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Association Between Breastfeeding, Oxytocin, and Risk of Postpartum Hemorrhage

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Tiny Tusks Internship:

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Introduction

Breastfeeding may carry a negative connotation in the public sector, but it is encouraged by healthcare providers. There is a juxtaposition between these two instances, and we have seen this tension firsthand. We have both found a love for women's health, and that love has led us to accept positions as Labor and Delivery nurses. Knowing that we will be encouraging and assisting mothers to breastfeed their babies has motivated our passion for helping women breastfeed with ease beyond the hospital.

While breastfeeding in public is legal in the state of Arkansas, many women feel pressure to breastfeed in private areas or simply choose to stay at home in order to feed their child. This could lead to breastfeeding mothers missing out on social events and outings which could be a contributor to early cessation of breastfeeding. As women's health experts and Eleanor Mann school of Nursing faculty assessed barriers to breastfeeding longevity, they recognized that mothers were avoiding or were unable to make desirable choices about breastfeeding in public at athletic events such as Razorback football games, basketball games, and gymnastics meets. This led to the creation of Tiny Tusks Breastfeeding and Infant Support, a grant-funded program that promotes community breastfeeding access and longevity, as well as opportunities for student learning.

From the fall of 2021 to the fall of 2022, we were given the opportunity to participate as interns for Tiny Tusks to provide spaces for women to breastfeed or pump. Throughout our time as interns for Tiny Tusks we provided breastfeeding services and education during Razorback athletic events. The mission of Tiny Tusks is to provide safe, comfortable, and clean spaces for mothers to care for their infants, as well as to reduce the negative stigma around breastfeeding by providing evidence-based research and education regarding breastfeeding. We achieved these

goals by providing two separate stations for women to breastfeed throughout the football stadium. These stations included education material and cold waters as well as a child enrichment table with temporary tattoos, coloring pages, and stickers for older children to enjoy while their mothers used our services. Through this program we hoped to promote exclusive and extended breastfeeding so that mothers and their infants receive its full benefit.

As Tiny Tusk leaders and interns we had the chance to engage with several mothers who shared with us the challenges they faced as breastfeeding mothers and how our service and services like ours have helped them continue breastfeeding. During the fall of 2022 we experienced exponential growth that we believe had to do with both the tapering of the COVID-19 pandemic as well as our individual role in utilizing the Tiny Tusks social media accounts to inform the public about the services that we provide and to promote breastfeeding.

Throughout our internship with Tiny Tusks, we learned about the importance of educating the community outside of the hospital setting and witnessed firsthand the impact that this education had on the public. This gave us excellent experience acting as healthcare professionals in the community and taught us more about the importance of breastfeeding accessibility, which is knowledge that we will use in our future field of women's health nursing.

Challenges and Lessons Learned

Tiny Tusks proved to be a valuable experience. It taught us about therapeutic communication, the importance of patient education, and gave us the opportunity to gain practical experience interacting with the public. However, we did face several challenges and learned important lessons along the way, many of which revolved around the COVID-19 pandemic.

The first challenge that we faced at the beginning of our internship for Tiny Tusks was still being in the middle of the COVID-19 pandemic. This meant that not only were there less people at the games, there also weren't many people that knew of the service that we provided. The patrons that had been using our services before the pandemic no longer needed them, so when a new football season began, we had to get the word out all over again and create a new base of people who knew about and used our resources. One way that we combatted this issue was by revamping our social media accounts so that more fans would know about us and use our services. We did this by making infographics, posting before events, and advertising our social media accounts at games.

Another challenge that we faced was exponential growth in the use of our services from the fall of 2021 to the fall of 2022. As the pandemic restrictions faded, more families brought their children to the games, including breastfeeding moms and their babies. While growth is good and we were glad to see so many people using our services, we were not prepared for the sheer amount of people that began utilizing our spaces. This led to lines at both spaces for mothers to use our facilities and a crowded waiting room at football games. To accommodate this growth, we hope to begin fundraising for additional location that will serve the Razorback community for seasons to come.

