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# Team-Based Care To Support Physiologic Birth: A Review Of Literature

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Team-Based Care to Support Physiologic Birth:  
A Review of Literature

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of the Requirements for the Degree

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Annemarie Heath

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Team-Based Care to Support Physiologic Birth:

A Review of Literature

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## Introduction

Practices that support the normal physiologic processes of labor and birth can avoid unnecessary medical intervention.<sup>1</sup> They are associated with improved maternal fetal outcomes including effective labor, optimal newborn transition, and early breast feeding. Longer-term outcomes include decreased perinatal morbidity through reduced complications of unnecessary surgical and medical interventions, and subsequent reduction in associated liability claims.<sup>2</sup> The World Health Organization (WHO) has long advocated that interventions during the normal birth process be limited, whenever possible, to those that are clearly supported by scientific evidence and have no known harms.<sup>3</sup>

Despite WHO recommendations, maternity care in the United States is often approached with a focus on risk, resulting in high interventions in many settings.<sup>4</sup> Defensive maternity practice has been identified as one of the factors contributing to the frequent use of obstetric medical interventions and decrease in physiologic birth practices.<sup>5</sup> Defensive medicine occurs when providers order tests or procedures, or avoid high-risk patients or procedures, in order to reduce their exposure to malpractice liability.<sup>6</sup>

Most women in the United States are at low risk for pregnancy complications; however, there has been a steady increase in the use of obstetric intervention that carries the potential for harm.<sup>5</sup> As examples, the cesarean delivery rate increased from 21% in 1997 to 32.7% in 2013<sup>7</sup> and the induction of labor rate doubled from 9.5% in 1990 to 23.3% in 2012.<sup>5</sup> The cost of maternity care, the single largest hospital expenditure at approximately \$111 billion per year, rose by 50% from 2004 to 2010, primarily due to an increase in obstetric procedures.<sup>8</sup>

The increased frequency of obstetric intervention has not necessarily improved birth outcomes. The incidence of postpartum hemorrhage increased by 26% from 1994 to 2006,<sup>9</sup> and the incidence of chorioamnionitis increased by 126% from 1995 to 2009.<sup>10</sup> Changes in the measurement of maternal mortality have created challenges in comparing current and past data. Regardless, the U.S. maternal mortality rate rose from 8/100,000 in 1990 to 17.8/100,000 in 2011.<sup>11</sup> The U.S. maternal mortality rate ranks 48<sup>th</sup> among developed nations in the world<sup>12</sup> and the infant mortality ranks 26<sup>th</sup>.<sup>13</sup>

Defensive maternity practices may contribute to the high rate of obstetric intervention and can create a barrier to physiologic birth practices. A 2008 survey of 883 physicians conducted by the Massachusetts Medical Society reported that 83% practiced defensive medicine due to liability concerns.<sup>6</sup> In a comprehensive literature review of evidence-based maternity care, Sakala and Corry noted that "fear of high cost awards to compensate families of children with disabilities appears to generate undesirable defensive behavior."<sup>5</sup>

The literature is limited and conflicted about defensive midwifery practice. A survey of 1340 CNMs found that exposure to litigation had no significant impact on management decisions.<sup>14</sup> However, a different survey of 282 CNMs found that 30% would typically use more diagnostic tests and introduce interventions earlier due to malpractice concerns.<sup>15</sup> One qualitative study poignantly illustrated these issues. Sixteen Australian midwives were interviewed after a legal investigation of cases with adverse outcomes.<sup>16</sup> They expressed feelings of fear and of being unsafe at work, anxiety, and terror of litigation. As a result, "their view of birth changed; they saw abnormal in everything" and felt that "normal birth was unrealistic." The midwives adopted a number of strategies to cope with this fear, including medicalizing labor management, relinquishing their clinical autonomy, and increasing the use of interventions such as electronic

fetal monitoring. The fear undermined their midwifery practice and ability to support physiologic birth.

Normal physiologic birth is a hallmark of midwifery care and is recognized as a key component in improving maternal fetal outcomes.<sup>1,3</sup> In 2012, the American College of Nurse Midwives (ACNM), in collaboration with Midwives Alliance of North America (MANA) and the National Association of Certified Professional Midwives (NACPM), issued a consensus statement to clearly define physiologic birth and identify key elements to promote the normal physiologic process. This statement has been operationalized through the Healthy Birth Initiative,<sup>1</sup> which calls for women, health care providers, and administrators to collaborate in teams to implement strategies to support physiologic birth. The ACNM, MANA and NACPM consensus statement describes normal physiologic birth as, “one that is powered by the innate human capacity of the woman and fetus.”<sup>18</sup> It is:

... characterized by spontaneous onset and progression of labor; includes biological and psychological conditions that promote effective labor; results in the vaginal birth of the infant and placenta; results in physiologic blood loss; facilitates optimal newborn transition through skin-to-skin contact and keeping the mother and infant together during the postpartum period; and supports early initiation of breastfeeding.<sup>18</sup>

