2020

Supporting Physiologic Labor: Effects of Hydrotherapy on Labor Outcomes

Ashley Y. Blaine
Bethel University

SUPPORTING PHYSIOLOGIC LABOR: EFFECTS OF HYDROTHERAPY ON LABOR OUTCOMES

A MASTER'S PROJECT

SUBMITTED TO THE GRADUATE FACULTY

OF THE GRADUATE SCHOOL

BETHEL UNIVERSITY

BY

Ashley Y. Blaine

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SCIENCE IN NURSING

MAY 2020

BETHEL UNIVERSITY

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Ashley Blaine

May 2020

Approvals:

Project Advisor Name: Jane Wrede, PhD, APRN, CNM

Project Advisor Signature: Jane Wrede

Second Reader Name: Katrina Wu_MSN, APRN, CNM

Second Reader Signature:

Director of Nurse-Midwifery Program Name: Jane Wrede, PhD, APRN, CNM

Director of Nurse-Midwifery Program Signature: Jane Wrede

Acknowledgments

To my parents: Words cannot express how grateful I am for all of the sacrifices you have taken and all of the encouragement you have given me throughout my life, but especially throughout this journey. When I needed inspiration to keep pushing forward, you were right behind me every step of the way, uplifting me. Thank you, thank you, thank you. I would also like to thank the rest of my family and friends who showed immeasurable understanding and immense support towards my journey to become a midwife. Without all of you, none of this would have been possible.

I have immense gratitude for the entire Bethel faculty. I admire all of the instructors and would like to acknowledge how well supported you have made me feel. In times of personal doubt and hardship, I was able to stay on track through your guidance and steadfast belief in my skills and abilities. A special thank you to Dr. Jane Wrede, my capstone advisor, who encouraged me to stay on track and has encouraged me since day one. Thank you for all of your time and the wisdom that you have shared on this project. With your help, I have created a piece of work that I am extremely proud of. I would also like to recognize the second reader and one of my biggest cheerleaders in this program, Katrina Wu, CNM, Nurse-Midwifery faculty at Bethel University. Over the years, your personal words of encouragement have inspired me more than you know and have pushed me to finish this journey.

Finally, to my fellow midwifery students, I am grateful to have traveled along this path with all of you. I have valued the collaboration and support from each and every one of you. Your dedication and passion to the profession of midwifery continues to inspire me to be better each and every day.

Ashley Blaine

Abstract

Background/Purpose: The purpose of this literature analysis was to identify the effects of hydrotherapy use in the first stage of labor. Although hydrotherapy has been well-studied and its benefits well documented, it is use in labor still remains under-utilized in the United States. There has been a recent rise in medical intervention in labor and a coinciding rising cesarean section rate. In an effort to promote physiologic labor, both the American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse-Midwives (ACNM) have issued statements supporting hydrotherapy use during labor.

Theoretical Framework: Katherine Kolcaba's Theory of Comfort provides a framework for the use of hydrotherapy and its role throughout the physiologic labor process. It can be utilized to promote holistic assessment and care. It will help guide them in providing comfort care to pregnant women in several settings.

Methods: 22 scholarly articles were evaluated and analyzed using the Johns Hopkins Research Evidence Appraisal Tool.

Results/Findings: Hydrotherapy use during the first stage of labor provides several benefits that promote physiologic labor. They include a decrease in pain, need for obstetric intervention, induction, and augmentation, epidural analgesia use, and anxiety. There was an increase in maternal satisfaction and movement during labor. Benefits were also seen in the levels of release of the hormones cortisol and endorphins.

Implications for Practice: Nurse-midwives can educate pregnant women on the benefits of hydrotherapy and how it facilitates a physiologic labor process. They are well trained to provide the option of hydrotherapy for use during labor.

Keywords: Hydrotherapy, Water immersion, Labor

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Chapter One: Introduction

Hydrotherapy is an umbrella term that encompasses water immersion in tubs and the use of showers (Cowan, Heale, Horrigan, & Koren, 2017). It is important to distinguish between hydrotherapy use during labor and/or water births. For the purposes of this paper, hydrotherapy will be referred to as an intervention that is applied using a tub or shower during the first stage of labor. Water birth, which involves the second stage of labor and delivery of the baby while in the tub, is not included in this review. Hydrotherapy is a useful intervention that can be applied by everyone involved in the labor process. Midwives, nurses, and doulas can implement this; even patients can do this independently at home during the earlier stages of labor.

Hydrotherapy has been used since ancient times by the Greeks, Romans, Chinese and other Eastern cultures (Cowan, Heale, Horrigan, & Koren, 2017). Water immersion during labor and birth has increasingly spread over the past 20-30 years. During the 1970s, hydrotherapy was restored in Europe by a Russian boat builder and a researcher named Michael Odent, who initiated a surge of popularity to promote water birth as he strongly believed in the physiological benefits associated with it (Cowan, Heale, Horrigan, & Koren, 2017). In the mid-1990s, the first international conference on water birth was held in London, bringing international focus to research on water immersion during labor (Cowan, Heale, Horrigan, & Koren, 2017). Since the 1990's, water immersion has become growingly more popular in various birth settings (Dykes, Johnson, Frazer, & Hussey, 2017). Unfortunately, there are differences in the availability of birthing facilities in terms of how well-equipped they are for hydrotherapy (Sanders & Lamb, 2017). Fifty percent of expecting mothers who desire to use hydrotherapy during labor do not have access to a hydrotherapy tub (Dykes, Johnson, Frazer, & Hussey, 2017). According to Harper (2014), less than 10% of all birth facilities in the U.S. are offering hydrotherapy as an

option. It was also discovered that facilities led by midwives were 4x more inclined to offer hydrotherapy than standard obstetric lead facilities.

In a position statement issued by the ACNM (2014), hydrotherapy use during labor delivers benefits including comfort and relaxation. It is a safe pain relief option that helps encourage physiologic childbirth. Other benefits for laboring women include reduced cesarean section rate, reduced use of medication, and enhanced maternal empowerment (Sanders & Lamb, 2017). It can also be useful in helping to progress labor along. It has been well documented that physical movements including walking or changing position can help labor progress. Keeping that in mind, women who use hydrotherapy might find it easier to move around because they are buoyant in a tub, potentially leading to faster labor progression and effective pain control. This paper delivers an analytical evaluation of the literature to identify the effects that hydrotherapy has on labor outcomes.

Statement of Purpose

This paper offers a critical analysis of research articles in order to evaluate if hydrotherapy use in labor encourages physiologic labor. This paper will inspect the effects of hydrotherapy on different outcomes including pain levels, length of labor stages, patient satisfaction, movements and positions utilized, and neuroendocrine factors.

Evidence Demonstrating Need

In the United States, the use of obstetric interventions during labor and delivery has become the standard of care. Over 50% of all women in labor receive synthetic oxytocin to stimulate or intensify their labor (ACNM, MANA, & NACPM, 2013). The use of medications necessitates further methods to monitor, avoid, or treat undesirable side effects. Women who

undergo a physiologic labor are less likely to have medical interventions performed that interrupts regular labor progression.

Physiologic birth is a process that is driven by the intrinsic capability of the woman and her fetus (ACNM, MANA, & NACPM, 2013). It is a process that begins spontaneously at term gestation, without the use of obstetric procedures or medications, that results in a normal vaginal delivery and uneventful postpartum course (Shaw-Battista, 2017). The U.S. had one of the highest cesarean section rates globally of 31.9% in 2018 (Centers for Disease Control and Prevention, 2018). To put that into better perspective, around 4 million women give birth in the U.S. each year and 1.5 million of them experience a cesarean delivery (King & Pinger, 2014). To address the high caesarean birth rate in the United States, different associations have called for alternative approaches to labor care. In 2014, ACOG and the Society for Maternal-Fetal Medicine encouraged evidence-based methods to safely avoid primary cesarean births. In 2017, ACOG released a committee opinion that outlines recommendations for limiting interventions during labor and delivery.

Comfort and pain management are also at the head of most birth discussion. According to Bailey (2017), labor pain is one of the biggest concerns to pregnant women. Some women prefer to undergo labor without the use of medication to manage pain in order to help encourage physiologic labor. There are several non-pharmacologic methods women can use to foster a physiologic birth, including acupressure, aromatherapy, chiropractic, massage, and hydrotherapy. Hydrotherapy is a complementary intervention that effectively helps manage labor pain and it can decrease the use of standard obstetric interventions, such as medical pain relief methods and labor augmentation (Shaw-Battista, 2017). Many professional organizations have published recommendations that focus on intrapartum procedures in order to reduce the cesarean rate.

Identifying care practices that encourage normal physiologic labor and birth has become an area of mounting interest in research (King & Pinger, 2014).

During labor, pain manifests in two ways, visceral and somatic. First, from pain receptors in the uterus and cervix followed by pain as the perineum stretches and distends putting pressure on the pudendal nerves (Sanders & Lamb, 2017). Pain is inevitable in labor, so women should be well prepared on that fact and supported throughout the process to remind her that the sensations she is feeling are normal. If they are tense or fearful, women may experience the 'fear cascade' where catecholamines, cortisol and vasopressin release is increased which further disrupts oxytocin production (Sanders & Lamb, 2017). Fear prompts the 'fight or flight' response. This triggers blood vessels to constrict, which decreases the amount of oxygenation to organs including the uterus (Sanders & Lamb, 2017). Decreased anxiety allows women to relax and feel more comfortable. Therefore, she is better able to move and change positions, and is more likely to find a comfortable position.

Taking a closer look into the physiology behind the beneficial factors of water immersion, Lapidus and Fountain (2015), state that water immersion helps facilitate the progression of labor by perfusing the uterus, increasing muscle relaxation, decreasing anxiety, and decreasing catecholamine levels (Dykes, Johnson, Frazer, & Hussey, 2017). The warmth of the water allows for blood vessels to dilate allowing better blood flow throughout the body (Stark, Rudell, & Haus, 2008). Muscle relaxation and limiting stress levels further help to decrease the sensation of pain by decreasing the release of cortisol and β-endorphins, while increasing the release of noradrenaline (Mascerhenas et al., 2019).

Optimal neuroendocrine function boosts the release of helpful hormones needed in labor such as oxytocin and catecholamines (ACNM, MANA, & NACPM, 2013). Women are also less likely to require artificial means to intensify labor, which can lead to negative outcomes such as interference with a woman's natural ability to manage pain, fetal compromise, or need for instrumental or surgical intervention (ACNM, MANA, & NACPM, 2013).

Oxytocin is useful during labor because it stimulates contractions that help dilate the cervix, guide the fetus through the birth canal, deliver the placenta, and minimize hemorrhage at placental detachment site (Childbirth Connection, 2020). Receptors that act in response to oxytocin slowly increase throughout pregnancy during labor. Childbirth Connection (2020), explains that the body's natural production of oxytocin during labor can be promoted by helping women to stay calm and avoiding disruptions, such as uncomfortable or unnecessary procedures. Finally, oxytocin affects mood by activating the parasympathetic nervous system, which produces calmness and reduce the activity of the sympathetic system (Johnson, 2016).

Endorphins are hormones that help with calming and pain relief. They are naturally produced by the body when someone experiences pain or distress. High endorphin levels can be beneficial in labor by producing an altered state of awareness that can help women cope with labor, even if it is a long and challenging process (Childbirth Connection, 2020). When women avoid using pain medication during labor, their endorphin levels continue to rise throughout labor and birth. According to Childbirth Connection (2020), research shows a sharp decrease in endorphin levels with epidural use or the use of other narcotic medications.

Adrenaline is the well-known "fight, flight, or freeze" hormone. Women who feel vulnerable or helpless during labor, either due to pain or fear, can produce higher levels of adrenaline, which can prolong labor or stop it altogether (Childbirth Connection, 2020). Too

much adrenaline can cause complications including, causing fetal distress, causing contractions to slow down, stop, or have an irregular pattern, and creating a sense of panic. When the blood is being shifted to the mother's heart and lungs, it is not being fully circulated to the fetus. Therefore, when women are laboring, adrenaline levels ideally should be low. If a woman feels a threat while laboring, her body can initiate the flight or fight response resulting in decreased blood flow to the baby (Johnson, 2016). Adrenaline can be kept at bay during labor by staying calm, comfortable and relaxed, having trust and confidence in her body and her capabilities. Childbirth Connection (2020), explains that being in a calm and private environment, among people who can provide comfort measures, offer good information, positive words and other support, further reduces adrenaline. Finally, avoiding intrusive, painful, or disruptive procedures contributes to relaxation instead of the "fight or flight" response.

Although hydrotherapy use in labor has been supported as a safe method by well-known organizations worldwide, when compared to pharmacologic pain relief methods, its use remains low, especially in the United States (Shaw-Battista, 2017). "Higher international utilization rates suggest a potential for increased US hydrotherapy utilization and benefits that may include support for labor physiology" (Shaw-Battista, 2017). From 2011-2012, 8% of women in the United States reported using hydrotherapy in labor (Shaw-Battista, 2017). The United Kingdom reported rates of hydrotherapy use ranging from 1.5% in hospital settings compared to 58% in midwifery led birth centers (Shaw-Battista, 2017). The differences can also be seen in other areas of labor and birth between countries. The differences in the frequency of obstetric interventions and inadequate use of hydrotherapy are significant when comparing the U.S. and U.K. In 2010-2011, The normal birth rate in the U.K. was 42%, which was 3x higher than for U.S. women at that time (Shaw-Battista, 2017). Around 20% of women in the U.K. used epidural analgesia for

labor pain in 2000 and 2005. Again, women in the U.S. had a rate that was 3x higher during the same time (Shaw-Battista, 2017).

When comparing infant and maternal rates, there is a difference between countries as well. When comparing the maternal mortality rate, in 2017, the United States had 720 maternal deaths, which is 19 deaths per 100,00 births (World Health Organization, 2018). By comparison, in the U.K., the maternal death rate was 5 per 100,000 births and in Brazil it was 74/100,000 births. (UNICEF, 2018). The infant mortality rate in the U.S. was 5.6/100,000 in 2018, 3.63/100,000 in the U.K., and 12.82/100,000 in Brazil (UNICEF, 2018).

Due to these discrepancies and the public health goals for evidence-based maternity care and normal childbirth promotion, further investigation and critical review of the literature is warranted to identify the effects of hydrotherapy use during labor.

Significance to Nurse-Midwifery

Certified nurse-midwives are health care providers that play a significant role in promoting physiologic birth, including the use of hydrotherapy. The practice of midwifery includes a comprehensive scope of services for women ranging in ages from adolescence through menopause (ACNM, 2012). The services include: primary care, gynecologic care, family planning services, preconception care, prenatal care, intrapartum care, postpartum care, newborn care for the first 28 days of life, and treatment of STI's (ACNM, 2012). Midwives conduct physical examinations, order and interpret laboratory tests, and have prescriptive authority including contraception and controlled substances (ACNM, 2012).

According to the ACNM (2014), women in labor should be given the opportunity to remain in water if they wish to do so. Women should be well-informed about the benefits and potential risks associated with hydrotherapy. As nurse-midwives, it is the provider's

responsibility to provide access to information regarding hydrotherapy research, and the researched benefits and risks of all available pain relief options (ACNM, 2014). Midwives can provide care, risk assessment, and education to women considering using hydrotherapy during labor.