Literature Review

The United States has a tragically high rate of maternal morbidity and mortality, with 23.8 deaths per 100,000 live births (CDC, 2021). Rates of maternal morbidity and mortality are typically higher in lower income, lower resource populations. There are 21 counties in Arkansas that do not have a Woman's Health provider. Not only that, the rates for breastfeeding in

Arkansas are particularly low compared to the rest of the country; according to the CDC (2021), only 40-50% of infants in Arkansas are breastfed at 6 months which ranks the state 46th in the nation for breastfeeding rates. The issue of postpartum hemorrhage is extremely relevant as it pertains to overall maternal health before and after delivery. There are many factors that correlate to maternal health and safety. Initiation of breastfeeding after delivery is a key factor in safe maternal recovery, not to mention breastfeeding longevity (WHO, 2022).

Methods

Study Design

A systematic review of research and articles was conducted on the relation of breastfeeding and postpartum hemorrhage. The databases utilized were MEDLINE complete and CINAHL. The search terms utilized were (a) *postpartum hemorrhage,* (b) *breastfeeding* OR *breast-feeding* OR *infant feeding* OR *lactation* OR *lactating,* (c) *skin-to-skin,* (d) *oxytocin*. All sources were required to be peer-reviewed scholarly articles, written or translated in the English language, and published within the years of 2017-2022 unless the source was a pilot study providing the most recent research on the topic. This review was not limited by geography as breastfeeding and postpartum hemorrhage applies to individuals across the globe.

Inclusion/Exclusion Criteria

At the conclusion of our research, the articles we collected were reviewed against inclusion criteria. Articles were included based off the search question, “What is the association between breastfeeding and postpartum hemorrhage?” Articles were utilized in the review if they included (a) discussion of both breastfeeding initiation and its effect on postpartum hemorrhage;

(b) effects of oxytocin (both endogenous and exogenous) on the third stage of labor; or (c) post-delivery interventions and their impact on bleeding and/or breastfeeding initiation.

Search Results

The first search from CINAHL complete and MEDLINE complete produced a total of 31 articles with the parameters of full text, a time frame of 2017-2022, and with the Boolean phrases (a) *breastfeeding* OR *breast-feeding* OR *infant feeding* OR *lactation* OR *lactating*, (b) *postpartum hemorrhage*. After screening for duplicates, 25 were left. Additional screening was done for relevance and only four were selected for analysis. Finally, the remaining eleven articles came from the reference section of other studies, especially the two systematic reviews we were able to retrieve.