Active support of physiologic birth allows the natural, hormonally-driven process to occur. The laboring woman can experience high levels of pain-relieving opiate beta-endorphins and the release of endogenous oxytocin, which facilitate labor progress, urge to push, decrease in postpartum bleeding, the initiation of lactation, and feelings of warmth and attachment.<sup>19</sup>

Physiologic birth is associated with decreased perinatal morbidity through the reduction of

complications associated with surgery and medical interventions, decreased iatrogenic adverse outcomes, and possible reduction in associated liability claims.<sup>1</sup>

The ACNM, MANA and NACPM consensus statement describes conditions and factors that disrupt normal physiologic birth. These include continuous fetal monitoring and cesarean delivery. Each of these, when performed as a result of evidence-based clinical necessity, is an important tool for the obstetric provider to ensure maternal infant safety and health. However, they can lead to unnecessary intervention or untoward outcomes when inappropriately used.<sup>18</sup> This statement has been operationalized through the Healthy Birth Initiative,<sup>1</sup> which calls for women, health care providers, and administrators to collaborate in teams to implement strategies to support physiologic birth.

Few strategies have been proposed to promote physiologic birth practices in settings where defensive maternity care is practiced. However, team-based maternity care has been studied as a method to decrease medical error in maternity settings through improved communication and teamwork skills.<sup>5, 17</sup> Can team-based care be used as a strategy to promote physiologic birth through decreasing defensive maternity practices? The genesis of this review of the literature was the first author's experience on a maternity unit that implemented defensive practices after a series of adverse events. The overall goal was to examine the intersection of physiologic birth practice, team-based maternity care, and defensive maternity practices in the literature.

### **Methods**

There are many factors that support or hinder physiologic birth. We chose to focus specifically on continuous electronic fetal monitoring (EFM) and cesarean delivery, as these practices were most affected by the adverse events in this clinical setting. Table 1 provides

operational definitions, key search terms, criteria for inclusion, numbers of studies reviewed and included, and significant findings.

Search engines used include OVID, CINAHL, Pub Med, Google Scholar and the Cochrane Library. The convergence between the terms physiologic birth, defensive maternity practice, and each individual intervention (electronic fetal monitoring (EFM) and cesarean delivery) was used. In addition, the term team-based maternity care was used. All literature generated by the search that was written in English and available electronically, or by interlibrary loan, was reviewed. Higher levels of evidence were given priority for inclusion. Table 2 provides the levels of evidence used to evaluate the studies.<sup>20</sup> Grey literature was included to provide a broader exploration of the issues, including the following sources: The Milbank Memorial Fund Report, the Childbirth Connection and the Reforming States Group<sup>19</sup>, and TRUVEN HEALTH ANALYTICS MARKETSCAN® STUDY<sup>8</sup> The data from the review of literature were organized according to major content area. Significant findings were synthesized to summarize the state of the science, limitations, identification of gaps, and implications for practice and future research.

## **Findings**

### **Electronic Fetal Monitoring**

Fetal heart rate assessment during labor and birth is essential in the evaluation of fetal wellbeing and can be easily incorporated into the support of a physiologic labor and birth. Fetal heart rate can be assessed with a stethoscope, fetoscope, hand held Doppler, or with electronic fetal monitoring (EFM) and can be done intermittently or continuously. EFM is the most common obstetric procedure in the United States and is used in 84% of all labor and births.<sup>21</sup> Continuous EFM can interfere with normal physiologic birth because it may increase maternal

discomfort, decrease maternal mobility, or place the focus on the machine rather than on the woman.<sup>5, 22</sup> Inconsistent interpretation of EFM findings may also increase the risk of cesarean delivery.<sup>23</sup>

Two major studies have been published that examine the effects of EFM on maternal newborn outcomes. A retrospective examination of more than 55 million singleton live births (22-44 weeks of gestation), through birth certificate data, found that the use of EFM increased by 17% from 1990 to 2004.<sup>21</sup> The increased use of EFM in births from 37-44 weeks gestation was associated with a 4-7% decline in 5 minute APGAR scores <4 and a 2% decrease in neonatal mortality. There were no differences in rates of neonatal seizures or cerebral palsy. This study had several limitations. Birth certificate data are often of poor quality. There was no documentation on whether EFM was used intermittently or continuously, and the risk status of the mother was not identified. It is critical to assess whether the EFM was applied appropriately, especially in high-risk women. The cesarean rate was increased by 2-4% for fetal distress, but was not reported for gestational age, making it difficult to draw relationships.