It is also the nurse-midwife's responsibility to promote healthy and normal physiologic childbirth. Two Hallmarks of Midwifery can be used to support the use of hydrotherapy by midwives. These are: Advocacy of non-intervention in normal processes in the absence of complications and incorporation of evidence-based complementary and alternative therapies in practice (ACNM, 2012).

Providers play a significant role in how a woman's labor experience goes. When it comes to hydrotherapy and its effectiveness, providers can also play a big part in that as well. Midwives can offer women an environment that encourages choice of movement and birth positions while using hydrotherapy. CNM's and NM's are there to provide care that supports each woman's comfort level and personal needs. Finally, midwives are skilled providers in non-pharmacologic methods for helping women cope with labor pain.

The pearls of midwifery are a set of 13 evidence-based strategies that have long been associated with midwifery care. They not only promote normal birth but are also associated with a lower cesarean rate. Through the application of the Pearls of Midwifery, maternal, neonatal, and labor outcomes are achieved. The following are the 13 pearls of midwifery:

1. Oral nutrition in labor is safe and optimized outcomes
2. Ambulation and freedom of movement in labor are safe, more satisfying for women, and facilitate the progress of labor

3. Hydrotherapy is safe and effective in decreasing pain during active labor
4. Continuous labor support should be the standard of care for all laboring women
5. Intermittent auscultation should be the standard of care for low-risk women
6. Do not routinely rupture the membranes
7. Second-stage management should be individualized and should support an initial period of passive descent and self-directed open-glottis pushing
8. There is no evidence to support routine episiotomy or aggressive perineal massage at birth
9. Delayed cord clamping improves neonatal outcomes
10. Immediate skin-to-skin contact after birth promotes thermoregulation, improves initial breastfeeding, and facilitates early maternal-infant bonding
11. Out-of-hospital birth is safe for low-risk women
12. Have patience with labor progress
13. Vaginal birth after cesarean is safe for most women (King & Pinger, 2014).

The Pearls of Midwifery have confirmed the value of midwifery practices. They improve maternal and neonatal outcomes while enabling normal physiologic birth, and reducing cesarean births (King & Pinger, 2014). Midwives are the providers who are at the forefront for promoting this standard of care within the healthcare field. Midwives are most responsible for ensuring that these practices again become the norm in intrapartum care.

Theoretical Framework

Katherine Kolcaba's Theory of Holistic Comfort is a well-suited theory to provide a framework for the use of hydrotherapy and its role throughout the physiologic labor process. This nursing theory can be used as a framework for directing providers to use hydrotherapy to

aid in the comfort care of women who are in labor and to promote physiologic birth. Kolcaba's Comfort Theory was first developed in the 1990's and asserts that comfort is an immediate and desired outcome of health care (Petiprin, 2016). "Having a guide and definition of comfort may aid in providing comfort to women in childbirth" (Bailey, 2017, p. 11). The provider's role in this model is to continuously and intentionally assess the patient's comfort needs throughout the process, then develop and implement appropriate nursing care plans, followed by reassessment (Petiprin, 2016). Throughout the use of hydrotherapy, providers are assessing the patient's comfort levels and trying to help her cope with labor pain.

According to Kolcaba (2003), the idea of comfort can be described as a desirable state. The term represents an individualized condition for a patient. Her theory was partially created from Watson's theory of human care as well as Kolcaba's own practice (Kolcaba, 2010). Dr. Kolcaba realized that when her patients were in a state of comfort, they socialized better, were more cooperative with staff, and displayed happiness with their surroundings. She also mentioned that being in a state of comfort before doing something difficult seemed to allow her patients to pull themselves together to engage in and complete certain tasks (Kolcaba, 2003).

According to Dr. Kolcaba, comfort exists in three forms including relief, ease, and transcendence (Bailey, 2017). Relief can be defined as the feeling a patient experiences when their specific comfort need is met. Ease is a state of calmness, while transcendence is the ability of a patient to rise above the pain and actively seek healthy behaviors to get them through their health situation (Kolcaba, 2003). Another aspect of Kolcaba's comfort theory is that patient comfort occurs in four contexts including physical, psychospiritual, environmental, and sociocultural (Petiprin, 2016). The most common form of comfort is physical. However, Dr. Kolcaba was interested in holistic comfort and explained physical comfort was just one portion

of health. This theory suggests that comfort is pulled from several sources within the patient's body, mind, and environment; requiring interventions that address the patient in a holistic manner. According to Kolcaba (2003), environmental comfort includes external conditions and surroundings, such as color of the room, noises, light intensity, temperature control, and views from windows. Sociocultural comfort includes interpersonal relationships and the encouragement/education a woman receives from her support system. Psychospiritual is a mixture of mental, emotional, and spiritual components of the individual.

Kolcaba (2003), explained that all health care members can perform comfort care by remembering the three types and four contexts of comfort. Midwives can be proactive in assessing the total comfort needs of patients, and designing interventions to focus on the needs that have not been met by the patients' existing support systems. When it comes to hydrotherapy, a patient who is in the tub for pain management during labor is experiencing comfort in the form of physical relief. The patient in the tub is also experiencing ease because their anxiety is being calmed or relieved due to a combination of factors including support from loved ones, ease of pain, and control of environment. Finally, transcendence is a state of comfort in which the patient is able to rise above their current health challenges (Petiprin, 2016). This can be depicted by patients who can successfully navigate labor and deliver in the tub without any additional pain medication.

Summary

Hydrotherapy is an effective intervention that can provide many benefits throughout labor. Although its utilization has increased in the United States recently, compared to global utilization, women in this country are under-utilizing hydrotherapy.

Midwives are in a position to educate women and encourage hydrotherapy use during labor. The use of hydrotherapy in labor has many benefits that will be well-documented throughout the rest of this paper. Chapter two will explain the methods used to search for and critically evaluate academic articles addressing the use of hydrotherapy and its effects on labor outcomes. Chapter three will offer a thorough synthesis of the research, including strengths and weaknesses, and recommendations for practice. Chapter four will present an examination of the consequences and conclusions for nurse-midwives.

Chapter II: Methods

Chapter two will review the methods that were used to identify and appraise the literature studying the use of hydrotherapy in labor and its effect on labor outcomes. The search process will be recalled including a list of search engines utilized, search strategies, criteria for inclusion and exclusion of research studies, and a summary of the 22 selected studies. Finally, evaluation criteria will be discussed for determining the quality and level of evidence.

Search Strategies

In order to be considered for review, the articles must have come from academic journals and published between the years 2009 and 2019. Two articles were dated prior to 2009, but are included as a result of the strong relevance to the topic. The Bethel University Library and Google were used to search through databases. The databases that were used in this search included: CINAHL, Cochrane Database of Systematic Reviews, EBSCOhost, Google Scholar, and PubMed. Key search terms included: hydrotherapy, labor, and water immersion. Lastly, a snowball technique was utilized to yield additional literature to examine. Snowball technique refers to the method of utilizing the reference list of research articles to help identify and produce more high quality sources to use in a literature review (Greenhalgh & Peacock, 2005). For example, I used the reference list from Cooper & Warland (2019), to find more articles that were related.

Criteria for Inclusion and Exclusion

Inclusion criteria for this literature review required research studies that focused on the effects of hydrotherapy on labor outcomes. Initially, the included studies reviewed were published between the years of 2000 through 2019, and included 110 articles. In an effort to decrease the number of articles used in the review and to use the most current research available,

new inclusion criteria required the studies reviewed to be published between the years of 2009 and 2019, which reduced the number of articles to 88. However, two articles that were greater than 10 years old, yielded strong evidence towards the research question and were included in this review.

Exclusion criteria included studies that were presented in a language other than English, studies more than 10 years old (except 2), studies in developing countries, and articles that did not have a full-text available. Studies that included the topic of waterbirth were also excluded from the review. Other criteria included poor quality of the study or poor design as determined by the Johns Hopkins appraisal tool.

Summary of Selected Studies

After initial review of 88 potential research articles for significance to the topic and meeting the inclusion criteria, the literature was reduced to the 22 articles analyzed in this critical review. The articles comprised in this review include quasi-experimental studies, randomized controlled trials (RCTs), retrospective cohort studies, prospective cohort studies, nonexperimental studies, and observational studies. The studies were conducted throughout the United States, Brazil, Europe, Australia, and Japan.

Evaluation Criteria

The articles were examined and appraised for quality and strength of evidence using the Johns Hopkins Research Evidence Appraisal Tool (Dearholt & Dang, 2018). This tool grades the strength of evidence on a scale of I-V. Level 1 is the highest level of scientific evidence strength which includes RCTs. Level II is the next level of strength and includes quasi-experimental studies. Level III includes qualitative studies and non-experimental studies. The 22 articles used in this literature review are graded between the levels of I-III.

Once the level of evidence was determined, overall quality was also evaluated. Dearholt and Dang (2018), state the classifications of quality as high (A), good (B), or low (C). The following factors are considered when determining quality: generalizability of results to the greater population, reliability of results when compared to similar studies, appropriate sample sizes, evidence of study control, the strength and level of conclusions drawn, and consistency of recommendations that are based on researched data (Dearholt & Dang, 2018).

High quality evidence has a sufficient sample size with generalizable results. It produces recommendations that are based on suggestions from scientific evidence (Dearholt & Dang, 2018). Good quality (B) evidence contains some control with mostly definitive conclusions and realistic recommendations based on a thorough literature review that includes scientific data. Low quality (C) research contains unsatisfactory sample size, unreliable results, and no definitive conclusions (Dearholt & Dang, 2018). All of the 22 research articles included in this review were classified as either Level I or Level II and met the criteria for being high (A) or good (B) quality. There are 8 Level I articles and 14 Level II articles included, with 21 of those articles rated as B quality and 1 as A quality.

Summary

An extensive database search was performed using the Bethel University Library and Google. Databases searched included CINAHL, EBSCOhost, PubMed, Google Scholar, and Cochrane Database of Systematic Reviews to search for the included research articles. A snowball technique was also utilized for additional research studies. Ultimately, 22 articles were chosen for evaluation based on inclusion and exclusion conditions. This review contains research studies that examine the effects of hydrotherapy used during labor on labor outcomes. Evaluation was completed using the Johns Hopkins Research Evidence Appraisal Tool.

Chapter III: Literature Review and Analysis

Synthesis of Matrix

A matrix was used to consolidate the research literature and to identify common and significant themes related to the hydrotherapy use during labor (see Appendix 1). The matrix includes eight RCTs, six quasi-experimental studies, two retrospective cohort studies, two prospective cohort studies, one descriptive exploratory study, one descriptive observational study, and one sequential mixed methods study. The matrix column headings include: study purpose and design, sample size, measurement, results, conclusions, strengths, weaknesses, implications for practice and author recommendations. Level and quality of research assigned to each study was also identified, and was evaluated using the Johns Hopkins Research Evidence Appraisal Tool (Dearholt & Dang, 2012). The purpose, design, and significant findings of each study were evaluated. Chapter three will present the synthesis of that data.

Synthesis of Major Findings

The twenty-two scholarly articles synthesized in this review support the use of hydrotherapy in labor and highlight the benefits that are associated with its use.

Half of the articles evaluated in this review explored the intervention as it was related to pain. A total of eight common themes that were explored within these articles include: pain, duration of labor stages, decrease in obstetric intervention, augmentation and induction, anxiety, maternal satisfaction, epidural analgesia use, and hormone changes. Finally, three articles discuss how the use of hydrotherapy impacts movement. There will also be a brief discussion on how movement in labor impacts positive outcomes and a physiologic labor experience.

Pain. The ideal analgesic technique used in labor should significantly reduce pain while having minimal impact on the mother, fetus, and labor process. Hydrotherapy has been proven to

be safe to use during labor while simultaneously helping with pain control (Benfield et al., 2004). Several research studies in this review also demonstrated the efficacy of using hydrotherapy to help manage pain at various times during labor (Abo-Romia & El-Adham, 2014; Barbosa da Silva et al., 2009; Cluett et al., 2004; Henrique et al., 2016; Lee et al., 2012; Liu et al., 2014; Mollamahmutoglu et al., 2012; Stark, 2013; Taghavi et al., 2015; Tuncay et al., 2019). A visual analog scale (VAS) was used in these eleven studies that studied the effects of hydrotherapy on pain levels. Typically, pain was scored on a scale of zero to ten, with zero meaning no pain and ten meaning the worst imaginable pain. The VAS scores in a study conducted by Mollamahmutoglu et al. (2012), were statistically lower in the experimental group that labored in water compared to the conventional group that did not labor in water. VAS scores in the water group were 4.7±1.3 while scores in the conventional care group were 5.6±1.1, ($p=0.0001$). A p-value <0.05 is accepted as statistically significant in the studies included in this review. Cluett et al. (2004), used a VAS score of 0 to 100. They reported an average VAS pain score of 49 in the water immersion group, significantly less than the control group score of 64 ($p=0.003$).

Liu et al. (2014) assessed pain scores at different intervals throughout labor and discovered similar results. VAS scores measuring pain were greater in the control group at all tested intervals, including 30 and 60 minutes after intervention. Thirty minutes after the intervention, the water group had VAS score of 6 vs 10 in the control group, ($p < 0.001$). Sixty minutes after the intervention the water group had VAS scores of 7 vs 10 in the conventional group, ($p <0.001$). Pain scores were measured at those intervals because previous research has suggested that it takes about 30 minutes for the analgesic effects of hydrotherapy to occur and become stable (Liu et al., 2014).

Whereas the study mentioned above assessed the effectiveness of hydrotherapy during the earlier stages of labor, Tuncay et al. (2019) studied the effect of hydrotherapy use during the active phase of labor. They also found that women who used hydrotherapy had lower pain scores. At 6 cm dilation, the VAS score was significantly lower in the experimental group 5.03 ± 1.10, compared to the VAS score of the control group 8.30 ± 0.52. Again at 10 cm, the VAS score of 7.63 ± 0.93 was lower in the experimental group than control group 9.53 ± 0.51, (*p*= .001) (Tuncay et al., 2019). The studies reviewed so far have shown a decrease in pain during various stages of labor, early labor as well as active labor.

Pain intensifies as women progress through labor. One study in particular demonstrates how the VAS scores increased in both groups as women's dilation increased. Although the pain scores increased in both groups, the average score in the experimental group was less than that of the women in the control group, (p=0.001) (Barbosa da Silva et al., 2009). Similar results can be seen in another study (Lee et al., 2012). They found the VAS scores for the experimental group to be lower than control group scores at all measured intervals. At 4cm, VAS scores were 6.84 vs 5.15 (p <.001) and at 7cm, scores were 8.74 vs 8.22 (p <.001). Women had higher VAS scores at 7cm. dilation than 4cm. in both groups, demonstrating that pain intensity increased as mothers advanced through the early stages of labor. Also, important to note, this study assessed pain scores after 20 minutes of intervention use at 4cm and 7cm. The scores in the experimental group decreased at 7cm from 8.74 to 7.10. The scores in the control group increased at 7cm from 8.22 to 8.85, further demonstrating the positive impact of showering in labor.