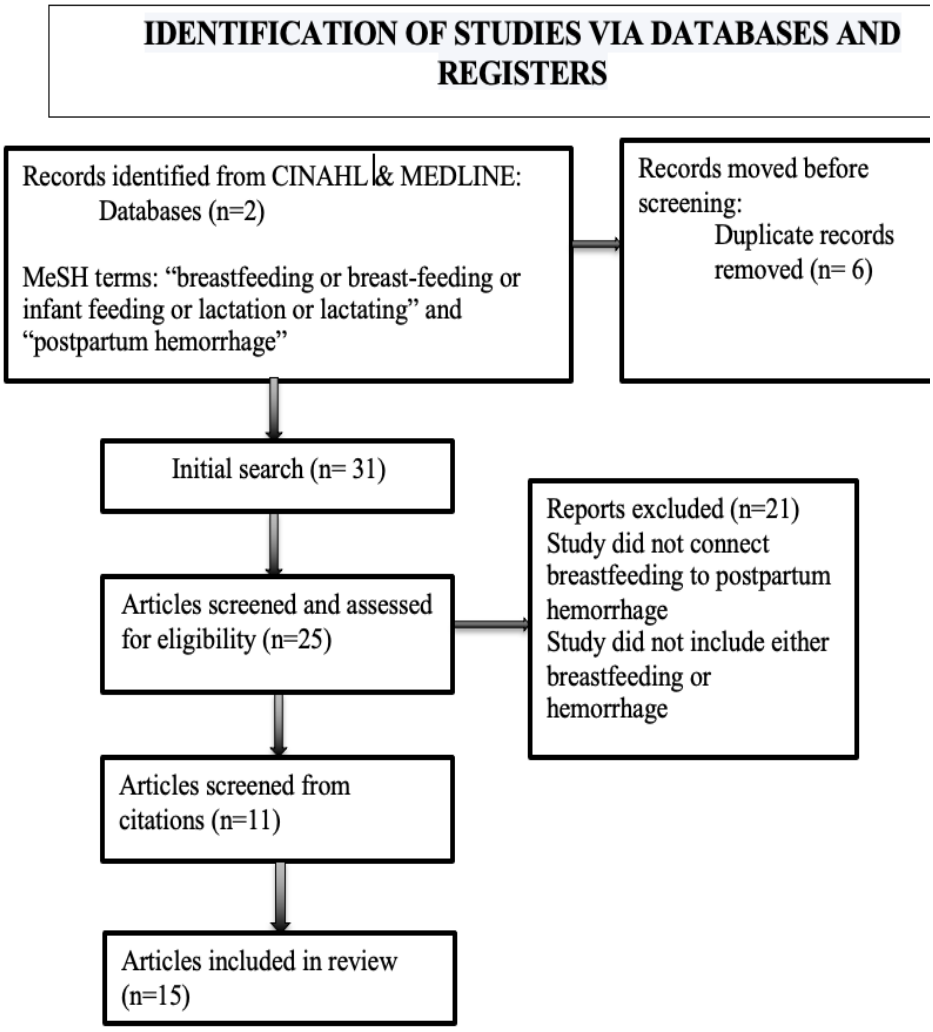

Figure 1. PRISMA flowchart to show article selection process.

Results

In 2020, Almutairi et al. found that women with postpartum hemorrhage (PPH) who participated in skin-to-skin contact (SSC) and breastfeeding (BF) had significantly less estimated blood loss (EBL) than women who suffered from PPH that did not get to participate in SSC and immediate BF. The study took place in the United States as a retrospective comparative chart review that reviewed 154 charts, 79 women with PPH and 75 without (Almutairi et al., 2020). They made note of studies that proved the overall increase in PPH in the last 20 years. Additionally, they described numerous studies that conducted experiments on the use of exogenous oxytocin to treat the third stage of labor rather than SSC, and how this intervention actually increased the likelihood for uterine atony leading to PPH. Endogenous oxytocin through SSC and BF, however, has long been shown to decrease EBL, decrease stress hormones like cortisol and adrenocorticotropic hormone (ACTH), and promote effective contractions of the myometrium (Almutairi et al., 2020). This study supported the advantages of endogenous oxytocin and therefore supported the promotion of SSC and BF over exogenous oxytocin administration.

In a retrospective population-based cohort study conducted in Australia in 2022, researchers Andrew et al. (2020) found "that the use of each of the intrapartum interventions investigated was associated with less favorable breastfeeding outcomes, both in hospital and in the months after birth" (p. 5). The study discussed how the rates of intervention after delivery have increased in Australia, and how this increase has been associated with a decrease in

breastfeeding success and longevity. Additionally, it was stressed that increased numbers of interventions in and around delivery increase the need for formula supplementation in the hospital, which has been shown to decrease successful breastfeeding in the hours and days after delivery as well as long term (Andrew et al., 2022). Similarly, another prospective cohort study by Morillo et al. (2018) focused on breastfeeding cessation evaluating the variables of oxytocin administration and type of birth. The study found that women who delivered vaginally and without exogenous oxytocin augmentation had the highest rate of successful exclusive breastfeeding, while lower percentages of exclusive breastfeeding were noted in women who received synthetic oxytocin (Morillo et al., 2018). They ultimately concluded that more research is necessary to concretely determine labor interventions' effect on long term breastfeeding success.