A Cochrane review of 13 trials with over 37,000 women compared intermittent auscultation with continuous EFM.<sup>24</sup> Continuous EFM was not associated with improved perinatal death rate (RR 0.86; 95% CI 0.59-1.23). Neonatal seizures were rare, but were less frequent in the EFM group (RR 0.50; 95% CI 0.31-0.80). Follow-up analysis found no difference in the incidence of cerebral palsy or neonatal death. Both studies found that continuous EFM was associated with a significant increase in cesarean birth (RR 1.63; 95% CI 1.29 to 2.07) and instrumental vaginal delivery (RR 1.15; 95% CI 1.01 to 1.33). None of the included studies analyzed the outcomes of EFM use according to appropriate use for pregnancy risk factors.<sup>24</sup>

The use of continuous EFM has consistently been associated with increased operative vaginal and cesarean delivery,<sup>24</sup> yet is imprecise in identifying fetuses with metabolic acidosis or hypoxic ischemic encephalopathy.<sup>25</sup> One explanation for this is the significant inter- and intra-observer variability of the interpretation of the EFM tracings. Chauhan and colleagues asked five physicians to interpret 100 fetal monitor strips.<sup>26</sup> Although all physicians used the American College of Obstetrician and Gynecologists (ACOG) approach on interpretation of EFM tracings, there was poor agreement in identification of episodic patterns, fetal heart rate baseline, or whether the overall tracing was reassuring or not. It is suggested that inconsistent interpretation of abnormal or unclear fetal heart rate tracings are responsible for increased operative delivery and associated economic costs.<sup>23, 27</sup>

Even though the efficacy of continuous EFM has not been established for low-risk women, and there is no evidence showing a relationship between EFM heart rate tracings and early identification of impending fetal neurologic damage,<sup>27</sup> EFM is often considered key for the prevention of cerebral palsy and neurologic birth injuries by the court system.<sup>28</sup> Carpentieri and colleagues summarized an ACOG review of 1117 obstetric claims.<sup>29</sup> Neurologic damage was the primary allegation in 27.4% of claims and stillbirth or neonatal death accounted for 15%. When asked about the primary factors associated with these claims, 22.1% of respondents cited electronic fetal monitoring. There is the potentially erroneous assumption by the court systems that “earlier and more expeditious intervention may have produced an improved outcome.”<sup>27</sup> A review of literature of nurse-midwifery practice found that the continued use of continuous EFM by nurse-midwives was due to fear of litigation and a culture of fear in the work place.<sup>30</sup> The use of EFM is an example of an obstetric technology that has been accepted without adequate

evidence to support its use and universally adopted in ways that act as barriers to physiologic maternity care.<sup>5</sup>

### **Cesarean Delivery**

Cesarean delivery can be lifesaving to the mother or infant in selected situations including, but not limited to, placenta abruption, placenta previa, and cord prolapse.<sup>31</sup> However, cesarean rates have risen to 32.8% in 2012<sup>11</sup> without concurrent decreases in the rates of maternal or fetal morbidity or mortality.<sup>31</sup> Within specific geographic regions, there are variations of 200-300% that are not accounted for by medical need or patient preference.<sup>32</sup> This raises the question of whether or not cesarean delivery is overused. Unnecessary cesarean delivery results in the potential loss of benefits of vaginal birth. Interrupted skin-to-skin contact disrupts the activation of maternal infant oxytocin systems that promote breast feeding and bonding.<sup>19</sup> Infants may have decreased gastrointestinal colonization from vaginal bacteria, which may lead to increased susceptibility to autoimmune diseases.<sup>33</sup> Mothers report prolonged postpartum pain<sup>33</sup> and associated use of narcotics for pain control.<sup>5</sup>

Compared to vaginal deliveries, cesareans are associated with increased risks of adverse outcomes. The maternal mortality rate for vaginal births is 3.6/100,000 compared to 13.3/100,000 in a cesarean delivery.<sup>31</sup> The risk of amniotic fluid embolism is 3.3-7.7/100,000 in vaginal birth compared to 15.8/100,000 in a cesarean delivery. Cesarean delivery is associated with an increased risk of a major puerperal infection, increased blood loss, thromboembolism, anesthetic complications, and prolonged hospital stays. With subsequent cesarean delivery, there is an increased risk of placenta previa, placenta accreta, uterine rupture, pelvic adhesions, bladder and bowel injuries, and need for hysterectomy. Cesarean delivery is also associated with increased risks for the neonate, such as higher rates of NICU admission and perinatal death.<sup>31</sup>

The two most common reasons cited for cesarean delivery are abnormal labor progress and abnormal or indeterminate fetal heart rate tracing.<sup>31</sup> A retrospective cohort study of 9,381 singleton births compared the cesarean delivery rates of women receiving care from traditional, private, obstetrician-led practices with those of women giving birth using a midwife-obstetrician laborist model. After controlling for covariates, the women receiving care from the private group were twice as likely to have a cesarean delivery as those delivering with the midwife-laborist group (adjusted OR 2.11; 95% CI 1.73-2.58,  $p < .001$ ). Of women who had arrest disorders or fetal heart tracing abnormalities, those in the private group had significantly increased incidence of a cesarean delivery (28.1% vs 15.6%; OR, 1.69; 95% CI, 1.21-2.37). The authors proposed that providers in the private model had competing demands for their time and were more apt to proceed with cesarean delivery in instances of fetal distress or abnormal labor progress, rather than to observe closely and allow labor to progress. There were no significant differences in neonatal outcomes between groups.<sup>35</sup> Assuming that the midwife-laborist providers were more likely to support physiologic birth practices, this study suggests they may decrease the rate of cesarean birth.