The studies analyzed above have assessed pain using subjective VAS scales. Barbosa da Silva et al. (2009) assessed pain during labor using both a subjective and objective scale. The subjective scale was the VAS. The objective scale was a 5-point behavioral scale rated by the

researcher. Initial review of the pain scores using the behavioral scale showed similar scores of 1.7 for the control group and 1.6 for the experimental group, ($p=0.591$). For the second evaluation, the behavioral scale showed an average score of 2.4 for the control group and 1.9 for the experimental group, ($p<0.001$). The numeric scale showed scores of 9.3 for the control group and 8.5 for the experimental group, ($p<0.05$) (Barbosa da Silva et al., 2009).

Multiple studies in this review specifically examined showering as the hydrotherapy intervention. Showering is under the hydrotherapy umbrella term, however, there has been limited research on its effectiveness for pain and coping in labor (Stark, 2013). Henrique et al. (2016), studied the solo use of hydrotherapy during labor by using a shower, compared to the solo use of a perineal ball during labor, as well as the combination of warm water shower while using a perineal ball. For the ball intervention, women sat on the ball with their legs bent, at a 90° angle, with their feet on the floor, performing and pelvic rotation movements for 30 minutes. In this study, there was no statistical difference found. The average pain score was similar among all 3 groups, with a mean VAS score of 7.5 (Henrique et al., 2016). This study did show other benefits from hydrotherapy including a reduction in anxiety and in stress hormone levels, which will be discussed later in this chapter.

Similar to Henrique et al. (2016), a study conducted by Stark (2013), did not find a statistical difference in the average pain scores. Stark used a single group, pre-test and post-test design to study the effectiveness of warm water showering. Although the mean pain score decreased from 6.2 to 5.7 after the shower intervention, the p-value was not significant. However, in another study conducted by Stark (2017), the intervention was tested using an experimental group and a control group. The group that used therapeutic showering showed statistically significant lower

scores (p = 0.001). Average VAS scores for women in the shower group were 4.2 compared to 6.2 in the control group (Stark, 2017).

Pain scores have been found to be lower in studies conducted around the world as well. A study conducted in Africa on the effectiveness of showering during the first stage of labor demonstrated that after 30 minutes of showering, women in the intervention group had an average VAS score of 4.8 ± 2.1 compared to a score 6.9 ± 3.0 in the control group, (p=0.011) (Abo-Romia & El-Adham, 2014). In a similar study conducted in Iran, the average pain intensity in the hydrotherapy group was 7.1 ± 0.85 while the scores in the control group were 7.6 ± 0.95, (p=0.010) (Taghavi et al., 2015).

Decrease in obstetric intervention and augmentation/induction. The use of hydrotherapy has been associated with a decrease in obstetric intervention as well as the need for labor augmentation or induction. Seven studies looked at the association between the utilization of hydrotherapy in labor and the subsequent need for intervention or augmentation (Burns et al., 2012; Cluett et al., 2004; Darsareh et al., 2018; Henderson et al., 2014; Lewis et al., 2017; Liu et al., 2014; Mollamahmutoglu et al., 2012). The obstetric interventions examined included, amniotomy, episiotomy, instrumental delivery, and cesarean section.

Mollamahmutoglu et al. (2012) compared the effects of hydrotherapy use to epidural analgesia use and conventional labor. In this review, conventional labor is defined as no hydrotherapy use or analgesia use. 610 women were selected for this study and they were able to choose one of three research groups: Hydrotherapy group (N=207), epidural analgesia (N=191), and conventional group (N=204). The results showed a decreased need for both induction and episiotomy among women who were in the hydrotherapy group compared to women who had an epidural, or women who labored conventionally. The hydrotherapy group had eleven women

(5%) that needed augmentation, compared to 58 women (30%) in the epidural group, and 57 women (28%) in the conventional group. In terms of the need for episiotomy, group 1 had 56 women (27%), group 2 had 132 (69%), and group 3 had 182 women (89%) that needed episiotomies. Both categories shared a p-value of 0.0001 (Mollamahmutoglu et al., 2012).

In a retrospective cohort study with a sample size of 502 women, 88% of women in the hydrotherapy group had a spontaneous vaginal delivery compared to 69% of women in conventional group, ($p<0.001$) (Lewis et al., 2017). In comparison, a larger prospective cohort study that involved 8,924 low-risk women who used a birthing tub, 7,137 (80%) women achieved a normal spontaneous vaginal delivery (Burns et al., 2012). 1,888 (21%) women had their labor augmented; 1,632 (18 %) women by artificial rupture of membrane and 256 (3%) by intravenous infusion of oxytocin (Burns et al., 2012). The results of this study support the research data that suggests the use of hydrotherapy during labor can help support a normal vaginal delivery and reduce the need for labor augmentation. Another large prospective study by Henderson et al. (2014), found that nulliparas using a tub during labor had a lower episiotomy rate of 33% when compared to nulliparas who did not labor in a tub at 53%.

Only two of the seven studies did not show a significant difference between the two research groups regarding the need for labor augmentation ($p= 0.445$), or the mode of delivery ($p= 0.902$). Darsareh et al. (2018) noted three women from both the hydrotherapy group (3%) and the control group (3%) required vacuum-assisted delivery while two women (2%) in the hydrotherapy group and 3 women (3%) in the control group required a cesarean section. Cluett et al. (2004) also found no statistical difference in the operative delivery rate amongst research groups (49% vs 50%), ($p=0.919$). However, a study conducted by Liu et al. (2014), found the cesarean section

rate to be significantly higher in the conventional group (N=23, 32.9%) than the water group (N=5, 13.2%), (p= 0.026).

Epidural analgesia use. Many women who are aiming to have a physiologic labor and birth experience are fearful of ending up needing an epidural. Four articles compared epidural use with hydrotherapy use. All of the studies associated hydrotherapy with a decreased need for epidural analgesia use (Burns et al., 2012; Cluett et al., 2004; Stark et al., 2008, Vanderlaan, 2017). Cluett et al. (2004), compared two groups that were experiencing labor dystocia. The hydrotherapy group had a lower rate of epidural analgesia (47%) than women who were assigned to the control group (66%), (p=0.056) (Cluett et al., 2004). Before this study was done, the thought of labor dystocia suggested inevitable augmentation and longer labor. However, in this trial, 30% of women who labored in the water did not receive oxytocin and 20% did not receive any obstetric intervention, with no evidence of longer labor (Cluett et al., 2004).

Stark et al. (2008) shared results from a small study of 7 women. Only 3 out of the 7 women utilized the tub but none of them needed epidural analgesia while 50% (2 out of 4) of the women who did not use the tub received epidural analgesia. Due to the rural setting and small sample size, the authors recommended more large-scale studies in more diverse settings be done to further support the positive effects of hydrotherapy and identify if it can postpone or prevent the use of epidural analgesia (Stark et al., 2004). Vanderlaan (2017) conducted a study to help provide estimates of hydrotherapy use and to describe other characteristics of labor associated with it. Two hundred sixty-eight women out of a total sample of 327 (82%) initiated hydrotherapy. According to Vanderlaan (2017), of the 268 participants, 80 (30%%) discontinued hydrotherapy use but only 24 (9%) proceeded to receive pharmacologic pain management. Nulliparity was associated with an increased likelihood of progressing to pharmacological pain

management, (p=.021) (Vanderlaan, 2017). Although women eventually converted to an epidural for pain relief, there is benefit in the use of hydrotherapy early in labor. Women are encouraged to be mobile in early labor to facilitate labor progression and to help with fetal descent and positioning. The use of hydrotherapy during this time is a helpful intervention to encourage movement while keeping pain manageable. Even if women progress to medical pain management options, there is still benefit for the time that hydrotherapy was in use. Further discussion about hydrotherapy and movement will be discussed later in this chapter.

The large-scale study conducted by Burns et al. (2012), revealed data on different intrapartum pain management methods that women using a tub ultimately chose. A total of 3,732 (42%) women left the tub before the second stage of labor, with 887 (24%) leaving mostly for additional analgesia (Burns et al., 2012). Of the 8,924 women who participated in the study, the most popular analgesia used was inhalational (50% nitrous oxide, 50% oxygen), which was used by 6,465 (72%) women. Other analgesics used included intravenous narcotics (962, 11%), epidural (825, 9%) and spinal anesthetic (333, 4%) (Burns et al., 2012). These results support hydrotherapy as a good option for women to try early in labor but allow women to choose other pain relief measures later in the labor process if necessary

Comparing hydrotherapy use and Swiss ball use in labor, a randomized control study done by Henrique et al. (2016) discovered differences between interventions and need for additional pain management. 24% of the women in the group who did perineal exercises with a Swiss ball ended up receiving epidural analgesia after participating in the intervention. Only 16% of women in the warm bath group received epidural analgesia and 15% of women in the combination group received an epidural. Although not statistically significant due to sample size, these numbers show that the use of hydrotherapy can help decrease the use of epidural analgesia. It further

shows that a combination of interventions (warm bath and Swiss ball use) is even more effective in decreasing the need for epidural use.

Anxiety. The use of hydrotherapy in labor has been shown to decrease anxiety. The importance of decreasing anxiety will be further discussed in chapter 4. In this review, 4 articles discussed the effects of hydrotherapy on anxiety levels (Abo-Romia & El-Adham, 2014; Benfield, 2018; Henrique et al., 2016; Stark, 2013). In an ethnographic study completed by Benfield (2018), women were interviewed about their experiences with bathing and bathing in labor. Only two women out of the 41 (5%) interviewed had used a bath in labor. When asked the question, "How did bathing in labor affect your anxiety level?", a response was "tried anything to stop the cramping and it eased it" (Benfield, 2018). When asked, "How did bathing in labor affect your relaxation level?", a response included "made me more relaxed, calmed, me down instead of being panicky" (Benfield, 2018). Although the results are from a small, ethnographic study, the verbatim responses from women who used hydrotherapy positively highlight its effects on decreasing anxiety.

Abo-Romia & El-Adham (2014) found that women who did not use hydrotherapy during their first stage of labor had an increase in their anxiety levels. Pre-test outcome measure scores were 6.2 ± 2.2 while posttest outcome scores increased to 6.3 ± 1.5 (Abo-Romia & El-Adham, 2014). The hydrotherapy group scores decreased 6.7 ± 1.8 to 4.5 ± 1.7. The difference in anxiety scores was statistically significant ($p=0.018$).

Henrique et al. (2016) supports the use of hydrotherapy in conjunction with another non-pharmacological intervention, the Swiss ball. When examining at anxiety in their study, they compared three groups. The first group consisted of hydrotherapy use alone, the second group consisted of hydrotherapy and Swiss ball use, the third group was Swiss ball use alone. All 3

research groups within the study had a decrease in their anxiety after the implementation of the intervention. However, it was the group that combined the use of hydrotherapy and Swiss ball use, that showed the highest score reduction after the intervention, 8.76 ± 2.07 to 8.44 ± 2.09 (Henrique et al., 2016). These results not only support the effectiveness of hydrotherapy, but also support its use in conjunction with other support measures to enhance the positive effects seen with its individual use.

As mentioned previously, therapeutic showering is an effective hydrotherapy method that can be used to reduce pain. Although not as thoroughly studied, there have been positive effects related to increasing relaxation while simultaneously decreasing tension and anxiety (Stark, 2017). Stark (2013) found a significant difference ($p=0.002$) in anxiety scores after the intervention of showering. This was a single group design with a small sample size. However, a similar study also conducted by Stark (2017) using a larger group, supports the findings of this study. The later study identified differences between two groups. At baseline, both groups had an average anxiety rating of 3.6. The scores of the intervention group decreased to 2.4 and 2.5 at the 15 and 30-minute testing intervals. The control group experienced a small or repeated decrease to 3.5 at 15 minutes, but an increase in scores to 3.9 at 30 minutes ($p= .033$). Thus the intervention group reported a greater decrease in anxiety at the tested intervals. (Stark, 2017).

Stark's study (2017) is important to highlight because the positive effects identified can impact the hormonal physiology of labor. High anxiety levels increase the stress hormones that can lengthen labor, while a calming environment can help reduce stress and the coinciding release of stress hormones (Stark, 2017). Also, the study by Stark (2013) found statistical differences between groups in terms of tension ($p=0.003$), relaxation ($p<0.001$), and coping

(p=0.006). The intervention group experienced increased relaxation and coping and a related decrease in tension.

Hormones. Taking a closer look at hormones and their importance in relation to labor progress, there are many hormones that need to be considered. Cortisol, or the stress hormone, is one of the most studied hormones in labor. According to Benfield et al. (2014), increased cortisol is needed to help maintain glucose balance and to be a source of energy during childbirth. However, too much cortisol can pose problems, so stress should try to be managed throughout labor to maintain normal levels of cortisol release. Other hormones that play an important role in labor include epinephrine, and norepinephrine, also called noradrenaline. Epinephrine and norepinephrine can influence the uterus' performance. According to Henrique et al. (2016), epinephrine is linked to a decrease in uterine activity; increased norepinephrine is correlated to an increase in contractions. Other hormones called β-endorphins are endogenous analgesia that is produced by the body in response to acute stress or pain. Norepinephrine also has benefits related to endogenous analgesia.

Although several studies briefly mentioned or alluded to hormone levels throughout labor, just one carefully studied the effects of hydrotherapy on hormone levels during labor. In the study performed by Henrique et al. (2016), noradrenaline release increased in all groups, but was seen greatest in the hydrotherapy group (76.50 pg/mL ± 178.95) after the intervention. Cortisol release also increased in all groups after the interventions but the hydrotherapy group showed the slowest release of cortisol after the intervention (17.90 pg/mL ± 12.45). β-endorphin release decreased in the two groups using the warm water, however, the decrease was greater seen in group 1, p=.oo7 (Henrique et al., 2016). Cortisol release and endorphin release are directly related to an increase in pain and stress that is experienced during labor. This study helps

demonstrate the positive effects of hydrotherapy through the slower release of those hormones, suggesting lower stress and pain levels.

Movement. Three articles assessed movement in women who used showers or birthing pools throughout labor **(**Cluett et al, 2004; Cooper & Warland, 2015; Stark et al., 2008).The findings support the use of hydrotherapy to promote upright positions and movements that encourage labor progression and increase coping. This will further help women to avoid unnecessary interventions. Cooper & Warland (2015), surveyed participants about their experiences and perceptions of their water immersion experience during labor. They found that 71.35% of their survey participants were most in agreement with the statement, "I was able to move freely" and 85.5% of participants stated that they would recommend water immersion to others. The women indicated that water immersion helped with ease of movement and helped them find a comfortable position (Cooper & Warland, 2015).

Stark et al. (2008) monitored and illustrated the different positions that 7 women in labor chose while submerged in a tub during the first stage of labor. Although an observational study, it provides detailed information on the natural positions that women choose during labor. The most significant information gained from this study is that women exhibited a wider range of positions and movements in the tub than in bed during the first stage of labor (Stark et al., 2008). Observations included women made more regular movements while in the tub compared to the bed (21% vs. 1.%), women made more pelvic movements in hydrotherapy compared to in bed (19% vs 0%), and 41% of women in the tub make more torso movements compare to 13% of the women in bed (Stark et al., 2008).

Cluett et al. (2004) studied 99 nulliparous women who were experiencing labor dystocia. Not only did the women show a decreased need for augmentation when allowed to labor in a tub, but

91% of the women in the hydrotherapy group were more satisfied with the freedom of movement that was allowed in the water compared to 63% of women in the control group who were satisfied with movement in bed, standing, or walking.

