise avoidable maternal and fetal morbidities. ^{12–15} Yet despite the increased risks, medically unnecessary cesareans account for approximately 10% of US cesarean births. ^{12–14} Cesarean deliveries are associated with increased maternal and neonatal morbidities, such as postpartum hemorrhage, postoperative infections, respiratory disorders, and increased risk of placental abnormalities in future pregnancies. ^{16–20,23,24}

Several health organizations have called for efforts to reduce the high cesarean birth rates. The WHO gave a recommendation in 1985 to limit cesarean birth to 10-15% of all births,

but further examination of data lead to a change in its recommendation about their suggested maximum cesarean rate. 15,28,29 The WHO now recommends that cesarean sections should only occur when medically indicated. 15 Similarly, ACOG has issued statements to promote vaginal delivery for mothers without medication indications for a cesarean, though it does not explicitly prohibit cesarean delivery upon maternal request. 30,31 Despite previous recommendations discouraging TOLAC and VBAC, current ACOG Practice Bulletins state that most women with a previous cesarean section are eligible for TOLAC and VBAC. 30 Healthy People 2020 objectives call for a reduction in cesarean births for low-risk women with or without prior cesareans. 34

Many factors at each level of the socioecological framework contribute to the US' high cesarean rate. Some of the individual factors include increased maternal age, excessive weight gain during pregnancy, and fears of labor and childbirth.^{35–42} Perceived pressure and decisional cues from physicians, friends, and family members contribute to the interpersonal factors impacting cesarean deliveries.^{39,40} US cultural norms around childbirth present it as a medical event and that medical interventions, particularly cesarean sections, can proved some control over an otherwise uncontrollable situation.^{43,44} Hospital policies, systematic pressures, and malpractice concerns can influence a physicians' decision to proceed with a cesarean section, especially if a labor is not progressing as desired.^{37,41,45,46}

By conducting a literature review of interventions, programs, policies, and approaches to reduce cesarean rates, this thesis was able to assess and identify gaps in current efforts to reduce the US' cesarean delivery rate and propose additional areas for intervention. A PubMed literature review produced 12 articles of existing US interventions. Four thematic categories emerged from

the articles during the review: hospital-based programs, staffing models, TOLAC policy impact, and insurance structure.

Six articles discuss a variety of hospital-based programs that address cesarean deliveries rates, particularly for elective cesareans prior to 39 weeks gestational age. Four articles discussed the effectiveness of hospital-based programs to reduce the rate for early term elective cesarean deliveries in a wide range of hospitals, but these interventions did not attempt to reduce elective cesareans beyond 39 weeks gestation. 49-52 The Hawaiian hospital-based program focused on reducing elective inductions to reduce cesarean deliveries, but the program only decreased in early term elective inductions and cesareans and did not change the overall rates of inductions or cesarean deliveries. 86 The New York hospital's patient safety program standardized hospital protocols to reflect evidence-based practices and supported the protocol changes with additional training and staffing changes.⁶⁵ The hospital had a significant decrease in its overall cesarean rate. 65 Three of the reviewed articles discuss variations to hospital labor and delivery staffing models and their impact on cesarean delivery rates. One article followed one hospital's transition through three labor and delivery staffing models and concluded that cesarean rates for low-risk women declined with the use of a full-time laborist model.¹⁶ One article compared the two staffing models for two practices in the same labor and delivery unit. The study concluded that women were nearly twice as likely to have a cesarean with the traditional staffing model than the combined midwife/laborist model.⁷ One article compared the cesarean rates for women with or without a doula.⁵³ While doulas were associated with lower cesarean rates, it was not statistically significant, but cesarean rates based on having a midwife or a physician as the primary provider were significantly different.⁵³ Two articles evaluated the impact of ACOG recommendations on access to TOLAC and on VBAC rates. The New Mexico study saw a significant decline in the

number of counties offering TOLAC following the strict 1999 recommendations, but began to see improved availability after the 2010 recommendation changes.⁴⁸ VBAC rates for the state followed a similar pattern.⁴⁸ The California study also saw a similar decline in the number of hospitals offering TOLAC and in the VBAC rate, but when assessed in 2011-2012, accessibility to TOLAC had not improved.⁴⁷ The remaining article from the literature review discussed the impact of a program, HealthyChoice, which changed Medicaid insurance structure from traditional fee-for-service model to managed care structure. The article concluded that, because of the program, the cesarean rate for women with Medicaid had increased less than the cesarean rate for privately insured women, though the study did not provide statistical significance to support this claim.⁷⁰

Professional guidelines must be evidence-based, carefully worded, and supported with anticipatory guidance for implementation of recommendations. The hospital-based programs previously discussed should be implemented in every state and expanded to limit elective cesareans even beyond 39 weeks gestation. Traditional staffing models for hospital maternity care units should be restructured to include laborists and midwives since both are associated with lower cesarean rates. Currently, only limited efforts directly target individual mothers. Future research efforts need to evaluate the effectiveness of interventions directed at mothers in the US.

There are several additional areas for future interventions to reduce the cesarean rate. Health communication campaigns will increase public awareness of the services and benefits of working with a midwife or doula and increase acceptability of midwives and doulas. Career and training opportunities for midwives and doulas will need to increase as the health campaigns increase mothers' and the public's awareness of their services and benefits as maternal care providers. Insurance policies will need to provide coverage for the individual, providers, and

hospitals that decide to use midwives and doulas. These insurance policies also must provide coverage and support evidence-based practices such as TOLAC and VBAC, in order to provide women with alternatives to repeating a cesarean delivery. Physicians need to have formal education and training opportunities for exposure to the midwifery model of labor and delivery. These trainings would encourage more understanding, trust, and further collaboration between the two professional fields. As discussed, collaborations between midwives and physicians have lower cesarean birth rates than physicians alone. Physicians also need training in alternative birthing techniques, such as using a vacuum or forceps, since these techniques can provide physicians with more options to handle some situations instead of relying only on a cesarean section.⁴

Interventions at each level of the socioecological framework must be supported by programs, recommendations, and policies at other levels. Multifaceted approaches will be necessary to make sustainable reductions in the US cesarean birth rate. The intervention areas presented in this paper to reduce the US cesarean rate, especially elective cesareans, will not only impact the health and wellbeing of each mother giving birth, but the entire cultural approach to birth in the US.

The main limitation of this paper is that the search was restricted to interventions in the US. While other countries, particularly ones with lower national rates for cesarean births, may have interventions that could be beneficial in the US, the focus of this paper was to understand the current US efforts to reduce cesareans. The search to limited reviewed articles to those published in English, though this may be limitation it is unlikely to have been restrictive since the search was already restricted to articles about the US. By searching a single database, this literature review for all current efforts to reduce cesarean deliveries may be incomplete.

Additionally, since this thesis is a literature review, no original data were collected. Without having tested any of recommendations made by this paper, the effectiveness of the proposed interventions is unknown. The paper relied on the published results. Unpublished data could support the results of the programs, but these data were not included.

Factors at each level of the socioecological framework contribute to high cesarean birth rates. Interventions aimed at one level alone will not have the sustainable impact needed to change this trend. Interventions at each level must be supported by the interventions and policies from other levels. Recommendations from professional organizations need to be supported by evidence and research for best practices. Hospital protocols and insurance policies need to reflect the recommendations and provide training opportunities and staffing environments that can support those recommendations. A significant culture shift for US mothers and physicians will occur as midwives and doulas become an increasingly integral part of the birthing process. Awareness and education campaigns can help improve perceptions of midwives and further promote the midwifery model of birth, therefore changing the heavily medicalized approach to birth that is prevalent throughout the US.

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