Dashtinejad et al. (2018) conducted a study comparing the effect of breast pump stimulation to the effect of oxytocin administration throughout the third stage of labor regarding the length and the amount of blood loss during the third stage of labor. Fifty-four women were randomly assigned to the breast pump stimulation group and 54 women to the synthetic oxytocin group. The women in the breast pump stimulation group received 10 minutes of intermittent breast pump stimulation on each breast and the women in the synthetic oxytocin group received 30 IU of oxytocin in 1000mL of Ringer's fluid at a maximum rate of 10mL per minute after delivery. They found that the "results demonstrated no difference between breast stimulation and administration of oxytocin regarding the length of the third stage of labor, PPH, and anemia in low-risk women. Using breast stimulation is cost effective and may be considered for women at low risk for PPH" (p. 7). These results imply that instead of intervening in an invasive way by using IV synthetic oxytocin, we can allow the body to use the endogenous oxytocin released

through breast stimulation to control the length of the third stage of labor, PPH, and anemia. In addition to these findings, it was found that the number of breast feedings 24 hours after delivery was significantly higher in the breast stimulation group (Dashtinejad et al., 2018).

Exogenous oxytocin can have a serious impact on the health and wellbeing of both moms and babies. Fernandez et al. conducted a pilot study in 2012 on the effects of intrapartum oxytocin on newborn feeding behavior. This was a relatively small Spanish study, with 20 healthy primiparous women as the participants. As the study progressed, they observed that intrapartum dosing of exogenous oxytocin resulted in decreased newborn sucking and associated breastfeeding reflexes (Fernandez et al., 2012). They went on to say that oxytocin used during labor may cross the newborn blood-brain barrier as well as the placenta, explaining the noted suppression of newborn feeding reflexes (p. 4). Oxytocin affected breastfeeding success not only in the first 24-48 hours after birth, but they followed these mothers and found that the women still exclusively breastfeeding at 3 months had received significantly lower doses of exogenous oxytocin during their labor and delivery. Not only can synthetic oxytocin harm a newborn's adjustment to extrauterine life, but it can also affect a mom's recovery. Another study conducted by Grotegut et al. (2011) discussed the association between oxytocin exposure in labor and hemorrhage related to uterine atony. Although seemingly contradictory on the surface, exogenous oxytocin is heavily associated with increased risk for uterine atony. This is due to desensitization of oxytocin receptors due to overstimulation, leading to decreased oxytocin-mediated uterine contractility (Grotegut et al., 2011). This study not only supported but expanded on that association. Their case control study demonstrated that women who hemorrhaged secondary to uterine atony were exposed to greater doses of oxytocin and for a longer period of time than women who didn't hemorrhage. Reduction in oxytocin administration was the

recommendation to reduce risk for such a costly adverse effect (Grotegut et al., 2011). Overall, it is fair to assert that oxytocin needs to be used both cautiously and sparingly for the betterment of moms and babies.

Monteiro et al. (2021) conducted a cross-sectional observational study analyzing the neonatal outcomes related to the interventions used during labor of 534 low-risk nulliparous women. The interventions that they examined were cardiotocography at admission, exogenous oxytocin administration during labor, amniotomy, use of the Valsalva maneuver, directed pulling, and episiotomy. These researchers found that the "use of obstetric interventions during labor in low-risk women is associated with unfavorable neonatal outcomes that lead to the need for further interventions after delivery" (p. 6). Cautious use of interventions (such as synthetic oxytocin) during labor to prevent further complications, such as postpartum hemorrhage, which leads to an interruption of SSC and breastfeeding is prudent (Monteiro et al., 2021).