The cesarean delivery rate has been cited in the literature as an indicator of defensive maternity practice. Minkoff states that, of the nine most common reasons for malpractice lawsuits in obstetrics, six could “in some manner ... involve the possible allegation of failure to perform a cesarean section or, if performed, failure to perform it in a timely fashion.”<sup>36</sup> ACOG found that 24% of physicians had increased their cesarean delivery rate in response to fear of being sued. The average damages awarded for a successful lawsuit of a neurologically impaired infant was \$982,050 and the average cost to the physician to defend a case was \$50,000.<sup>37</sup>

Cesarean delivery is an essential component of safe maternity care. However, inappropriate cesarean delivery due to fear of litigation has a profound impact on practice that supports physiologic birth and potential for short and long-term complications.

### **Team-Based Maternity Care**

Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS™) is a systematic approach based on Crew Resource Management (CRM) to integrate teamwork into health care practice.<sup>38</sup> It was developed by the Department of Defense and the Agency for Healthcare Research and Quality in direct response to the 1999 Institute of Medicine report, *To Err is Human* which proposed that human error is inevitable and is a valuable source of information.<sup>19</sup> TeamSTEPPS uses standardized communication techniques within an interdisciplinary, nonhierarchical, problem-solving approach.<sup>39</sup> The goal was to improve the quality, safety, and efficiency of health care through team-based care to improve patient care outcomes. TeamSTEPPS™ is based on 25 years of research that has consistently shown improvements in communication, attitudes, role clarification, perceptions of improved team functioning, as well as a decrease in adverse outcomes and medical errors.<sup>40,41</sup>

There are no studies that specifically examine how TeamSTEPPS™ interventions impact physiologic or defensive maternity practices. However, there has been some research on the effects of team-based maternity care on safety measures and outcomes that might be extrapolated to support physiologic birth through team-based care. A comparison study was performed on a maternity unit in a tertiary care center that evaluated perinatal outcomes before and after a team-based intervention program was initiated.<sup>42</sup> Team training, based on CRM, was introduced to address difficulties in communication and create interdependent team culture among the provider groups and staff. A total of 13,622 deliveries were included in the analysis. There was a

significant decrease in the incidence of adverse events ( $r^2 = 0.33$ ,  $p < .001$ ) after the CRM initiatives were introduced, but there was also a significant increase in cesarean rate ( $r^2=0.50$ ,  $p=.01$ ). The authors proposed that the increased cesarean rate was due to national trends and response to mounting liability concerns.

Nielsen and colleagues conducted a randomized controlled trial, in which CRM team-based training was introduced in seven hospital maternity units.<sup>43</sup> No improvement in the incidence of adverse events was found four months after the training. The authors acknowledged that one four-hour training session, with only a four-month implementation period, might not have been sufficient to change behavior. This finding is consistent with other studies that show that sustained change must be cultivated through ongoing feedback, support, and training.<sup>38</sup>

Harris et al. performed a retrospective study to evaluate the effects of an interdisciplinary care program designed to promote physiologic birth.<sup>44</sup> They compared perinatal outcomes of 1,238 women enrolled in a birth program that utilized a multidisciplinary, team-based model that included care from nurse-midwives, family practice physicians, doulas, and the option to enroll in group prenatal care. These were compared with 1,238 women who received standard care that included routine periodic visits with the physician or nurse-midwife. Overall, 41.9% of the births in the program group were attended by midwives, compared with 7.4% in the comparison group. The participants in the birth program were less likely to have a cesarean (RR 0.76, 95% CI 0.68-0.84), more likely to receive intermittent auscultation (RR 1.41, 95% CI 1.31-1.53), less likely to use epidural anesthesia (RR 0.75, 95% CI 0.69-0.81), and less likely to have labor induced (RR 0.83, 95% CI 0.74-0.93). The authors concluded that the most effective components of the program were the close working relationship and the ability to discuss patient care within the team.

Multidisciplinary, team-based care has been shown to improve communication, safety awareness, staff attitudes, and to decrease the incidence of adverse outcomes on maternity units.<sup>45, 46</sup> However, the data on the effects of team-based care on cesarean delivery is conflicted, possibly due to the increased liability pressure on physicians.<sup>42</sup> There is also some evidence that team-based care supports physiologic maternity practices; however, more research is needed.