Maternal Satisfaction. Maternal satisfaction is an important labor outcome to consider. Four research articles in this review showed that maternal satisfaction is high when women in labor utilize hydrotherapy (Darsareh et al., 2018; Liu et al., 2014; Neiman et al., 2019; Tuncay et al, 2019). Neiman et al. (2019), showed high maternal satisfaction scores among all three research groups, waterbirth, water labor, and conventional. The average COMFORTS scale scores, which were used to indicate maternal satisfaction, ranged from 184.6 to 186.6 out of a maximum score of 200. There was no significant difference among the (Neiman et al., 2019).

Darsareh et al. (2018), found that women in their hydrotherapy group had significantly more contentment with their birth experience (8.85 ± 1.31) compared to women in the control group (5.08 ± 2.01), $P < 0.001$. Results from the Liu et al. (2014) study further support findings that hydrotherapy utilized during labor increases maternal satisfaction. After childbirth, 2 of the 38 hydrotherapy group participants were very satisfied and the remaining 36 were satisfied with the effect of water immersion during labor (Liu et al., 2014).

Tuncay et al. (2019) assessed the outcomes of hydrotherapy applied during the active phase of labor, on the overall feelings of labor for the mother. Women in the experimental hydrotherapy group reported more positive feelings about labor. Participants completed a labor agentry scale (LAS) within 12-hours postpartum that measured their feelings of being in control. The average LAS score in the experimental group was 129.45 ± 5.33 compared with 44.97 ± 6.09 in the control group (p= .001) (Tuncay et al., 2019).

Duration of labor stages. There are mixed results when it comes to hydrotherapy and its impact on the duration of labor stages. Seven studies included labor duration as an outcome measured (Darsareh et al., 2018; Henrique et al., 2016; Lewis, Hauck, Butt, & Hornbuckle, 2018; Liu et al., 2014; Mollamahmutoglu et al., 2012; Stark, 2013; Taghavi et al., 2015). Several studies in this matrix did not find a significant discrepancy in the duration of labor among research groups. In the study conducted by Liu et al (2014), women entered the tub at 3cm. cervical dilation. They were encouraged to drink water and to leave the tub after 2 hours of immersion and rest for half an hour. After 30 minutes, women could re-enter the tub if the wished to do so. Duration of labor between the water immersion group and the control group was similar. Both groups showed large variation. The duration of the first stage of labor was 596.55 ± 249.71 for group 1 and 552.30 ± 241.85 in group 2, (p=0.429) (Liu et al, 2014). The duration of the second stage of labor in group 1 was 58.79 ± 31.37 compared to 56.04 ± 35.15 in group 2, (p= 0.720) (Liu et al, 2014). Lewis, Hauck, Butt, & Hornbuckle (2018) also found no significant difference between groups for the length of the first stage (p=0.331) or the second stage of labor (p=0.703) (Lewis, Hauck, Butt, & Hornbuckle, 2014). Finally, a study in Italy, also found similar duration of labor in both groups, (p=0.448) (Henderson et al, 2014).

Taghavi et al. (2015**),** did find a difference between groups during the first stage of labor but not the second stage of labor**.** Duration of the first stage of labor in group 1 was 119.5 ± 45.05 and 210.6 ± 55.45 in group 2, (p< 0.001. There was no statistically significant difference between groups in the second stage of labor. Group 1 duration was 21 ± 18.65 and group 2 was 24.32 ± 23.2, (p=0.395) (Taghavi et al., 2015). Overall, group 1 had a shorter first and second stage of labor combined at 140.5 ± 58.5 compared to group 2, which lasted 234.6 ± 84.9, (p<0.001) (Taghavi et al., 2015).

Mollamahmutoglu et al (2012), found a statistical difference between groups during the second and third stages of labor. In this study, the researchers compared three groups: water labor, epidural, and conventional. The first stage of labor was shortest in the control group, (p= 0.0001). However, the second and third stages of labor were shortest in the hydrotherapy group compared to the other groups. The second stage of labor was 10.9±5.02 in group 1 and the third stage of labor was 3.8±1.5, (p= 0.0001) (Mollamahmutoglu et al, 2012).

Darsareh, Nourbakhsh, & Dabiri (2018), had women in the hydrotherapy group immerse in the tub at 4cm until complete dilation at 10cm. The results of their study showed an increase in the length of labor of the experimental group, 232.95 ± 20.76, when compared to the control group 165.81 ± 22.76 min, ($p < 0.001$). Another finding worth mentioning is there was no statistical difference seen between the groups in regards to the length of the second stage of labor 48.40 ± 9.80 vs 48.00 ± 4.50, (p=0.63) (Darsareh et al., 2018).

Henrique et al (2016), studied the use of warm bath and perineal ball during labor and the effect on labor outcomes. The study revealed an increase in the occurrence of contractions in the hydrotherapy group, ($p = 0.025$). When hydrotherapy was combined with the use of a perineal ball, that group showed more rapid progression of fetal head descent (p=0.688) than did hydrotherapy use alone (p=0.428), or perineal ball use alone (p=0.679) (Henrique et al, 2016). The use of a warm bath combined with perineal exercises and the Swiss ball did alter labor progress. The grouping of the interventions revealed greater impact to the labor process. Overall, the combined intervention group had a more rapid progression of cervical dilatation, more effective fetal descent, an increased incidence of contractions ($p <0.001$), and a decrease in labor time of 41.18 minutes, compared to group 1 and group 2.

Finally, a study conducted by Stark (2013), assessed therapeutic showering in active labor. After 30 minutes of therapeutic showering during active labor, women were assessed. There was a significant difference in cervical dilatation after the implementation of the intervention. Before the shower, average cervical dilation was 4.1 and after 30 minutes of showering, the average dilation was 5.1 ($p<0.001$) (Stark, 2013).

Critique of Strengths and Weaknesses

The first strength of the matrix review is that the majority of the studies included in this review are quantitative in nature, making it easier to analyze data and measure causal relationships between the tested variables. Only two of the twenty-two studies included in this review were qualitative studies. However, because the labor experience is a very personal and individualized one, the qualitative studies provide essential subjective information from the patients themselves. Those studies provide a unique perspective on the subject that highlights patient's perceptions and experiences with hydrotherapy.

All studies included in this review were determined to be of high and good quality, based on the Johns Hopkins Research Appraisal Tool. There is a mix of the sample sizes that were included in this review and overall, most studies had an adequate sample size. However, there are several qualitative studies with smaller sample sizes included in this review, making it difficult to generalize those results to a larger population. The findings gathered from the small sample size studies were well supported and were strengthened by similar results found in the larger-scale studies that were included in the review. Another strength is using studies by the same author. For example, Stark continued to study hydrotherapy, refining the research question and design to increase the strength of evidence.

Summary

Twenty-two scholarly articles were reviewed and appraised to determine the impact of hydrotherapy on labor outcomes and how it can support a physiologic labor process. The majority of research was from the use of randomized controlled trials that were of high or good quality, according to the Johns Hopkins Research Appraisal Tool. After analyzing the body of research, the most significant impact of hydrotherapy on labor was seen in the following areas: decreased pain levels, decreased epidural analgesia use, decreased need for labor induction and/or augmentation, decreased obstetric intervention, decreased anxiety, increased maternal satisfaction, increased movement, and adaptive hormonal changes. This chapter also appraised the selected articles for quality and discussed the strengths and limitations of the research appraisal.

Chapter four will discuss the current trends in hydrotherapy use, including the trends and gaps in the literature. There will be discussion on the benefits associated with its use in labor as well as the implications for nurse-midwifery practice, and recommendations for future research. Finally, there will be a discussion on the integration of Kolcaba's Theory of Care as it is related to hydrotherapy use in labor.

Chapter IV: Discussion, Implications, and Conclusions

The purpose of this literature review was to discover the effects of hydrotherapy use on labor and how it promotes a physiologic labor process. There were 22 scholarly research articles chosen for appraisal and critical analysis using the Johns Hopkins Research Evidence Appraisal Tool. Upon completion of the literature review, trends and gaps of the literature were identified as well as implications for nurse-midwifery practice. In chapter four, the aforementioned will be discussed. The chapter will then conclude with recommendations for future research and an incorporation of Katherine Kolcaba's Comfort Theory with the use of hydrotherapy during labor.

Literature Synthesis

The research question for this critical review asked "does the use of hydrotherapy during labor promote a physiologic labor process?" Hydrotherapy has been endorsed by the ACNM (2014) and ACOG (2016) as a safe and effective non-pharmacological intervention to use during labor. The outcomes that were included for analysis in this review included pain, duration of labor stages, decrease in obstetric intervention, augmentation and induction, anxiety, maternal satisfaction, epidural analgesia use, hormone changes, and movements. When analyzing the measured outcomes it was important to include those categories because they can have either a positive or negative effect on the physiologic labor process. The findings generally showed beneficial outcomes with the use of hydrotherapy in labor.

Trends and Gaps in the Literature

Hydrotherapy use during labor has been a popular topic of research for decades. The ACNM (2016) stated the strong association between warm water immersion and several benefits. These include increased mobility, reduced need for epidural, lower episiotomy rates, greater patient satisfaction, and encouragement of labor progress through diminishing anxiety and stress

hormone production. The research analyzed in this review further support the benefits of hydrotherapy as stated by the ACNM.

A common trend in the literature and well known benefit of hydrotherapy is a reduction in pain which can lead to the reduced need for analgesia and anesthesia. Liu et al. (2014) supports this benefit in their study findings. They compared water immersion effects during the first stage of labor. They found VAS score to be greater in the conventional labor group. Although considered hydrotherapy, showering during labor has not been as widely studied as water immersion in a tub. Abo-Romia & El-Adham (2014) evaluated the effects of warm showers on labor pain. They found the pain scores of the hydrotherapy group to be significantly lower than the non-hydrotherapy group. Thus, regardless of the type of hydrotherapy intervention used, shower or tub, both have a beneficial impact on pain and are effective non-pharmacological options. In the Cluett (2004) study, they compared the impact of different interventions in women experiencing labor dystocia. Not only did women in the hydrotherapy group have a lower rate of epidural analgesia when compared to the control group, but they also had a lower average pain score than women in the control group.

More recent studies have started to focus on anxiety and hydrotherapy use during labor. Psychological factors can affect physiologic labor. Increased maternal anxiety in labor has been linked to prolonged labor and/or fetal distress (Benfield et al., 2001). Several studies found an association between hydrotherapy and decreased maternal anxiety (Abo-Romia & El-Adham, 2014; Benfield, 2018; Henrique et al., 2016; Stark, 2013). Henrique et al. (2016), found a greater decrease in anxiety when hydrotherapy was used. They also found a slow cortisol release in the hydrotherapy group compared to the other group. As mentioned earlier, cortisol is a stress related hormone. As the hydrotherapy group demonstrated, controlling anxiety levels is an important

aspect of labor. Anxiety, although considered to be a psychological disruption rather than a physical one, can cause physiological disruptions in the labor process.

Stark et al., (2008) observed and described the movements and positions that women chose while submerged in water during the first stage of labor. They found that women in the tub demonstrated greater assortment of movements in the tub than women who were not in the bed. While studies by Cluett el al. (2004) and Cooper & Warland (2015), found that women were more satisfied with the freedom of movement that hydrotherapy allowed. Although increased mobility has been shown, no studies looked at the specific impact that movements used during hydrotherapy have on the facilitation of labor progress.

Darsareh et al. (2018), Liu et al. (2014), and Tuncay et al (2019) found women in their hydrotherapy group to have significantly greater satisfaction when compared to non-hydrotherapy groups. Neiman et al. (2019) found that maternal satisfaction was high in all the research groups, regardless of intervention. However, the research still supports benefits of the intervention related to maternal satisfaction.

Implications for Midwifery Practice

Despite hydrotherapy being a proven safe and effective non-pharmacologic intervention to utilize during labor, its use continues to remain relatively low compared to pharmacological interventions. Also, when compared to other developed nations such as Europe and Australia, hydrotherapy use is significantly lower in the United States. Nurse-midwives are well-positioned to provide education and to offer access to this intervention during labor. Promotion of hydrotherapy use during labor is consistent with the following Pearls of Midwifery: hydrotherapy is a safe and effective pain management option during active labor and ambulation

and freedom of movement in labor is safe, more satisfying, and encourages labor progression (King & Pinger, 2014).

Midwives are known to promote natural remedies and interventions during labor to help support and encourage women. It is also important to focus on patient education during the antenatal period in order to introduce women to hydrotherapy and its potential risks and benefits during labor. Women may need more prenatal education about different interventions that are available to them. They may also need more opportunities to address any questions, concerns, or anxieties that they have concerning hydrotherapy use. It is important for midwives to assess and focus on the patient as a whole, understanding that comfort takes place within four contexts; environmental, physical, psychospiritual, and sociocultural. This allows midwives to provide education that is most suitable for that patient's specific comfort needs. It also helps identify the areas that women might need more support.

Midwives have the necessary skills required to support the hydrotherapy use during labor. Two of the Hallmarks of Midwifery (ACNM, 2012) include incorporation of scientific evidence into clinical practice and incorporation of evidence-based complementary and alternative therapies in education practice. Midwives ae expected to adhere to these Hallmarks and are therefore charged with educating patients on the benefits of hydrotherapy use during labor. They are also responsible for supporting women holistically and giving them the tools to have a physiologic labor process. Therefore, it is important that midwives have a thorough understanding of the benefits hydrotherapy, thus, allowing them to provide the proper guidance and counseling to their patients.

Recommendations for Future Research

Although the benefits of hydrotherapy use in labor has a strong research base highlighting its benefits, recommendations for future research should concentrate on increasing the depth of knowledge on the various benefits of hydrotherapy. Research should include more in depth comparison of the different hydrotherapy methods used during labor such as showering versus water immersion in a tub. Further research should include exploring the suggested timing of hydrotherapy use during labor, the effectiveness of longer and shorter shower duration, and how hydrotherapy affects movements in labor.

Only three articles assessed movements during hydrotherapy use **(**Cluett et al, 2004; Cooper & Warland, 2015; Stark et al., 2008). However, several variables can impact the use of hydrotherapy and the positions and movements used during labor. As a result, more large-scale studies need to study movements during hydrotherapy use and how that can help facilitate physiologic labor. The variables that should be included in these studies are labor support, mothers' knowledge, labor preparation, patient preferences, and the culture of the facility. Understanding the factors that impact hydrotherapy use as a labor support intervention is a goal for future research.

The point in labor in which hydrotherapy is most effective is another area for future study. There were mixed findings regarding the effects of hydrotherapy on the duration of the stages of labor (Darsareh et al., 2018; Henrique et al., 2016; Lewis, Hauck, Butt, & Hornbuckle, 2018; Liu et al., 2014; Mollamahmutoglu et al., 2012; Stark, 2013; Taghavi et al., 2015). There is questions on when hydrotherapy should be utilized during labor. A good research question could include, "At what point in labor, is hydrotherapy use most effective?" In some studies it has been associated with lengthening labor if utilized too early. However, its use during active labor is

associated with shortening the length of labor. More research should be done focusing on timing of the intervention during labor and when the most beneficial time is for a woman to use it.