In a retrospective cohort study by Saxton et al. (2015), the effect of SSC and breastfeeding on postpartum hemorrhage were evaluated. One unique feature of this study was the coining of the term "pronurturance" to describe a combination of SSC and breastfeeding. Like many other studies reviewed, they also discussed the high incidence of maternal morbidity and mortality and how much PPH contributed to this high rate of maternal danger. Pronurturance promotes the release of endogenous oxytocin which has exhibited more effective uterine contraction and less risky bleeding when compared to the exogenous form (Saxton et al., 2015). Emphasis on pronurturance education could empower women to push for pronurturance immediately after delivery and challenge providers/nurses to take a natural approach in order to achieve the same lifesaving result of reduced risk of PPH.

Kartal et al. (2021) conducted an assessor-blinded randomized control trial using 68 primiparous women and their infants to determine the impact that SSC has on the mother and the infant throughout the third stage of labor on PPH and pain. Thirty-four infants received SSC with their mothers 30 minutes after birth, and the other thirty-four received routine care instead. Data was collected regarding pain, postpartum bleeding, blood oxytocin, and beta endorphin levels between the two groups. They found that although there was no difference in beta-endorphin levels between the two groups, oxytocin levels were significantly higher in the SSC group rather than the routine care group of infants (Kartal et al., 2021). This indicated that the endogenous oxytocin released by the mother when experiencing SSC with their infant could be considered a sufficient PPH preventative measure in low-risk births.

In two different systematic reviews by Erikson et al. in 2017 and Jiang et al. in 2022, exogenous oxytocin was reported to have negative effects in both uterine contraction and effective breastfeeding. Synthetic oxytocin is known for its ability to augment labor, and due to its overall success, there has been little research conducted on its potential adverse effects, despite the continued increase of maternal morbidity and mortality in the United States in the past ten years (CDC, 2022). Jiang et al. (2022) concluded that there is moderate risk of uterine tachysystole and PPH when exogenous oxytocin is continued beyond the active stage of labor. They also confirmed that oxytocin doesn't expedite labor once the active stage has been reached. Exogenous oxytocin serves a purpose in necessary induction and augmentation of labor, but it is possible to overuse synthetic oxytocin past its therapeutic threshold. Erikson et al. (2017) state that synthetic oxytocin has also been shown to weaken newborn breastfeeding behavior in patients who received exogenous oxytocin. This finding indicates that exogenous oxytocin could cross the placenta and enter the fetal bloodstream. There is evidence that exogenous oxytocin is

beneficial until the point of active labor, at which point it is best to allow the labor process to proceed naturally and prevent unnecessary exposure to the baby.

The table below organizes and summarizes a collection of fifteen articles relevant to our review of literature regarding the association between oxytocin, PPH, and breastfeeding.

Table 1

Characteristics of Studies and Data Extraction				
Author(s) & Year	Design Method	Sample Size	Country	Significant Findings
Almutairi et al., (2020)	Retrospective comparative chart review	154 charts, 79 with PPH, 75 without	United States	Mothers who were able to participate in the combination of SSC + BF have a positive impact on the duration of the third stage of labor and estimated blood loss for both women with PPH and women without PPH. This stands in contrast to the effect of exogenous pitocin on rates of PPH and EBL.

Andrew et al., (2022)	Retrospective population based cohort study	599,191 primiparous women in Victoria, Australia	Australia	The use of intrapartum interventions was associated with less favorable breastfeeding outcomes, both in hospital and in the months after birth. Rates of intrapartum intervention use have increased in Australia over the last decade, which has increased formula supplementation in the hospital and decreased the likelihood of successful, exclusive breastfeeding, especially long term.
Charles et al., (2019)	Randomized control trial	4983 women	Egypt	The route of oxytocin administration should be standardized and specified. IV infusion or IV bolus administration of oxytocin may be preferable to IM injection in the third stage of labor. IV bolus delivery of oxytocin does not present any safety concerns regarding postpartum hemorrhage post vaginal delivery.