### **Discussion**

There is mounting evidence that supports the maternal newborn benefits of physiologic maternity practices. However, as indicated by this literature review, these practices are not being readily embraced by maternity care providers, and maternity care in the U.S. persists in a high-risk, high-intervention environment.<sup>4</sup> Kennedy and an international team recently performed an analysis of research gaps in quality maternal newborn care. The authors proposed a shift in research priorities to seek “knowledge beyond the treatment of complications, to inform better ways of providing sustainable, high-quality care, including preventing problems before they occur.”<sup>47</sup> Eleven research priorities were isolated, including one that identifies and describes “aspects of care that optimize, and those that disturb, the biological/physiological processes for healthy childbearing women and fetus/newborn infants and those who experience complications.” Sakala and Corry observed that the overuse of certain maternity interventions that interfere with physiologic birth (such as EFM and cesarean birth) and were initially developed for specific medical conditions have now become routine. At the same time, there is widespread underuse of preventative and supportive maternity practices (such as continuous labor support, ambulation, and non-supine positions for delivery).<sup>5</sup>

The question must be asked why maternity care providers, in the face of clear evidence, are resistant to adopting maternity practices that support physiologic birth. The literature shows

a relationship between the fear of liability or a poor outcome, with the persistent overuse of specific maternity interventions that do not support physiologic birth.<sup>6</sup> Fear is a powerful barrier to change. Porter-O'Grady & Malloch describe how the health care environment is permeated with fear, which inhibits individuals' and organizations' willingness to attempt change.<sup>48</sup> Maternity care providers, charged with the health of a mother and infant, are recognized as some of the most vulnerable to litigation in health care.<sup>6</sup> A survey of 3282 obstetricians, nurse-midwives and nurses found that only 9% of physicians, 13% of midwives, and 13% of nurses shared their concerns with coworkers when faced with a safety issue.<sup>48</sup> This organizational silence may be due to fear of repercussions. In view of this environment, it is not surprising that maternity providers may be resistant to discussing, or fundamentally changing, long-held practices.

There is evidence that members of interdisciplinary teams may be more willing to adopt new practices when they embark on the change together.<sup>50</sup> The literature on safety provides examples of changes in a team based-care model (i.e. flattening the hierarchy, use of communication techniques that challenge the status quo) that are successful in decreasing the incidence of medical error and adverse events.<sup>45,46,49</sup> Team-based care may also provide a forum to discuss and implement fundamental change in maternity care, to embrace practices that support physiologic care and intervening only when the clinical scenario dictates it is necessary. In an effort to address the rate of unnecessary cesarean birth, ACOG released a consensus statement in 2014 that redefined the parameters of the normal labor and birth process, and abnormal fetal heart rate interpretation, both of which are more supportive of physiologic birth.<sup>51</sup> At a macro team level, ACOG and ACNM should partner to examine how they can encourage

maternity professionals to support physiologic birth. Future research is necessary to evaluate the efficacy of these strategies.

Team-based maternity care offers the opportunity for care providers to examine and discuss new evidence, and implement changes in practice on the individual and departmental levels. Communication skills that are embedded in team training empower individuals to address concerns so that they can reach areas of shared agreement that may challenge previously-held opinions. This has the potential to shift maternity culture away from one of fear and accusation, to one of curiosity, exploration and collaboration. A team-based culture provides the opportunity for change, allowing new initiatives, such as physiologic birth practices, to be implemented. The widespread adoption of physiologic birth practices has huge implications on the health of women and infants in the form of improved outcomes. These include a decrease in complications caused by unnecessary intervention, savings in health care costs, and improved maternal and newborn birthing and postpartum experience.

### **Conclusion**

Normal physiologic birth practices promote the innate birth process while judiciously using obstetric interventions when evidence-based clinical indications exist. Defensive maternity practices can serve as significant barriers to physiologic birth and can lead to increased use of obstetric interventions, which can result in an increase in adverse patient outcomes. There is some evidence to support the concept that team-based maternity care could decrease the incidence of defensive maternity practices and increase the capacity to support physiologic birth; however, there is still much to learn.

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Table 1: Summary of the Review of the Literature