Henrique et al. (2016) is the only one study in this review that looked at specific hormone changes related to hydrotherapy use. They found that hydrotherapy use was associated with a decrease in cortisol and an increase in endorphins. However, more large studies should address this topic to help support the positive impact hydrotherapy can have on hormone release during labor. Cooper & Warland (2019) and Benfield et al. (2018) are the only two studies in this review that specifically asked women about their personal experience with hydrotherapy use during labor. There should be an expanded analysis of the subjective experiences and narratives of women who labored using hydrotherapy. Extensive exploration has not yet occurred in regards to that topic of research. Also important to note, due to the nature of the intervention, most studies did not include randomization of the research groups. Therefore, participant bias could impact some of the results in this review. More research that uses randomization could be helpful. Lastly, future research should also examine evidence-based strategies for increasing hydrotherapy utilization.

Integration of Kolcaba's Theory of Comfort

Dr. Kolcaba's Theory of Comfort clearly defines and explains the value of comfort care. Comfort is one of the main goals in labor, for both the patient and provider. This theory guides our understanding of comfort as holistic and multifactorial (Kolcaba, 2003). This theory also invites providers to assess comfort in several contexts including physical, psychospiritual, environmental, and sociocultural.

Pain is a complex and multi-dimensional phenomenon. Kolcaba's Theory of Comfort assumes that humans respond to complex stimuli, such as pain, holistically (Kolcaba, 2010). The

goal of pain management in labor is to decrease the tension that is felt throughout the body. The result is to help create a sense of safety and well-being. The woman will then be able to cope with and work with the normal physiologic birth process instead of against it, through increased muscle tension, stress, and anxiety.

It's important to work through the four contexts of comfort as they are related to pain. The physical pain is obvious as labor progresses and is addressed through the effects of hydrotherapy itself. Psychologically and spiritually, women can experience pain based on their previous encounters with pain, either in labor or other non-pregnancy related pain. Anxiety can also contribute to the perception and experience of psychospiritual and physical pain (Koehn, 2000). Hydrotherapy is considered an alternative or complementary therapy, and these types of therapies are based on a mind, body, and spirit balance. Hydrotherapy has been shown to decrease muscle tension and anxiety. Women who utilize hydrotherapy will experience relief from having the ability to interact and alternate their environment, feel interpersonal connectedness with their partners as they bond during that time, and also feel the physical benefits of the warm water immersion. All of these factors contribute to supporting a physiologic labor process (Koehn, 2000).

A provider's role is to identify the patient's comfort needs then provide the appropriate interventions with the motive alleviating the tension that is being experienced (Koehn, 2000). In response, the patient will determine whether or not those interventions have increased their comfort. Hydrotherapy or water immersion can be an alternative form of pain management that offers patients holistic comfort. Women have more control over their environment and the setting can feel more relaxed and supportive. It is the responsibility of the provider to allow the patient that comfort, when it is an available option. It is also the provider's duty to adjust and modify the

intervention as needed to accommodate the patient's various comfort levels. By applying Katherine Kolcaba's Comfort Theory, providers can help patients utilize hydrotherapy as a way to reach their desirable levels of comfort throughout their labor and birth experience.

Conclusion

The significant findings of this literature review included the documentation of the benefits associated with hydrotherapy use in labor. These include decreased pain and increased movement, decrease need for obstetric intervention, augmentation and induction, decreased anxiety, increased maternal satisfaction, decreased epidural analgesia use, and beneficial hormone changes. All of these benefits that are associated with hydrotherapy use during labor help facilitate a physiologic labor process. Twenty-two articles were analyzed for this review using the Johns Hopkins Research Appraisal Tool with statistically significant results found in the areas mentioned above.

The ACNM (2014) released a position statement encouraging the use of hydrotherapy during labor. Hydrotherapy is an effective non-pharmacological alternative to use in labor. It is safe and provides comfort and relaxation, which helps promote physiologic childbirth. The benefits found in this review are all proponents of physiologic labor. Physiologic labor is characterized by minimal intervention and includes several factors that encourage effective labor. Decreased pain and anxiety help slow the release of cortisol which can alter labor progress. It can also help release natural endorphins produced by the body to increase pain tolerance. Increased maternal satisfaction also increases a sense of control and empowerment. This allows patients to feel safe and comfortable and allows labor to progress naturally. Finally, a decrease in the need for obstetric intervention, including episiotomy, cesarean section, epidural use, and instrument deliveries are all beneficial and promote physiologic labor.

Nurse-midwives are well-positioned and encouraged to educate pregnant women on the benefits of hydrotherapy and how it facilitates a physiologic labor process. Through the application of Katherine Kolcaba's Theory of Care throughout the prenatal and intrapartum period, hydrotherapy can be an effective and meaningful intervention for women. Application of the theory will improve the patient-provider relationship and give midwives an opportunity to gain a more thorough understanding of patients and their care needs. This in turn, will help guide both the patient and the midwife throughout labor to help provide the patient with the best labor outcome possible.

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Appendix 1 – Literature Review Matrix

Source:
Abo-Romia, F.A., & El-Adham, A.F.M. (2014). Effect of warm showering on laboring pain during the first stage of labor. *International Journal of advanced research, 2*(5), 438-442. Doi: http://www.journalijar.com/uploads/736_IJAR-3277.pdf

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Evaluate the effect of warm showers on labor pain during the 1st stage of labor **Sample/Setting:** 100 participants total Group 1 (n=50) – Study Group Group 2 (n=50) Control Setting: Almatrentaih Private Hospital at Alexandria, Egypt **Level of evidence:** Level I **Quality of evidence:** Good (B)	RCT -A questionnaire sheet to collect the necessary data was developed and validated. -Visual Analogue Scale (VAS) used for measurement of the degree of pain of the first stage of labor, anxiety, and fatigue. -Participants showered for 30 minutes at a time	-Significantly lower pain (p= 0.011) levels in Group 1 compared to Group 2 -Significantly lower anxiety scores, (p= 0.018) in Group 1 compared to Group 2 at a confidence interval of 0.05%, -No statistically significant differences were found between both groups regarding fatigue.	**Strengths:** -Data supported by several other similar studies -Study instruments validated **Limitations:** -Small sample size -Unable to perform blind study design **Conclusion:** There is a positive effect of therapeutic showering on the studied women's pain and anxiety levels

Author Recommendations: Continuing education for nurse midwives should emphasize water therapy as a non-pharmacological measure for pain relief during first stage of labor in clinical practice. This study enhanced the non-pharmacological knowledge, based on scientific evidence and good outcomes in pain relief during labor with humanized care at clinical settings.

Summary for current clinical practice question: Labor pains and loss of control, the two most frequently cited unpleasant experiences of childbirth, directly affect woman's satisfaction concerning birth care. With labor pain outside the mother's control, she also faces increased risk of feeling fear, tension, anxiety, helplessness, and loss of control of the overall birthing process. Nurse-midwives can implement simple, effective, low-cost, and non-pharmacological labor pain relief measures that promote labor progress, increase women satisfaction, and avoid side effects of medications. Warm water showering is one measure that diminishes pain stimulus at the source, inhibits pain awareness, and reduces women's negative reaction to childbirth pain.

Source:
Barbosa da Silva, F.M., Vasconcellos de Oliveira, S.M., & Nobre, M.R. (2009). A randomized controlled trial evaluating the effect of immersion bath on labour pain. *Midwifery, 25*(3), 286-294. Doi: 10.1016/j.midw.2007.04.006.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To assess the pain scores of laboring, nulliparous women during the first stage of labor; comparison of those using an immersion bath versus non-bathing. **Sample/Setting:** Sample size included 108 nulliparous women in labor, with 54 women randomly assigned to each group. Sao Paulo, Brazil at the Normal Birth Center of Amparo Maternal. **Level of evidence:** Level 1 **Quality of evidence:** Good (B)	RCT -Pain scores were evaluated using both a subjective and objective pain scale. -The objective 5-point behavioral pain scale -The subjective numeric pain scale (VAS). -Evaluations of the pain scales were recorded at 2-time intervals. The first at 6-7cm. cervical dilation and the second was 1 hour after the first pain score evaluation. Behavioral 5-point scale Intensity 0 - normal respiration, no gasping Intensity 1 – Frequency/amplitude of respiratory rate is modified during contractions Intensity 2 – In addition to above, signs of tension appear during contractions including grasping reactions that cease between contractions. Intensity 3 – Manifestations of level 2 that persist between contractions, indicating an absence of relaxation, Intensity 4 – Signs of relaxation may arise during contractions or between them (abrupt uncontrollable movements)	-Initial evaluation of the pain scores using the behavioral scale showed an average score of 1.7 for the control group and 1.6 for the experimental group ($p=0.591$) -For the second evaluation, there was a statistically significant difference between the groups -The behavioral scale showed an average score of 2.4 for the control group and 1.9 for the experimental group. ($p<0.001$). -The numeric scale showed scores of 9.3 for the control group and 8.5 for the experimental group ($p<0.05$)	**Strengths:** -This study evaluated both observer-scored (behavioral scale) and self-reported (numeric scale) pain scores for women -Pain measurements taken by the researcher and reported by the women were consistent -Study results are consistent with multiple other clinical studies **Limitations:** -Due to the nature of water immersion, it was not possible to blind the birthing women or caregivers to the intervention **Conclusion:** The use of an immersion bath can be associated with a reduction of pain and is a good alternative form of pain relief.

Author Recommendations: It would be interesting to report the puerperal infection rates among the women in this study. However, such a measure was not possible because the research locale does not offer a follow-up service for postpartum women. The study was not designed to evaluate the effects of the immersion bath on neonatal outcomes, although it was noted that it had no adverse effects on the immediate health (Apgar) scores of the babies.

Summary for current clinical practice question: Although the pain scores increased upon re-evaluation, that is to be expected as women progress further along in labor. The potential advantages of immersion bath on labor pain include a reduction or delay in the use of drugs for pain control. This results in laboring women having the ability to take a more active role in the labor process and offers another option for non-pharmacological pain management to support a woman through physiological birth.

Source:
Benfield, R., Heitkemper, M.M., & Newton, E.R. (2018). Culture, bathing and hydrotherapy in labor: An exploratory descriptive pilot study. Midwifery, 64, 110-114. Doi: https://doi.org/10.1016/j.midw.2018.06.005

Purpose/ Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To explore pregnant women's experiences of bathing, bathing in labor, and cultural beliefs about bathing. **Sample/Setting:** 41 total participants Setting: low risk obstetrical clinics in a rural community in Southeast United States. **Level of evidence:** Level II **Quality of evidence:** Good (B)	Exploratory, descriptive study -Women responded to a questionnaire on the use of bathing during a routine prenatal visit. -Three primary questions were asked: 1. "Do you use bathing for purposes other than getting clean?" 2. "Have you used bathing in labor with a previous pregnancy?" 3. "Are there factors in your cultural beliefs about bathing?" - If the answer was "yes" to any of the questions, participants were asked the following open-ended questions for further information: 1. "For what other purposes do you bathe?" 2. "Tell me about your experience with bathing in labor: how did bathing in labor affect your pain?" 3. "How did bathing in labor affect your anxiety?" 4. "How did bathing in labor affect your relaxation?" 5. "Describe your cultural beliefs about bathing."	-46% of women used bathing for purposes other than hygiene -Only 4.9% (n=2) of women bathed during a previous labor, both African-American -The words used to describe the effects of bathing include: relaxing, easing, calming, and efficacious for relief of menstrual cramps and labor contractions. -10% of women reported cultural beliefs about bathing. - Only one woman had previously used bathing during term labor; she said the experience "made me more relaxed, calmed me down instead of being panicky."	**Strengths:** -Sample was racially and ethnically diverse **Limitations:** -Small sample -Study data was collected in busy prenatal settings, with stringent time limitations imposed by the clinic schedule, routine antenatal tests and participants' own schedules for transportation, work or other appointments. **Conclusion:** Women who bathe report relief of anxiety, menstrual and labor pain and promotion of mental and physical relaxation. The findings do not support the view that bathing is associated with identifiable cultural beliefs; rather, they suggest that bathing is a self-care measure used by women of many cultures.

Author Recommendations:
-Findings of the current study are based on one geographic area. The study needs to be duplicated in more diverse settings including areas with more deeply rooted ethnic or religious traditions and intact cultures.
- A longer interview with more in-depth questions if possible.
-Recommend using more open, unstructured, in-depth approach, in a more relaxed setting, to clarify the findings presented in this study and to uncover additional themes or concepts related to bathing in pregnancy and labor and the cultural beliefs of women about this intervention.

Summary for current clinical practice question: The responses in this study reinforce both psychological and physiological purposes of bathing. It is viewed as a method to control or seek relief from pain and to promote physical and mental relaxation. Throughout labor, this can be beneficial in supporting physiologic birth.

Source:
Burns, E., Boulton, M., Cluett, E., Cornelius, V., & Smith, L. (2012). Characteristics, interventions, and outcomes of women who used a birthing pool: A prospective observational study. *Birth, 39*(3),192–202. Doi: https://doi.org/10.1111/j.1523-536X.2012.00548.x

Purpose/Sample	**Design (Method/Instrument)**	**Results**	**Strengths/Limitations**
Purpose: -To describe and compare maternal characteristics, intrapartum events, interventions, and maternal and neonatal outcomes by planned place of birth for women who used a birthing pool **Sample/Setting:** -8,924 low-risk women in labor, who used a birthing pool -Multiple hospitals in England, Scotland, and Northern Ireland between 2000 and 2008 **Level of evidence:** Level II **Quality of evidence:** Good (B)	Prospective Cohort Study -Data were collected on "low risk" obstetric profile (defined as an uncomplicated pregnancy, singleton fetus with cephalic presentation, and labor at 37 weeks or more gestation, and no preexisting disease that may affect a woman's labor risk) -Midwives prospectively recorded data on a standardized form while caring for the woman during labor and birth.	Of the 8,924 women, the most popular analgesia was inhalational (50% nitrous oxide, 50% oxygen), which was used by 6,465 (72.4%) women. -Other analgesics used included injected opioids (962, 10.7%) and epidural (825, 9.2%) and spinal anesthetic (333, 3.7%). -Overall, 1,888 (21.1%) women had their labor augmented: 1,632 (18.3%) by artificial membrane rupture and 256 (2.8%) by intravenous infusion of oxytocin. - 7,137 (79.9%) achieved a "normal birth" -A total of 3,732 (41.8%) women left the birthing pool before delivery, mostly for additional analgesia (n=887, 23.7%) or slow progress in the first stage of labor (n=581, 15.5%)	**Strengths:** - large sample of data with almost complete follow-up on all recruited women. -First study to comprehensively report intrapartum interventions and maternal and neonatal outcomes across different care settings by maternal parity -Sample is diverse representing 29 care setting in 3 countries **Limitations:** - Lack of a control group of women who met the eligibility criteria and chose not to use the pool. -Measurements for some outcomes were subjective, such as duration of labor, which may have resulted in measurement error. **Conclusion:** -Differences found among care settings for nulliparas included fewer augmentations, epidurals, operative vaginal deliveries, and cesarean sections for community than for obstetric unit and alongside midwifery unit women. -Hospital transfer from the community occurred less frequently than from the alongside midwifery unit, with no apparent difference in adverse outcomes.