Dashtinejad et al., (2018)	Randomized control trial	108 women: 54 with breast pump stimulation 54 with oxytocin administration	Iran	No significant difference in the length of the third stage of labor, rates of PPH, or anemia were found between the two groups, indicating that breast pump stimulation may be utilized as a low cost and non-invasive intervention to prevent PPH, lessen the length of the third stage of labor, and lessen rates of postpartum anemia. Additionally, the number of breastfeedings 24 hours after delivery in the breast stimulation group was more than that in the control group.
Erikson et al., (2017)	Integrative literature review	26 studies	United States	Over half of the studies reviewed in this study reported suboptimal breastfeeding as a result of exogenous oxytocin use. While the existing research does not provide a clear answer of the effects of oxytocin, care providers may want to be observant for breastfeeding challenges among women and newborns who received oxytocin. Oxytocin exposure is likely a risk

				factor for suboptimal breastfeeding outcomes.
Fernandez et al., (2012)	Pilot study	20 healthy primipara women	Spain	The observed negative relationship between the oxytocin dose and early supplementation or artificial feeding could be related to the inhibitory effect on the newborn rather than by an effect on the mother. The current findings suggest newborn babies born to women receiving higher doses of intrapartum oxytocin could experience difficulties with some neonatal reflexes related to breastfeeding.

Gomes et al., (2018)	Retrospective cohort study	201 women, 101 with oxytocin exposure and 100 without	Portugal	This study suggests that intrapartum oxytocin exposure may negatively influence the first hour of breastfeeding. This corroborates the theory that exogenous oxytocin can cross the placental and fetal blood-brain barrier.
Grotegut et al., (2011)	Case control study	54 participants with PPH as a result of uterine atony	United States	This study demonstrated that women with severe PPH secondary to uterine atony were exposed to greater amounts of oxytocin and for a longer time.
Jiang et al., (2022)	Systematic review and meta-analysis	13 studies	China	There was moderate risk noted for uterine tachysystole and postpartum hemorrhage when oxytocin is continued beyond the active stage of labor. The study also confirmed that once the active stage of labor is reached, continuing oxytocin does not accelerate the duration of labor and therefore is not worth the increased risk of hemorrhage or disrupted uterine contractility.

Kartal et al., (2022)	Randomized control trial	68 women 34 in intervention group 34 in control group	Turkey	The maternal 30th-min oxytocin levels increased significantly after the SSC intervention. The skin contact applied at the third stage of labor reduced the amount of PPH in the first 24 hours after birth. A significant increase in the oxytocin levels of the mothers in the SSC group supported this result.
Monteiro et al., (2021)	Observational cross-sectional study	534 nulliparous women	Brazil	Interventions such as cardiotocography, oxytocin use, amniotomy, encouragement of Valsalva maneuver, directed pulling, and episiotomy during labor in low-risk women are associated with unfavorable neonatal outcomes that lead to the need for further interventions after delivery, therefore delaying SSC and breastfeeding initiation.

Morillo et al., (2018)	Prospective cohort study	529 full-term singleton pregnancies	Spain	Women who delivered vaginally and without exogenous oxytocin augmentation had the highest rate of successful exclusive breastfeeding, while lower percentages of exclusive breastfeeding were noted in women who received synthetic oxytocin.
Robertson et al., (2017)	Qualitative analysis	23 women who experienced PPH, 8 in a focus discussion, 15 via online survey	Canada	Overall, women felt supported and informed by their midwives. Only a few of them reported long lasting difficulty with breastfeeding as a result of PPH, but the majority expressed anxiety and disappointment due to lost SSC while dealing with the hemorrhage.
Thompson et al., (2010)	Multi-centered cohort study	206 women who suffered from PPH from 17 hospitals in Australia and New Zealand	Australia and New Zealand	Among women intending to breastfeed, those with the higher estimated blood loss were less likely to fully breastfeed in the first postpartum week than women with lower estimated blood loss according to this study. They also recorded delays in breastfeeding in women with PPH.

Saxton et al., (2015)	Retrospective cohort study	7548 women in over two years in two obstetric units	Australia	There was a significantly reduced risk (over 50%) of PPH when pronurturance (SSC and BF) had occurred. Even partial pronurturance (SSC or BF) showed less incidence of PPH compared to no pronurturance.