<b>Physiologic Birth</b>				
Operational definition: <i>“A normal physiologic labor and birth is one that is powered by the innate human capacity of the woman and fetus” (p.2) and avoids unnecessary interventions. Support of normal physiologic birth processes, even in the presence of complications has the potential to enhance outcomes for the mother and infant (ACNM, 2012).</i>				
<i>Maternity practices that can support or hinder physiologic birth</i>				
<u>Electronic fetal monitoring</u> : <i>the use of cardiotocography to evaluate fetal well-being. It can be used intermittently or continuously (Alfirevic, Devane, Gyte, 2013).</i>				
Inclusion criteria: Highest level of evidence or clinical pertinence; 25 studies reviewed; 6 studies included				
Citation	Level of Evidence	Study Type/Population	Maternal Outcome	Neonatal Outcome
Alfirevic Z, Devane D, Gyte GML. Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour. <i>Cochrane Database Syst Rev.</i> 2013; 11. <sup>24</sup>	Level I	Meta-analysis of 13 trials comparing the outcomes of 37,000 women who had intermittent EFM vs. continuous EFM.	Significant increase in the risk of having a cesarean delivery (RR 1.63, 95% CI 1.29 to 2.07, n = 18,861, 11 trials) or instrumental delivery (RR 1.15, 95% CI 1.01 to 1.33, n = 18,615, 10 trials) with continuous EFM.	No differences in perinatal death (RR 0.86, 95% CI 0.59 to 1.23, n = 33,513) or cerebral palsy (RR 1.75, 95% CI 0.84 to 3.63, n = 13,252). Incidence of neonatal seizures decreased by half (RR 0.50, 95% CI 0.31 to 0.80, n = 32,386)

<p>Ananth CV, Chauhan SP, Chen HY, D'Alton ME, Vintzileos AM. Electronic fetal monitoring in the United States: Temporal trends and adverse perinatal outcomes. <i>Obstet Gynecol.</i> 2013; 121: 927-933.<sup>21</sup></p>	<p>Level III</p>	<p>Retrospective analysis of 55 million singleton live births from 1990-2004 examined the relationship between EFM trends and primary cesarean rates and neonatal morbidity and mortality.</p>	<p>Increased EFM use associated 2-5% increased rate of primary cesarean for fetal distress (RR 0.78 95%, CI 0.77 to 0.79)</p>	<p>5% decline in preterm neonatal mortality  No changes in incidence of neonatal seizure.</p>
<p>Chauhan SP, Klauser CK, Woodring TC, Sanderson M, Magann EF, Morrison JC. Intrapartum nonreassuring fetal heart rate tracing and prediction of adverse outcomes: Interobserver variability. <i>Am J Obstet Gynecol.</i> 2008; 199: 623.e1-623.e5.<sup>26</sup></p>	<p>Level III</p>	<p>Five clinicians reviewed 100 FHR tracings 1 hour before abnormalities and, if applicable, the hour before delivery. Weighted Kappa coefficients used to assess inter-observer variability and likelihood ratio of FHR tracing</p>		<p>Inter-observer variability of FHR is excessive, ability to identify newborn infants who have a low Apgar score or abnormal acid-base is poor.</p>

		to identify low pH.		
Clark SL, Nageotte MP, Garite TJ, et al. Intrapartum management of category II fetal heart rate tracings: Towards standardization of care. <i>Am J Obstet Gynecol.</i> 2013; 209: 89-97. <sup>23</sup>	Level V	Consensus panel reviewed the literature on EFM and outcomes and created algorithm to evaluate and manage Category II tracings.	Fetal heart rate patterns are a primary driver of rising cesarean rates.	No standard approach to the management of category II FHR patterns. Difficult to demonstrate the clinical efficacy of FHR monitoring
Graham EM, Ruis KA, Hartman AL, Northington FJ, Fox HE. A systematic review of the role of intrapartum hypoxia-ischemia in the causation of neonatal encephalopathy. <i>Am J Obstet Gynecol.</i> 2008; 199(6): 587- 595. <sup>25</sup>	Level V	Metaanalysis of 7 observational studies of nonanomalous infants with cord pH < 7, intrapartum fetal heart rate patterns and associated neonatal outcomes.		Ability of EFM to identify intrapartum hypoxia-ischemia is limited.
Stout MJ, Cahill AG. Electronic fetal monitoring: Past, present, and future. <i>Clin Perinatol.</i> 2011; 38: 127-42, vii. <sup>27</sup>	Level V	Historical literature review of the use of EFM, both continuous and intermittent in labor and delivery	EFM increases cesarean delivery rate, increases operative vaginal deliveries.	Does not reduce overall perinatal mortality or incidence of cerebral palsy. Recommended for high risk pregnancies