Author Recommendations: The use of interventions and outcomes in alongside midwifery units was similar to that in the obstetric units, but not the community. With the exception of more normal births for community multiparas, no evidence was found that care setting affected interventions or outcomes in multiparas or outcomes for newborns. These data will help practitioners inform women about using a birthing pool during labor in the hospital, midwife-led, and community settings

Summary for current clinical practice question: Birthing pool use was associated with a high frequency of spontaneous birth and normal birth, particularly among nulliparas.

Source:
Cluett, E.R., Pickering, R.M., Getliffe, K., St. George Saunders, N.J. (2004). Randomised controlled trial of laboring in water compared with standard of augmentation for management of dystocia in first stage of labour. *BMJ*. doi:10.1136/bmj.37963.606412.EE

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To evaluate the impact of laboring in water during the first stage of labor on rates of epidural analgesia and operative delivery in nulliparous women with dystocia **Sample/Setting:** 99 nulliparous women with dystocia (defined as <1cm/hour in active labor) Group 1 (n=49) water labor Group 2 (n=48) control Setting: University teaching hospital in southern England, **Level of evidence:** Level I **Quality of evidence:** Good (B)	RCT -Immersion in water in birth pool versus standard augmentation for dystocia (amniotomy and IV oxytocin) Primary outcomes: -Epidural analgesia and -operative delivery rates Secondary outcomes: -Augmentation rates w/ amniotomy and oxytocin Length of labor -maternal and neonatal infections -Maternal pain score -Maternal satisfaction with care.	-Group 1 had a lower rate of epidural analgesia (47%) than women allocated to Group 2 (66%) p=0.056 -No statistical difference in operative delivery rate between groups (49% vs 50%) p=0.919 -Mean pain score was less (49) in the water immersion group compared to the control group (64) p=0.003 -No difference in length of labor p=0.677 -Women in group 1 were more satisfied with freedom of movement (91%) compared to women in control group (63%) p=0.001	**Strengths:** -1st trial to evaluate the impact of laboring in water for nulliparous women with dystocia **-**RCT **Limitations:** -Only 99 of the intended 220 women participated for a variety of reasons. -Generalizability -The low participation rate contributed to the outcomes achieved, such as the lack of statistical significance in relation to the difference in rates of epidural analgesia. **Conclusion:** Compared with women given standard augmentation, the women laboring in water had no difference in operative delivery rates and tended to receive less epidural analgesia. Those women also reported less pain and greater satisfaction.

Author Recommendations: More studies are needed on a larger scale to detect statistical significance concerning epidural analgesia rates and to further support the findings of this study. Consideration should be taken on ways to overcome recruitment problems.

Summary for Clinical Practice:
For nulliparous women with labor dystocia, immersion in water for up to four hours might reduce the need for augmentation of labor. Hydrotherapy can be an alternative option to early augmentation of labor. Delaying augmentation in association with hydrotherapy is acceptable to women with dystocia and may reduce the need for epidural analgesia without increasing labor length or operative deliveries.

Source:
Cooper, M. & Warland, J. (2019). What are the benefits? Are they concerned? Women's experiences of water immersion for labor and birth. Midwifery, 79, 1-11. Doi: https://doi.org/10.1016/j.midw.2019.102541

Purpose/Sample	**Design (Method/Instrument)**	**Results**	**Strengths/Limitations**
Purpose: Explore the views, experiences, perceptions of and access to water immersion (WI) during labor and birth **Sample/Setting:** 740 women in labor in Australia Data collected from November 2016 through October 2017 **Level of evidence:** Level II **Quality of evidence:** Good (B)	Sequential exploratory mixed methods study -Participants completed 2 surveys -The first survey focused on women's experiences of using WI during labor and/or birth -The second survey questioned women who had given birth but had not used WI, for the purpose of comparing the views and perceptions of those who did and did not use WI. -Question types included: multiple choice, Likert scales, sliding scales and text responses. -Women asked to rate their views on commonly documented benefits (7-point) and concerns (5-point) related to water immersion,	<u>Participants were most in agreement with the following statements:</u> 'I would recommend WI to others' (*n* = 633/740, 85.54%), 'I felt safe' (*n* = 593/740, 80.13%), 'My baby was alert' (*n*=555/740, 75.00%), 'I had a positive birth experience' (*n* = 538/740, 72.70%), 'Water immersion was soothing' (*n* = 533/740, 72.02%) 'I was able to move freely' (*n* = 528/740, 71.35%). <u>Participants least agreed with the statements:</u> 'I had a quicker labor than I anticipated' (*n*=63/740, 8.5%), 'I had less pain than I anticipated' (*n* = 43/740, 5.8%) 'I had an easier birth than expected' (*n* = 42/740, 5.7%). <u>Participants indicated that they were most concerned about:</u> being told to get out of the bath when they didn't want to (*n* = 120/736, 16.30%), their contractions going away (*n* = 76/736, 10.32%), the staff not being supportive of their choice (*n* = 65/736, 8.83%) getting too hot (*n* = 65/736, 8.83%).	**Strengths:** -More responses were achieved than the required 381, adding to level of rigor and reliability to the results. **Limitations:** -The survey was set up to capture ratings against Likert- scales which, can be difficult to analyze -The authors avoided reporting parametric statistics for the Likert scales, which reduces the strength of the findings. -The findings are not able to be contextualized further due to the quantitative design of the study **Conclusion:** Women suggested that water immersion helped facilitate a better experience and increased satisfaction, relaxation, comfort, empowerment and control.

Author Recommendations: It is important that research reporting women's experiences of care provision does not go under-looked when compared empirical measures. These results should assist policy makers and clinicians to support water immersion and its benefits.

Summary for current clinical practice question: This paper adds to the growing evidence base that suggests women experience a positive childbearing experience when they are able to access hydrotherapy during labor. Women value having this option available and they can experience a broad range of benefits including, but not limited to, greater satisfaction, relaxation, empowerment and privacy.

Source:
Darsareh, F., Nourbakhsh, S., & Dabiri, F. (2018). Effect of water immersion on labor outcomes: A randomized clinical trial. *Nursing and Midwifery Studies, 2018*(7), 111-115. Doi:10.4103/nms.nms_18_17

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To determine the effects of water immersion during the first stage of labor on labor outcomes **Sample/Setting:** 180 women total Group 1 – hydrotherapy (n=90) Group 2 – Non-hydrotherapy group (n=90) Setting: January 2015-October 2015, L&D unit of Khaleej-e Fars hospital in Bandar Abbas, Iran. **Level of evidence:** Level 1 **Quality of evidence:** Good (B)	RCT -At 4cm, each woman entered the tub and sat in until the end of the first stage (10cm). -While sitting in the tub, staff regularly assessed uterine contractions every 30 minutes, performed vaginal examinations, and monitored fetal heart rate. Vaginal examinations were done every 1–2 h.. -Women with inadequate uterine contractions were provided with labor augmentation using five units of oxytocin in 1000 ml of Ringer's solution. - Women in the control group received the same care women in the intervention group with the exception of water immersion Primary outcome: length of active stage of labor Secondary outcomes: length of 2nd stage of labor, mode of delivery, perineal conditions, need for augmentation with oxytocin, maternal satisfaction with birth experience, and neonatal outcomes.	- The length of the active phase of labor in the group 1 was significantly greater than group 2 -232.95 ± 20.76 vs. 165.81 ± 22.76 min; ($p < 0.001$). -no statistically significant difference was observed between the groups in terms of the length of the second stage of labor 48.40 ± 9.80 vs 48.00 ± 4.50 ($p=0.631$) - women in the experimental group had significantly greater satisfaction with birth experience, 8.85 ± 1.31 vs 5.08 ± 2.01 ($p < 0.001$) The groups did not significantly differ regarding the following outcomes: -need for augmentation ($p = 0.094$), -1 and 5-min Apgar scores ($p = 0.283$ and 0.695), -mode of delivery ($p = 0.956$)	**Strengths:** -The first author was present in the study setting throughout each participant's entire labor. -Majority of findings are supported by other related studies **Limitations:** -Women in the experimental group were treated in a setting different from that of those in the control group. The privacy and silence of that setting might have exerted some relaxing effects on women in the experimental group. - Unable to keep participants and health-care providers blind to the groups. **Conclusion:** Water immersion significantly increased the length of the active phase of labor.

Author Recommendations: Large-scale clinical trials are recommended to compare the effects of different water immersion protocols on maternal and neonatal outcomes and thereby, to determine the best water immersion protocol for labor. More studies should be conducted to determine at what cervical dilation does water immersion help with labor progress versus stall labor progress

Summary for current clinical practice question: Water immersion significantly increased the length of the active phase of labor. The active phase of labor has recently been widely accepted and considered at 6cm dilation.

Source:
Henderson, J., Burns, E.E., Regalia, A.L., Casarico, G., Boulton, M.G., & Smith, L.A. (2014). Labouring women who used a birthing pool in obstetric units in Italy: Prospective observational study. *BMC Pregnancy and Childbirth, 12*(17), 1-7. Doi: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3897991/pdf/1471-2393-14-17.pdf

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To describe maternal characteristics, intrapartum events, interventions, maternal and neonatal outcomes for all women who used a birthing pool during labor or birth **Sample/Setting:** 2,505 women in labor using a birthing pool in 19 obstetric units Setting: 19 obstetric units **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi-experimental study, Prospective observational study - Data were collected on women's age, gestation, parity (nullipara or multipara), previous caesarean, labor onset (spontaneous or induced) and cervical dilatation before entering the pool, -Intrapartum outcomes included water temperature, duration of pool use, pain relief, reason for leaving the pool, birth position for vaginal delivery, caregiver hands on or off delivery technique, duration of labor, type of delivery, whether waterbirth or not, third stage management, perineal outcome -Other outcomes included blood loss, maternal and neonatal complications, and neonatal readmission within seven days.	-No difference in duration of labor between groups (p=0.448) -97.1% of women using birthing pool during labor had a SVD compared to 95% of women who didn't use birthing pool -Compared with controls, significantly more women who used a birthing pool gave birth in an upright position (30.7% vs 6.6%), had hands off delivery technique (40.6% vs 8.9%) and a physiological third stage of labor (20.3% vs 0%) -Nulliparas using a tub had a lower episiotomy rate (33% vs 53%), and more had a second degree perineal tear (26% vs 15%),	**Strengths:** -Adequate sample size -Study strengthened by prospective data collection and having a low proportion of missing data. **Limitations:** -Although all 46 obstetric units with a birthing pool were invited to participate in this study, only 21 agreed to do so. -Data relating to two of them could not be used due to concerns about quality. **Conclusion:** The use of a birthing pool during labor and/or birth is associated with lower obstetric intervention rates compared with controls.

Author Recommendations: Future studies need to be done with a bigger sample size and more consistent participation from participating units.

Summary for current clinical practice question: Water immersion during labor supports a physiologic birth process by potentially encouraging more upright positions and pain relief. It is also associated with a SVD, which is a part of physiologic birth.

Source:
Henrique, A.J., Gabrielloni, M.C., Cavalcanti, A.N.A., de Souza Melo, P., & Barbieri, M. (2016). Hydrotherapy and the Swiss ball in labor: randomized clinical trial. *Acta Paulista de Enfermagem, 29*(6), 686-692. Doi: http://dx.doi.org/10.1590/1982- 0194201600096

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To understand the influence of a warm bath and perineal exercise with a Swiss ball on the progression of labor **Sample/Setting:** 128 participants total Group 1 – (n=44) warm bath Group 2 – (n=45) perineal exercises w/ Swiss ball Group 3 – (n=39) Combination Conducted from June 2013 to February 2014 in two hospitals in two public hospitals in S o Paulo, Brazil **Level of evidence:** Level I **Quality of evidence:** Good (B)	RCT w/ pre and posttest measures -The participants were evaluated before the intervention and 30 minutes after the intervention -Outcomes measured: the frequency of uterine contractions, fetal heart rate, cervical dilatation, fetal descent stations -Interventions utilized for 30 minutes -The warm bath intervention was performed using a warm water jet spray directed to the lumbo-sacral region, at 37 degrees Celsius -The Swiss ball participants were instructed to sit on the ball with their legs flexed, at a 90 degree angle, knees apart, with feet resting on the floor, performing movements of pelvic rotation and propulsion	-Increase in the frequency of UC's in Group 1 (p = 0.025) and Group 2 (p <0.001) -24 women received epidural analgesia after participating in the intervention Group1=15.9% Group 2=24.4% Group3=15.4% -108 women had a vaginal delivery Group1=86.4 % Group2=80.0% Group3=87.2% -20 women had a cesarean delivery Group 1=13.6% Group2=20.0% Group3=12.8% Group3 (p=0.688) showed a higher progression of fetal head descent than group 1 (p=0.428) and group 2 (p=0.679).	**Strengths:** -Results supported by similar RCTs -Randomization **Limitations:** -Smaller sample size **Conclusion:** The use of a warm bath combined with perineal exercises and the Swiss ball modify labor progress. The combination of the interventions demonstrated greater impact to the labor process. Group 3 needed less analgesia, had a greater occurrence of vaginal delivery (87.2%), a more rapid progression of cervical dilatation, a better evolution of fetal head presentation, an increased frequency of contractions (p <0.001), and a greater reduction in labor time of 41.18 minutes, compared to group 1 and group 2

Author Recommendations: Formulation of public policies, women's autonomy, and changes in the care practices during the prenatal and labor periods may contribute to the reduction of unnecessary caesarean sections. More studies need to be done on this topic to help further support the findings.

Summary for current clinical practice question: Combining a warm bath with perineal exercise using a birth ball during labor has been shown an effective intervention for effecting changes to the labor process, such as shorter length of labor, and higher occurrence of vaginal delivery. The encouragement of normal birth is related to support in the reduction of unnecessary cesarean rates.

Source:
Henrique, A.J., Gabrielloni, M.C., Rodney, P., & Barbieri, M. (2016). Non-pharmacological interventions during childbirth for pain relief, anxiety, and neuroendocrine stress parameters: A randomized controlled trial. *International Journal of Nursing Practice, 24*(3), 1-8. doi: 10.1111/ijn.12642

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Study the effects of warm shower hydrotherapy and perineal exercises with a ball on pain, anxiety, and neuroendocrine stress hormones. **Sample/Setting:** 128 women Group 1 (GA)– shower hydrotherapy Group 2 (GB)– perineal exercises with a ball Group 3 (GC)– combined intervention Setting: Hospital in Sao Paulo, Brazil **Level of evidence:** Level I **Quality of evidence:** Good (B)	RCT -Women randomly allocated into groups -Pre and post-intervention parameters were evaluated using visual analogue scales for pain and anxiety, and salivary samples were collected for the stress hormones analysis. -Salivary samples were collected by using cotton swabs and placing under the tongue of the participants for 3 minutes.	-Average pain score was similar between all 3 groups (Mean = 7.5) - Anxiety score decreased in all 3 groups after intervention. Group 2 showed the highest score reduction after the intervention (8.76 ± 2.07 to 8.44 ± 2.09) Group 1 (7.75 ± 2.69 to 7.52 ± 2.78) -Cortisol release increased in all groups after the interventions but the hydrotherapy group showed the slowest release of cortisol after the intervention (17.90 ± 12.45) - After the intervention, β-endorphin release decreased in the group using the warm shower in groups 1 and 3. The decrease was greater in group 1 (30.87 ± 80.40). p=.oo7 - All groups increased their noradrenaline release, and this change was greatest in group 1 (76.50 ± 178.95) after the intervention.	**Strengths:** -Group randomization **Limitations:** - There was limited validity of the biochemical hormone kits used. -small sample size **Conclusion:** This therapy is associated with clinical and neuroendocrine changes during childbirth, including a reduction in pain and anxiety.