Discussion

Postpartum hemorrhage is one of the most pressing issues in maternal-fetal medicine and is worthy of research and discussion. It is overwhelmingly evident that there is a need for continued research on this topic due to both the lack of research and the danger of this maternal complication.

Clinical research has provided evidence that the more interventions performed the higher the need will be for further complications and thus more interventions (Childbirth Connection, 2022). These complications require more interventions which further delays the initiation of breastfeeding. From the studies reviewed it is indicated that SSC and breastfeeding should be initiated either in conjunction to or in place of synthetic oxytocin in order to prevent or decrease the likelihood of PPH and increase maternal and fetal wellbeing.

It is also relevant to mention that although some studies found that SSC did not equate to less reported pain, bleeding, or length of the third stage of labor, it also did not find that less interventions lead to more pain, bleeding, or longer length of the third stage of labor (Dashingtejad et al., 2018). SSC could be considered equally successful as a less invasive

method of PPH prevention. There is also a growing supply of data that suggests that SSC and timely initiation of breastfeeding after delivery comes with substantially reduced risk when compared to IV oxytocin administration. Coupling the comparable success rates of PPH prevention with SSC and exogenous oxytocin along with the dramatically reduced risk of complication with SSC makes SSC a far more appealing option for PPH prevention.

Although the use of fewer interventions is considered to be optimal in the situation of childbirth, there are times that the use of oxytocin is indicated. When indicated, oxytocin should be used in a standardized manner, citing IV bolus as the most effective method of oxytocin administration (Charles et al., 2019). If oxytocin must be used it should be used sparingly and for women who are not progressing on their own instead of to augment labor as a standard of care. SSC and breastfeeding should be the primary and initial intervention to prevent PPH and various other postpartum complications.

There were some limitations to the analysis performed. For one, the pilot study by Fernandez et al. was conducted in 2012, which is more than five years old and thus an older source than preferred. This study was included, however, because it is the most recent research on the topic of neonatal breastfeeding reflexes and the use of exogenous oxytocin during and post labor and is cited by several other researchers as the most relevant pilot study to base further research on. Additionally, the case control study by Grotegrut et al. was conducted in 2011 but was included for similar reasons of uniquely discussing relevant research and laying a good foundation for related research, pointing to the need for further research on the topic. Another limitation in this research is that only three of our studies were conducted in the United States. The standard of practice is different everywhere, and by using information collected from around the world it became clear that there is a lack of continuity in the standard of practice. Despite this

fact, however, PPH and breastfeeding initiation is something that affects women and infants all over the world, thus research conducted outside the United States could be relevant when assessing the larger issues addressed by this review.

As nurses we are bought into the nursing process, which prioritizes choosing the least invasive approach before advancing to more complex and invasive interventions. This approach is championed in multiple other channels of the healthcare system. This begs the question: Why do we not take the same approach in one of the most natural processes in medicine, childbirth?

Ultimately, more research is needed in order to make definitive statements about how exogenous oxytocin compares to the endogenous oxytocin released through breastfeeding and SSC and how that impacts PPH. This need was echoed in almost every study utilized in this literature review as it seems that the research currently available reflects the impatience of the healthcare industry to deliver quickly and on their schedule.

Conclusion

It is our belief that childbirth is made more complicated and risk-laden by utilizing several interventions at once rather than encouraging immediate breastfeeding and skin-to skin contact. Our literature analysis indicated that skin-to-skin contact and breastfeeding may be the most optimal and least invasive way to prevent complications for the mother and infants.

Research has indicated that the use of exogenous oxytocin could limit the infant's breastfeeding success and thus limit the duration and continuation of breastfeeding. If caregivers wish to encourage breastfeeding, then the standard of care in labor and delivery needs to reflect that goal by using interventions that are proven to increase breastfeeding success. Additionally,

the community needs to continue rallying behind initiatives such as Tiny Tusks to improve the community's access to adequate breastfeeding locations.

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