<p><u>Cesarean Birth</u> a surgical procedure where the fetus is delivered through an incision in the mother's abdomen and uterus (ACOG, 2010).</p> <p>Inclusion criteria; U.S. cesarean trends and factors associated with them, impact of cesarean delivery with hormonal physiology, clinical relevance; 21 studies/resources reviewed; 7 included</p>				
<p>American College of Obstetricians and Gynecologists, Society for Maternal Fetal Medicine, Caughey AB, Cahill AG, Guise JM, Rouse DJ. Safe prevention of the primary cesarean delivery. <i>Am J Obstet Gynecol.</i> 2014; 123: 693-711.<sup>51</sup></p>	<p>Level V</p>	<p>Comprehensive literature review of risks of cesarean birth and strategies for prevention of primary cesarean delivery. Literature graded according to level of evidence.</p>	<p>3 fold increase of major complications w cesarean vs vaginal delivery (2.7% vs 0.9%)</p>	<p>Increased neonatal risk of respiratory distress (1-4% vs &lt; 1%), risk of neonatal laceration (1-2%), no risk of shoulder dystocia</p>
<p>Buckley SJ. Hormonal Physiology of Childbearing: Evidence and Implications for Women, Babies, and Maternal Care. <i>Washington, District of Columbia: Childbirth Connection Programs, National Partnership for Women &amp; Families.</i> 2015.<sup>19</sup></p>	<p>Level V</p>	<p>Synthesis of literature of physiologic birth and practices that can interfere with physiologic birth.</p>	<p>In pre-labor cesarean delivery: reduction in oxytocin and prolactin receptor peaks in the breasts and brain with potential impacts on breastfeeding, maternal adaptations, and maternal-infant attachment</p>	<p>In pre-labor cesarean delivery: postpartum breathing difficulties, hypoglycemia, and hypothermia</p>
<p>Dahlen HG, Downe S, Kennedy HP, Foureur M. Is society being reshaped on a microbiological and epigenetic level by the way women give birth? <i>Midwifery.</i> 2014; 30: 1149-1151.<sup>33</sup></p>	<p>Level VII</p>	<p>Commentary based on current evidence that</p>	<p>Is society being reshaped on a microbiological and epigenetic level by the</p>	

		explores the possibility of profound changes in society and future health due to the way women give birth.	way women give birth?	
Declercq ER, Sakala C, Corry MP, Applebaum S, Herrlich A. (2013). Major Survey Findings of Listening to Mothers(SM) III: Pregnancy and Birth: Report of the Third National U.S. Survey of Women’s Childbearing Experiences. <i>J Perinat Educ.</i> 2014; 23(1): 9-16. <sup>34</sup>	Level VI	Survey of 1573 pregnant women by phone and/or online survey about their prenatal, intrapartum and postpartum care experiences.	Mothers reported the following 32% c-section rate 25% due to fetal intolerance 25% due to baby in the wrong position 14% due to labor too long 4% no reason	
Klagholz J, Strunk AL. Overview of the 2012 ACOG survey on professional liability <i>Washington DC: American College of Obstetricians and Gynecologists.</i> 2012: 1–6. <sup>37</sup>	Level VI	Survey of 9,008 OB/GYNs physicians completed survey on the impact of professional liability on practice.	51% report changes to their practice as a result of liability concerns.  15.1% reported increasing the number of cesarean deliveries and 13.5% indicated they stopped performing or offering VBACs.	

			Average claim was \$502, 473 and for a neurologically impaired infant \$982,051	
Minkoff H. Fear of litigation and cesarean section rates. <i>Semin Perinatol.</i> 2012; 36: 390-394. <sup>36</sup>	Level V	Literature synthesis on the relationship between cesarean rates and cognitive bias.	Author makes argument that rising cesarean rates are associated with increased fear of liability	
Nijagal MA, Kuppermann M, Nakagawa S, Cheng Y. Two practice models in one labor and delivery unit: Association with cesarean delivery rates. <i>Am J Obstet Gynecol.</i> 2015; 212: 491.e1-491.e8. <sup>35</sup>	Level II	Retrospective cohort study of 3987 women with singleton pregnancies managed by a midwife laborist model were compared to 5394 managed by a traditional private practice model delivered by obstetricians.	Women in the private model were significantly more likely to have a cesarean delivery (31.6% vs 17.3%; $P < .001$ ; adjusted odds ratio [aOR], 2.11; 95% confidence interval [CI], 1.73-2.58) than women in the midwifery laborist model.	

**Interdisciplinary Team Based Maternity Care**

Interdisciplinary Team Based Maternity Care: the provision of services to women and their families that include at least 2 health care providers who work collaboratively with patients and their families to attain shared goals within and across health care settings to provide high quality, well-coordinated care (ACOG, 2016).