Author Recommendations: The sample size possibly influenced the significance. Therefore, researchers suggest surveys involving larger samples should be conducted.

Summary for current clinical practice question:
-Because medication changes the physiology of birth, hydrotherapy can be used instead of analgesia. Perineal exercise can be effective for promoting women's comfort also.
-Optimal physiologic function of the neuroendocrine system enhances the release of endogenous oxytocin and beneficial catecholamines in response to stress.
-These hormones promote effective labor patterns and protective physiologic responses, including enhanced endorphin levels.
-When there is optimal physiologic functioning, women are less likely to require interventions to artificially augment labor, which can potentially interfere with their ability to cope with pain.

Source:
Lee, S.L., Liu, C.Y., Lu, Y.Y. & Gau, M.L. (2013). Efficacy of warm showers on labor pain and birth experiences during the first labor stage. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 42*, 19-28. Doi: https://doi.org/10.1111/j.1552-6909.2012.01424.x

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To study the effects of warm shower use during the active phase of the first stage of labor on pain relief and on the impact of the birth experience **Sample/Setting:** 80 total participants. Group1 –experimental (n=39) Group 2 – control (n= 41) Setting: Maternity ward of a regional teaching hospital in Taipei City, Taiwan. Conducted from July 2010 to January 2011 **Level of evidence:** Level I **Quality of evidence:** Good (B)	RCT - Participants in the experimental group received warm shower interventions. -Each shower lasted 20 minutes. -After a 5-minute full body or lower back shower, women could spend 15 minutes directing shower water toward any body region -Women allowed to stand and sit as desired. -Participants in the control group received standard childbirth care. -Pain assessed using a VAS and maternal feelings of control during labor assessed using the self-administered Labor Agentry Scale (LAS)	- The mean LAS score of the group 1 was 54.15 (*SD* = 6.38) and 46.58 (*SD* = 8.61) in the control group ($p < .001$) - The VAS scores for the experimental group were lower than control group scores at all measured periods, 4cm ($p<.001$) and 7cm ($p<.001$) - Women had higher VAS scores at 7-cm dilations than 4-cm in both groups, indicating that pain level increased as mothers progressed through the initial stages of labor	**Strengths:** -Study data that demonstrates the effectiveness of warm showers in reducing labor pain is reinforced by the results of similar studies **Limitations:** -Small sample size -Unable to have blind study design **Conclusion:** Warm showers improved the childbirth experience and decreased labor pain

Author Recommendations: - More and larger scale studies should be performed to confirm results. Continuing education for nurses/midwives should emphasize water therapy as a non-pharmacological alternative for pain relief in clinical practice. Enhancing a nurse's familiarity with such concepts and techniques will provide laboring women more pain control options.

Summary for current clinical practice question: A warm shower is effective in relieving labor pain and fostering positive feelings toward the labor process during the first stage of labor. This non-pharmacological alternative to pain relief is economical, easy to arrange, and does not require preintervention training. It can be useful for women during labor.

Source:
Lewis, L., Hauck, Y.L., Butt, J., & Hornbuckle, J. (2017). Obstetric and neonatal outcomes for women intending to use immersion in water for labour and birth in Western Australia (2015-1016): A retrospective audit of clinical outcomes. *The Australian and New Zealand Journal of Obstetrics & Gynecology, 58*, 539-547. Doi: https://doi.org/10.1111/ajo.12758

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To evaluate the obstetric and neonatal outcomes of women using water immersion for labor and birth **Sample/Setting:** 502 women intending to labor or birth in water at a tertiary maternal hospital in Australia. Group 1 – Labor in water (n=303) Group 2 – Did not labor in water (n=199) Conducted between July 2015 and June 2016. **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi-experimental, Retrospective cohort study -Obstetric and neonatal outcomes collected retrospectively through the participant's medical records.	-88% of women in group 1 had a SVD compared to 69% of women in Group 2 $p<0.001$ -No statistical difference in groups between the lengths of the 1st ($p=0.331$) and 2nd stages of labor ($p=0.703$) -No differences in perineal integrity between groups $p=0.095$ **Conclusion:** Water immersion during labor can lead to higher rates of SVD. There is no evidence showing association between water immersion and increased perineal lacerations or shorter duration of labor.	**Strengths:** -Multiple variables evaluated **Limitations:** -The data were collected from the women's medical records which relied on accurate input of data by clinical midwives. -Women who did not sign an 'Agreement for use of water for birth' but still birthed in water were excluded from this analysis and were not able to be included in this analysis. -Sample was small and taken from one tertiary maternity center

Author Recommendations: There is more need for high-quality collaborative research into water immersion for labor and birth, to help women make an informed decision.

Summary for current clinical practice question: Water immersion shows benefits of decreasing the rates of cesarean section and operative delivery while increasing the rates of SVD.

Source:
Liu, Y., Liu, Y., Huang, X., Du, C., Peng, J., Huang, P., & Zhang, J. (2014). A comparison of maternal and neonatal outcomes between water immersion during labor and conventional labor and delivery. *BMC Pregnancy and Childbirth, 14*(160). doi: http://www.biomedcentral.com/1471-2393/14/160

Purpose/Sample	**Design**	**Results**	**Strengths/Limitations**
Purpose: To compare maternal and neonatal outcomes of women who underwent hydrotherapy during the first stage of labor with those who underwent conventional labor and delivery. **Sample/Setting:** 108 primipara, singleton pregnant women at Sun Yatsen Memorial Hospital, China Group 1 – water (n=38) Group 2 – conventional (n=70) **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi experimental study -Patients were allowed to choose water immersion during labor or conventional labor and delivery. -A visual analog scale (VAS) was used to assess pain during labor, at 4cm, 6cm, and 10cm dilation -Other outcomes measured included duration of labor, infection, symptoms of stress urinary incontinence at 42 days postpartum, and need to transfer infant to NICU	- VAS pain scores were greater in group 2 at 3 cm -30 min after: 10 vs. 6 (Group 1) -60 min after: 10 vs. 7 (Group 1) - p-value < 0.001 - Duration of labor was similar First Stage -Group 1: 596.55 ± 249.71 -Group 2: 552.30 ± 241.85 - p-value: 0.429 - The cesarean section rate was higher in group 2 -Group 1 (n=5) 13.2% -Group 2 (n=23) 32.9% - p-value: 0.026 **Conclusion:** Hydrotherapy is associated with a reduction in labor pain and is associated with a lower rate of cesarean delivery. Water immersion does not increase the rate of maternal or neonatal infections. There was no statistical difference in duration of labor between groups.	**Strengths:** -Although no randomization, the 2 groups were similar with respect to baseline demographic and clinical characteristics. -Although the sample size was small, the confidence is high that the difference was significant. **Limitations:** -No randomization, patients were allowed to choose water immersion or conventional labor, thus they were not randomized. Patients that choose water immersion may have had a bias towards believing that water immersion would be beneficial. -number of patients in the water immersion group was small -The exclusion criteria was strict. For example, hepatitis B virus carriers are excluded, and this condition is common in the Chinese population.

Author Recommendations:
Water immersion during labor is an intrapartum service model that is worthy of promotion and application. Patients that choose water immersion may have had a bias towards believing that water immersion would be beneficial. Further studies with randomization would be beneficial.

Summary for current clinical practice question: Results of this study suggest water immersion during labor can reduce labor pain and is associated with a lower rate of cesarean delivery.

Source:
Lukasse, M., Rowe, R., Townend, J., Knight, M., & Hollowell (2014). Immersion in water for pain relief and the risk of intrapartum transfer among low risk nulliparous women: Secondary analysis of the birthplace national prospective cohort study. *BMC Pregnancy & Childbirth, 14*(60), 1-11. Doi: http://www.biomedcentral.com/1471-2393/14/60

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To assess whether water immersion in labor used for pain relief is associated with a lower risk of intrapartum transfer and other intrapartum interventions and adverse maternal outcomes in low risk nulliparous women planning birth outside an obstetric unit. **Sample/Setting:** 16,577 total participants. Low risk nulliparous women planning birth at home, in a freestanding midwifery unit (FMU) or in an alongside midwifery unit (AMU) in England between April 2008 and April 2010. **Level of evidence:** Level II **Quality of evidence:** Good (B)	Prospective cohort study -Data recorded by the midwife attending the birth -If a woman transferred, the form transferred with the woman and data collection was continued in the receiving unit. Main outcomes were: - Intrapartum transfer before birth - Intrapartum caesarean section - Straightforward vaginal birth Secondary outcomes were: - Transfer for failure to progress in the first stage of labor - Transfer before birth for 'potentially urgent reasons' - Transfer for pain relief or epidural analgesia - Augmentation in labor with oxytocin - Epidural or spinal analgesia	- Immersion in water for pain relief was most common in women at a FMU (54%), then 50% in planned home births, and 38% in AMUs. -Immersion in water was associated with a lower risk of transfer before birth for births planned at home (adjusted RR 0.88; 95% CI 0.79–0.99), in FMUs (adjusted RR 0.59; 95% CI 0.50–0.70) and in AMUs (adjusted RR 0.78; 95% CI 0.69–0.88). -At FMU, immersion in water was associated with a lower risk of intrapartum caesarean section (RR 0.61; 95% CI 0.44–0.84) and a higher chance of a straightforward vaginal birth (RR 1.09; 95% CI 1.04–1.15).	**Strengths:** **-**High quality data: prospectively collected from a large, nationally representative sample -Sample was homogeneous and a low risk population -Researchers were able to control for a number of maternal characteristics that might confound the relationship between immersion in water and the outcomes studied. **Limitations:** -Not a blind or random study **Conclusion:** Immersion of water for pain relief was associated with a significant reduction in risk of transfer before birth for nulliparous women and fewer interventions overall during labor.

Author Recommendations: The study findings support a policy of offering water immersion for pain relief , but the potential benefits and risks of water immersion at home are less well established and should be further researched. The study findings also showed that water immersion had limited effect on transfer and no significant effect on intrapartum interventions for births planned at home.

Summary for current clinical practice question: Water immersion for pain relief is associated with a significantly lower risk of transfer before birth, a higher chance of a straightforward vaginal birth and a lower risk of intrapartum caesarean section. This is good news for women who would like to give birth in an out-of-hospital setting and prefer less medical intervention throughout their labor and birth.

Source:
Mollamahmutoglu, L., Moraloglu, O., Ozyer, S., Su, F.A., Karayalcin, R., Hancerlioglu, N., Uzunlar, O., & Ilmen, U. (2012). The effects of immersion in water on labor, birth and newborn and comparison with epidural analgesia and conventional vaginal delivery. *Journal of Turkish-German Gynecological Association, 12*(1), 45-49. Doi: https://dx.doi.org/10.5152%2Fjtgga.2012.03.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Assess the effects of hydrotherapy during labor and birth on maternal, fetal, and neonatal well-being; compared to those of conventional vaginal deliveries and deliveries with epidural analgesia **Sample/Setting:** 610 pregnant women total. Zekai Tahir Burak Women's Health Education and Research Hospital, Turkey Group 1 – Labor in water (n=207) Group 2 –vaginal deliveries with epidural (n =191) Group 3 –conventional vaginal deliveries (control group n=204) **Level of evidence:** Level II **Quality of evidence:** High (A)	Quasi-experimental study Outcomes measured: -stages of labor (min) -number of inductions, -pain via visual analog scale (VAS) - systolic blood pressure -diastolic blood pressure Outcomes were noted on a questionnaire.	The 1st stage of labor was shortest in the 3rd group (p-value: 0.0001) -Group 1: 265.6±546.6 -Group 2: 268.7±177.4 -Group 3: 240.1±190.8 The 2nd and 3rd stages of labor wee shortest in Group 1 (p-value: 0.0001) -Group1: 10.9±5.02 ; 3.8±1.5 -Group 2: 28.3±13.3; 5.3±4.4 -Group 3: 23.9±14 ; 8.02±3.3 Significant reduction in the induction in Group 1 compared to the others (p-value: o.ooo1 Group 1 - 11 (5.3%) Group2 - 58 (30.4%) Group 3 - 57 (27.9%) VAS scores lowest in Group 1 (p=0.0001) Group1 – 4.7±1.3 Group 2- 5.8±0.9 Group 3-5.6±1.1 Systolic blood pressures were lower in group 1 (p-value:0.016) Group 1- 110±11 Group 2-111±10 Group3-113±9	**Strengths:** -Adequate sample size -Reference of studies that support findings **Limitations:** -No randomization **Conclusion:** The study validates the advantages of laboring in water including a reduction in 2nd and 3rd stages of labor, lower blood pressure, reduction in pain, induction, and obstetric intervention.

Author Recommendations: In this study, women were allowed to select which group they were in. Mentally/psychologically, this can have an effect on how they perceive pain and the overall experience of labor, which could have an effect on the results. To avoid this, randomization should occur in future similar studies

Summary for current clinical practice question:
-Laboring in water does not pose an increased risk of adverse effects to the laboring mother or fetus.
-Laboring in water positively contributes to maternal physiological and psychological health by reducing the need for augmentation

Source:
Neiman, E., Austin, E., Tan, A., Anderson, C.M., & Chipps, E. (2019). Outcomes of waterbirth in a US hospital-based midwifery practice. A retrospective cohort study of water immersion during labor and birth. Journal of Midwifery & Women's Health, 1-8. doi:10.1111/jmwh.13033

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To assess and generate evidence regarding maternal and neonatal outcomes related to water immersion in both labor and birth **Sample/Setting:** Convenience sample of 230 women receiving prenatal care at a nurse-midwifery practice Group 1 - Waterbirth (n=58) Group 2 - Water labor (n=61) Group 3 - Neither (n=111) **Level of evidence:** Level II **Quality of evidence:** Good (B)	Retrospective cohort study Women directed their own use of the tub as long as they continued to meet inclusion criteria. Maternal labor outcomes: -duration of labor stages -maternal satisfaction. -Measured outcomes collected immediately after the birth and later collected retrospectively from health records. -At the 6 week postpartum visit, satisfaction with birth experience, was measured using the Care in Obstetrics: Measure for Testing Satisfaction (COMFORTS) scale	-No statistical difference between duration of labor between Group 2 and Group 3 -Group 2: 764.7 (512.9) -Group 3: 757.8 (442.8) -p-value: 0.13 -Maternal satisfaction scores were high across all groups	**Strengths:** -Findings are consistent with the results of previous research - Factors prompting discontinuation of water immersion during labor were consistent with those reported by others, identifying maternal choice as the primary reason followed by reasons related to health indications **Limitations:** -This study has a small sample size, and as such, is not adequately powered to detect statistical significance. -The self-selection may have made this population different in some ways from a typical US population of birthing women. -The study sample included a highly educated, well-insured, white population, limiting generalizability to other demographic groups. -In addition, there were missing data (16%-23%) for COMFORTS scales. **Conclusion:** Hydrotherapy during labor shows several benefits including increased maternal satisfaction with labor and birth experience

Author Recommendations: More research is needed on the specific outcomes of shoulder dystocia, postpartum hemorrhage, and cord avulsion during waterbirth. Although the study has the stated limitation, nevertheless, the effect sizes established in this study will provide valuable information to guide sample size for similar, future large-scale studies.