Inclusion criteria; highest level of evidence or clinical relevance for team-based care in maternity settings. 19 studies/resources reviewed; 10 studies included			
Citation		Study Design/Methodology	Outcomes
Haller G, Garnerin P, Morales MA, et al. Effect of crew resource management training in a multidisciplinary obstetrical setting. <i>Int J Qual Health Care</i> . 2008; 20: 254-263. <sup>45</sup>	Level III	Before-after cross sectional study to assess 239 participants' satisfaction, learning, and change in behavior after teamwork training.	63-90% were highly satisfied with the training experience, their learning showed significant change in teamwork and communication skills (p< 0.05) and positive change in team and safety climate (OR 2.9, 95% CI 1.3-6.3).
Harris SJ, Janssen PA, Saxell L, Carty EA, MacRae GS, Petersen KL. Effect of a collaborative interdisciplinary maternity care program on perinatal outcomes. <i>Can Med Assoc J</i> . <sup>44</sup>	Level III	Retrospective study comparing the cesarean delivery rate of 1,238 women who received team based interdisciplinary maternity care and 1,238 women who received traditional care.	Women in team based group were more likely to be delivered by a midwife (41.9% v. 7.4%, p , .0001), less likely to have a cesarean delivery (RR 0.76, 95% CI 0.68-0.84), shorter length of stay (mean +/-standard deviation 50.6 +/- 47.1 v 72.7 +/- 66.7h p < .0001) more likely to breastfeed at discharge (RR 2.10, 95% CI 1.85-2.39).
Nielsen PE, Goldman MB, Mann S, et al. Effects of teamwork training on adverse outcomes and process of care in labor and delivery: A randomized controlled trial. <i>Obstet Gynecol</i> . 2007; 109: 48-55. <sup>43</sup>	Level II	Randomized controlled trial at 7 hospitals. 1,307 personnel received 4 hours in team work training and 28,536 deliveries analyzed. Adverse Outcome Index scores were measured in the	There were no statistically different Adverse Outcome Index scores between the two groups. Possible reason is the short training with minimal follow up.

		control and intervention group.	
Nielsen P, Mann S. Team function in obstetrics to reduce errors and improve outcomes. <i>Obstet Gynecol Clin North Am.</i> 2016; 35: 81-95. <sup>39</sup>	Level III	Pre-post intervention design of 14,271 patients receiving care prior to team training and 19,380 post team training intervention	Adverse Outcome Index decreased by 23%, Weighted Adverse Outcome Score decreased by 16%. Data from their malpractice carrier showed a 62% decrease in the number of high-severity adverse events.
Pettker CM, Thung SF, Norwitz ER, et al. Impact of a comprehensive patient safety strategy on obstetric adverse events. <i>Am J Obstet Gynecol.</i> 2009; 200: 492.e1-492.e8. <sup>42</sup>	Level III	Adverse Outcome Index Indicator (AOI) score was measured while a series of initiatives were introduced including team based care. A total of 13,622 deliveries occurred during this period. Regression analysis was used to identify significant change.	Significant decrease in AOI score ( $r^2=0.50$ , $P= 0.11$ ). Safety Attitude Questionnaire showed improved “teamwork climate (38.5% to55.4%) and “good safety climate” (33.3% and 55.4%). Increased cesarean delivery rate ( $r^2= =0.50$ $P=.01$ ) and decreased episiotomy rate ( $r^2= =0.50$ $P=.01$ ).
Sawyer T, Laubach VA, Hudak J, Yamamura K, Pocrnich A. Improvements in teamwork during neonatal resuscitation after interprofessional TeamSTEPPS™ training. <i>Neonatal Network.</i> 2013; 32(1): 26-33. <sup>41</sup>	Level III	42 OB/pediatric personnel participated in TeamSTEPPS simulation training for neonatal resuscitation using a prospective pretest/post test design.	Significant improvements in team structure (pretest 2.5 vs posttest 4.2 [95 percent CI 22.0 to 21.4]; $p$ ,.001), leadership (pretest 2.6 vs posttest 4.4 [95 percent CI 22.0 to 21.4]; $p$ ,.001), situation monitoring (pretest 2.5 vs posttest 4.3 [95 percent CI 22.2 to 21.5]; $p$ ,.001), mutual support (pretest 2.9 vs posttest 4.3 [95 percent CI 21.8 to 21.0]; $p$ ,.001), and communication (pretest 3.0 vs posttest 4.4 [95 percent CI 21.6 to 21.1]; $p$ ,.001).

<p>Shea-Lewis A. Teamwork: Crew resource management in a community hospital. <i>J Health Qual.</i> 2009; 31(5): 14-18.<sup>46</sup></p>	<p>Level III</p>	<p>Retrospective analysis of change in AOI scores in 4,323 discharges prior to obstetric team training in team based care and 4,484 discharges on post training.</p>	<p>AOI scores significantly decreased from 0.07 to 0.04. (305 events to 187 events). 14.4% increase in staff teamwork scores, 13.5% increase in staff satisfaction and 5% in patient satisfaction scores.</p>
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Table 2: Levels of Evidence<sup>20</sup>

Level	Description
Level I	Evidence from a systematic review of all relevant randomized controlled trials (RCT's), or evidence-based clinical practice guidelines based on systematic reviews of RCT's
Level II	Evidence obtained from at least one well-designed Randomized Controlled Trial (RCT)
Level III	Evidence obtained from well-designed controlled trials without randomization, quasi-experimental
Level IV	Evidence from well-designed case-control and cohort studies
Level V	Evidence from systematic reviews of descriptive and qualitative studies
Level VI	Evidence from a single descriptive or qualitative study
Level VII	Evidence from the opinion of authorities and/or reports of expert committees

(Melnik & Fineout-Overholt, 2005).