Summary for current clinical practice question: Maternal satisfaction is high in women who used hydrotherapy during labor. The effects of maternal satisfaction on labor progress and labor outcomes are known to be beneficial.

Source:
Stark, M.A., Rudell, B., & Haus, G. (2008). Observing position and movements in hydrotherapy: A pilot study. *Journal of Obstetrics, Gynecologic, and Neonatal Nursing, 37*, 116-122. doi:10.1111/J.1552-6909.2007.00212.x

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To observe and describe the positions and movements that laboring women choose while immersed in water during the first stage of labor **Sample/Setting:** 7 women Rural community hospital in the US **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi Experimental, descriptive observational pilot study -Participants were observed every hour for 15 minutes throughout labor -Participant position and movements were observed and recorded -Women were free to choose when and how long to use hydrotherapy and had no restriction on their positions and movements.	None of the women who used the tub received epidural analgesia (0%) compared to (50%) of the women who did not use the tub -Women demonstrated a greater range of positions and movements in the tub than in bed during the first stage of labor -Women made more rhythmic movements while in the tub than in bed (20.8% vs. 1.1%) -Women made more pelvic movements in hydrotherapy compared to in bed (18.9% vs 0%) -Women made more torso movements in the tub vs in bed (40.6% vs 12.9%)	**Strengths:** -Observational design allowed women to move freely without any inhibition in natural movements **Limitations:** -The study was conducted in a single, small rural community hospital and the sample included a small homogenous group of women -The number of observations was limited to 435 - 2 women who had longer labors influenced the data more than the others who had shorter labors) -Most of the observations of women in hydrotherapy were in late labor (86.2%) which not true of the observations of women in bed. -The observational tool was new and therefore, previously untested. **Conclusion:** Hydrotherapy may encourage upright positions and movements that facilitate labor progress and coping, helping women avoid unnecessary interventions

Author Recommendations:
Further research is needed with a larger and more diverse sample. Because many other factors influence the use of hydrotherapy and position and movements in hydrotherapy, more variables should be included in future research. Labor support, mothers' knowledge, preparation and preferences, and the culture of the facility are factors that should be considered when testing these complementary therapies. Understanding the many factors that can influence the use of hydrotherapy as a complementary labor support strategy is a goal for future research.

Summary for current clinical practice question:
Hydrotherapy may be useful for women who have difficulty coping with labor. Midwives can support and encourage women who are not progressing adequately or having difficulty coping with labor to use hydrotherapy before using medical interventions and/or augmentation. Hydrotherapy allows a woman freedom of movement and supports the normal labor process.

Source:
Stark, M.A. (2013). Therapeutic showering in labor. *Clinical Nursing Research, 22*(3), 359-374. doi: 10.1177/1054773812471972

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To test the effectiveness of therapeutic showering in labor The primary research question: What are the effects of 30 min of therapeutic showering during active labor? **Sample/Setting:** 24 women total; convenience sample was recruited from a Level I community hospital in southwest Michigan **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi-experimental, pretest-posttest design -Women in active labor were asked if they were interested in participating in the study after it was determined that they met the study inclusion criteria -Women completed pretest measures before entering the shower, and posttest measures, 30 minutes after intervention -Primary outcomes: pain, coping, tension, anxiety, relaxation, and fatigue -Measured with numerical rating scales that ranged from 0 (being none at all) to 10	-There were significant decreases in tension ($p=0.003$), anxiety ($p=0.002$), relaxation ($p<0.001$), and coping (0.006). -No statistically significant differences in pain or fatigue even though the means for both decreased after showering. (Pain: 6.2 to 5.7; Fatigue: 4.5 to 4.2) -Significant differences in cervical dilatation ($p<0.001$), pulse ($p=0.002$), and fetal heart rate ($p=0.001$) after the intervention -Changes in maternal and fetal heart rates were not outside a normal range.	**Strengths:** -Pilot study -Relative outcomes measured **Limitations:** -the convenience sample was homogeneous and recruited from one site so the findings cannot be generalized. -the pretest-posttest single group design was not strong -No randomization -The time in the shower was 30 min yet measures were not tested during that time but rather before and after showering. What the benefit was during showering is unknown. **Conclusion:** Showering during active labor was found to significantly increase coping and relaxation while reducing tension and anxiety.

Author Recommendations:
-Having a nurse available during showering was part of this study's protocol, however, nurses should encourage support persons to remain with the woman for support during showering and emphasize the value of their support to the laboring woman.
-Other safety measures are recommended. Having nonskid shower shoes on and having extra towels for shower spray that escaped the shower are safety measures that should be implemented with therapeutic showering. Before entering the warm humid showering environment, women should be adequately hydrated.
-Due to the design of the study, the length of time in the shower needed for relief is unknown and should be examined in future research. The point in labor at which therapeutic showering is most effective is another area for future study.
-Greater control for phase of labor as well as parity would be helpful for future research. Last, the measures were selected for their ease of use during labor. More testing is needed to identify best measures to use in labor.

Summary for current clinical practice question: Therapeutic showering may be beneficial for increasing relaxation and coping while reducing tension and anxiety.

Source:
Stark, M.A. (2017). Testing the effectiveness of therapeutic showering in labor. *Journal of Perinatal and Neonatal Nursing, 31*(2), 109-117. doi: 10.1097/JPN.0000000000000243

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To compare the effectiveness of therapeutic showering with usual care during active labor. **Sample/Setting:** 32 total participants. Group 1 – (n=17) treatment group Group 2 – (n=14) Control group **Level of evidence:** Level I **Quality of evidence:** Good (B)	RCT -A pretest posttest control group repeated-measures design was used. Participants were randomized to treatment group (n = 17), who showered for 30 minutes, or to control group (n = 14) who received usual labor care. Women evaluated pain, discomfort, anxiety, tension, coping, and relaxation at enrollment, again 15 minutes after entering the shower or receiving usual care, then again 30 minutes after entering the shower or receiving usual care. Chart reviews after delivery recorded obstetric interventions. Primary outcomes include: Pain, discomfort, anxiety, tension, coping, and relaxation Outcomes measured with numerical rating scales	-The experimental group showed statistically lower scores in the following areas compared to the control group: Pain (p= .001) Discomfort (p=.003) Anxiety (p=.033) Tension (p=.005) -The experimental group showed higher relaxation scores when compared to the control group (p=.007)	**Strengths:** -Randomized method -Results supported by other similar studies **Limitations:** -The sample was homogenous -Small sample size -Convenience sample **Conclusion:** Therapeutic showering in labor is effective in decreasing labor pain, discomfort, anxiety, and tension, while simultaneously increasing relaxation.

Author Recommendations:. Future research could test the effectiveness of longer and shorter showering duration. The sample for this study was small. Larger, more diverse samples in future research will build knowledge about this nonpharmacologic intervention. Future research should also examine racial and cultural preferences of showering and how this intervention can best be adapted for women of different races and cultures.

Summary for current clinical practice question: This study supports therapeutic showering as an intervention that could be used more by providers for improving comfort in labor. Midwives fulfill a critical role in providing care for laboring women. Providing care that incorporates principles of physiologic labor is beneficial for laboring women. Therapeutic showering is an intervention that is easily available, inexpensive, and effective in providing comfort and care while also supporting physiologic labor and birth.

Source:
Taghavi, S., Barband, S., & Khaki, A. (2015). Effect of hydrotherapy on pain of labor process. *Baltica, 28(*1), 116-121. Doi: http://wrhrc.tbzmed.ac.ir/uploads/User/116/a94-4-dr%20khaki.pdf

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Study the effect of hydrotherapy on pain and labor duration in pregnant women **Sample/Setting:** 100 total participants, 50 primiparas, 50 multiparas. Group 1 – hydrotherapy group (n=50) Group 2 – control group (n=50) Setting: Alzahra educational hospital of TUMS in Tabriz, Iran between March 2010 through March 2013 **Level of evidence:** Level II **Quality of evidence:** Good (B)	Clinical trial Samples of intervention group after referring to the hospital and entering to the delivery room and finishing primary clinical examinations, took a 37◦C hot water shower for 30 minutes. In control group, mothers were hospitalized in labor and delivery room with similar conditions to those of case group. The only difference between this group and case group was lack of hot water shower in samples of intervention group. Before taking shower all samples underwent cardiotocography (CTG) to be validate lack of fetal distress symptoms. To collect data, a Numeric Rating Scale was used to measure pain intensity in dilatations of 4, 6, 8, and 10 centimeter and pain intensity in any sample was obtained from mean of four numbers.	- Average delivery pain intensity: -Group 1: 7.1 ± 0.85 -Group 2: 7.6 ± 0.95 - p=0.010 - Time of first phase of Labor (min) -Group 1: 119.5 ± 45.05 -Group 2: 210.6 ± 55.45 - p< 0.001 - Time of second phase of Labor (min) *not statistically significant -Group 1: 21 ± 18.65 -Group 2: 24.32 ± 23.2 - p=0.395 - Time of first and second phase of Labor (min) - Group 1: 140.5 ± 58.5 - Group 2: 234.6 ± 84.9 - p< 0.001	**Strengths:** -Results supported by those of similar studies. -Objective outcome measures tools used **Limitations:** -small sample size -No randomization No blind study **Conclusion:** Average pain scores of the intervention group were significantly lower than that of control group. Average length of 1st labor stage was significantly lower in the intervention group than that of control group.

Author Recommendations: This method should be developed in other delivery centers for pregnancies without risk factors. Obtained results represent useful effects of taking showers during labor for women. However, wider studies are suggested to obtain more precise results.

Summary for current clinical practice question: Using hydrotherapy is usually inexpensive and without side effects. It's widely available, leads to pain reduction, and improvement in delivery progress. Based on the results of this study, providing proper facilities to use warm water baths and showers in labor rooms with supervision of a midwife could be a method for relieving labor pains.

Source:
Tuncay, S., Kaplan, S., & Tekin, O.M. (2019). An assessment of the effects of hydrotherapy during the active phase of labor on the labor process and parenting behavior. *Clinical Nursing Research, 28*(3), 298-320. doi: 10.1177/1054773817746893

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To assess the effect of hydrotherapy utilized during the active phase of labor on the labor process, the feeling of labor for the mother, and postpartum parenting behavior **Sample/Setting:** 80 participants from a research hospital in Ankara, Turkey between November 2015 and June 2016 **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi-experimental study Participants allowed in the tub once cervical dilation reached 5cm. -Interviewer used 4 forms to collect data: 1. The Participant questionnaire was completed upon admission to the hospital. (Demographic and obstetric characteristics) 2. The Birth Follow-Up Questionnaire was completed when cervical dilation was 5cm, 6cm, and 10cm. (VAS scale and vitals) 3. The Postpartum Behavior Scale was completed within the first 10 minutes postpartum (maternal behavior towards infant) 4. the Labor Agentry Scale was completed within the first 12 hours postpartum (measures mother's feelings of being in control).	- Systolic and diastolic blood pressures of the experimental group were lower when cervical dilation was 10cm (p=.001) -The pulse was lower in the experimental group 74.80 ± 4.29 compared to the control group 80.15 ± 4.05 (p=.001) -The active phase of labor was shorter for experimental group 210.18 ± 19.18 min compared to the control group 272.18 ± 23.23 min (p=.001) - At 6 cm dilation, the VAS score was lower in the experimental group 5.03 ± 1.10 compared to the control group 8.30 ± 0.52 -At 10 cm, the VAS score was lower in the experimental group 7.63 ± 0.93 than control group 9.53 ± 0.51 (p= .001) - Participants in the experimental group had more positive feelings about labor. -Average LAS score in the experimental group was 129.45 ± 5.33 compared with 44.97 ± 6.09 in the control group. (p= .001)	**Strengths:** -The same researcher performed all interventions for the participants in the experimental and control groups, which minimized the variations that may arise from different investigators **Limitations:** -The groups were not randomized -Written consent was received from only the pregnant women for hydrotherapy application in the study, and no consent was obtained from their spouses/partners. Therefore, it cannot be generalized. **Conclusion:** Hydrotherapy used during the active phase of labor is effective in diminishing pain, reducing labor duration, improving maternal and neonatal well-being, developing a positive labor experience, and facilitating parenting behavior.

Author Recommendations: The use of hydrotherapy during labor should be generalized, and the standard procedures and nursing care protocols should be issued as a health policy. The long-term outcomes of hydrotherapy for the mother and infant should be assessed in future studies. It's also recommended that the results of future studies be supported by blood hormone levels.

Summary for current clinical practice question: Women who used hydrotherapy during the active phase of labor experienced less pain, shorter labor, improved maternal and neonatal well-being, reported a positive labor experience, and pregnant women who utilized used more positive parenting behavior.

Source:
Vanderlaan, J. (2017). Retrospective cohort study of hydrotherapy in labor. *Journal of Obstetrical Gynecological and Neonatal Nursing, 46*(3), 403-10. Doi: https://doi.org/10.1016/j.jogn.2016.11.018

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To provide estimates of hydrotherapy use and to describe the characteristics associated with it **Sample/Setting:** 327 women eligible to use hydrotherapy in labor Setting: Hospital L&D unit in Northwestern U.S. **Level of evidence:** Level II **Quality of evidence:** Good (B)	Quasi Experimental, Retrospective Cohort Study a secondary analysis of retrospectively collected practice monitoring data Primary outcomes: -Initiation of hydrotherapy -Discontinuation of hydrotherapy -Duration of hydrotherapy - Reasons for hydrotherapy discontinuation -Data was collected by the midwives	-82% (n=268) of participants initiated hydrotherapy. -The average duration of tub use was 156.3 minutes -Induction of labor was associated with declining the offer of hydrotherapy - Of the 268 participants who initiated hydrotherapy, 80 (29.9%) discontinued. -56 (20.9%) were removed because they met medical exclusion criteria ($p = .002$) -24 (9%) progressed to pharmacologic pain management. ($p = .021$) - Nulliparity was associated with medical removal from hydrotherapy	**Strengths:** -The results of this study support previous findings that hydrotherapy for labor can be an effective method of pain management **Limitations:** -limited study sample -The database for this study did not distinguish between first and second-stage hydrotherapy. **Conclusion:** In a hospital environment in which hydrotherapy for labor pain management is promoted, most women who were eligible for hydrotherapy did initiate hydrotherapy.

Author Recommendations: These findings can be used to justify the costs of implementing or maintaining a hydrotherapy program. The calculations performed to describe the use of hydrotherapy tubs by participants who discontinued hydrotherapy were intended for the prediction of hydrotherapy use and should not be considered estimates of failure of hydrotherapy. Also, in future studies, researchers should investigate women's acceptance of the promotion of hydrotherapy as a first step in pain management.

Summary for current clinical practice question: The finding of no significant difference in duration of hydrotherapy between those who progressed to pharmacologic pain relief and those who continued to use hydrotherapy suggests that hydrotherapy was a successful first step for pain management for many participants.