Introduction

A woman's labor pain is affected by both internal and external factors. Many analgesic therapies that exist are aimed at easing physical discomfort in labor. These include use of inhaled, oral, intramuscular, or intravenous anesthetic agents. Women may also receive nerve-blocking injections in the pudendal, paracervical, neuraxial, or spinal regions (Cunningham et al., 2014). Experts have disagreed about the use of these analgesic interventions since their onset in 1847, expressing concern about side effects for mother and baby (Hawkins, 2015). Regardless of beliefs about pain intervention during labor, an appropriate means of evaluating a woman's response to the labor experience is crucial.

Labor pain is widely assessed using a numerical rating scale (NRS) despite concerns about the usefulness of the NRS in a laboring population. The NRS was originally designed to ensure adequate pain control in patients undergoing orthopedic procedures. A NRS has been noted to be less effective when applied to laboring women where pain ebbs and flows with each contraction (Lowe, 2004; Roberts, Gulliver, Fisher & Cloyes, 2010) and women are often confused or annoyed with ongoing requests to 'rate their pain' (Gulliver, Fisher & Roberts, 2009). In 2010, Roberts and colleagues described development of an alternative pain assessment tool designed specifically for women in labor, the Coping with Labor Algorithm© (CWLA) (Roberts, Gulliver, Fisher & Cloyes, 2010) (see Figure 1). The CWLA emphasizes how well the laboring woman is coping with the physiologic changes of labor and sensations related to this rather than determination of a number which is meant to reflect the intensity of pain.

The CWLA prompts maternity care providers to look for specific cues to determine if a woman is coping well (or not coping) with labor. The ability to cope with labor has been found to be influenced by four key factors: personal expectation, caregiver-patient relationship, support from caregivers, and involvement in decision-making (Hodnett, 2002; Huntley et al., 2004; Karlsdottir et al., 2014). These four factors override the influence of age, socioeconomic status, ethnicity, childbirth preparation, physical environment, pain, immobility, medical interventions,

and continuity of care in determining overall labor experience (Hodnett, 2002; Huntley et al., 2004; Karlsdottir et al, 2014). If a woman is coping well, continued support is offered. If she is not coping well, specific interventions are recommended based on needs in three interrelated areas: physiological-natural, physical, or emotional (Roberts et al., 2010).

There are a wide variety of specific coping interventions that can be recommended for use with laboring women by maternity care providers. These interventions include both pharmacologic and non-pharmacologic approaches. *Pharmacologic* approaches include epidural and pudendal use, inhaled analgesics, sedatives, and opioid and opioid agonists; *non-pharmacologic* approaches range from acupressure/acupuncture to hydrotherapy to yoga. Comprehensive review of the literature provided clarity regarding the level of evidence for use of each available intervention (see Table 1).

Implementation of the CWLA in a L&D unit of a large urban tertiary care facility in the southwestern United States with women of varied ethnicity, was the purpose of this change project. The unit averages 6,000 deliveries annually with 19 L&D suites; 8 L&D operating rooms, an 8 bed OB Triage unit, and 14 high-risk antepartum rooms. In the past, pain management has been largely through pharmacologic options (e.g., regional anesthesia, intravenous medications). Nitrous oxide was not available in this facility during the conduct of this project. Alternatives to pharmacologic pain management which were available included hydrotherapy (i.e., portable tub, shower), hot/cold packs, massage/pressure, position changes, birth/peanut balls, focus points, breathing techniques, and self-hypnosis. Acupuncture, sterile water injections, and transcutaneous electrical nerve stimulation (TENS) were not available. There was not ready access to a birth pool unless arranged prior to the onset of labor as a restriction of this facility was a lack of permanent tubs on the labor unit. In addition, environmental changes (e.g., music, lighting changes, TV/movies, temperature control) and emotional/psychosocial support (i.e., one-on-one nursing support) were accessible.

This paper describes a quality improvement project with implementation of an alternate approach to pain assessment during labor with use of the CWLA. SQUIRE 2.0 guidelines are used to report the process (Ogrinc et al, 2015).

Project Methods

This project, conducted in the 4th quarter of 2015 and first two quarters of 2016, was based on Deming's Plan-Do-Check (or Study) cycle (Deming, 1982) which was further adapted using Stakeholder Theory (Freeman, 1951; Friedman & Miles, 2002) by Roberts (2014) (see Figure 2). Within this framework, the project leader, the RNs, physicians, staff managers and educators were all stakeholders on the L&D unit at the focal organization; no midwives worked on the unit. As suggested by the theory, implementing change required consideration of both those who were planning the change and those who were implementing the change – each at varying times (see Table 2). Most preparatory work was performed by the project leader and the unit nurse educator with pilot implementation by an existing task force of 18 RN leaders. This task force, composed of both experienced and new unit nurses, work to champion evidence-based practice on the unit.

The project was approved by the Baylor University Institutional Review Board prior to implementation (IRBNet #798915-1).

Pilot Implementation

Following discussion with the unit nurse manager and nurse educator, an assessment was conducted to ascertain readiness for change using the *Readiness Assessment & Developing Project Aims* tool (Robert Wood Johnson Foundation, 2008). Results indicated staff members were open to change and a PowerPoint™ presentation and educational poster were created which outlined the CWLA and its use. These educational materials were presented to all nursing staff prior to pilot launch with the 18-member RN task force. Laminated copies of the CWLA were also posted in the staff lounge and in each labor suite. The existing electronic health

record (EHR) did not need to be adapted for this change as it allowed for documentation of both coping and a NRS score.

The 18-member RN task force piloted use of the CWLA over a 2-week pilot period with the project leader and nurse educator continuously available on-site or by phone during this time. A survey was also administered at mid-point (end of week one) to evaluate response to CWLA use. The survey tool was adapted from that used in Roberts' initial work in developing the CWLA tool (L. Roberts, personal communication, July 20, 2015). Following the pilot period, project leaders met with the 18-member RN task force to obtain feedback for improving the implementation process with the full staff. No suggestions were made for modification of the algorithm resulting in use of the CWLA as detailed in Figure 1. An educational program was then tailored for presentation to the entire unit staff, providing greater detail on how to use the algorithm and document assessment of the woman's ability to cope with her pain in labor. This completed the first phase of the PDSA cycle.

Full Implementation

Stakeholder Theory asserts that a stakeholder's ability to influence change is largely determined by the interdependence of the focal organization's members, or *density*, where density is the level at which coworkers rely on one another (Friedman & Miles, 2002). Use of the CWLA by the pilot group of 18 RNs created a positive influence for tool adoption by the full RN staff and demonstrated density. Full implementation for use of the CWLA tool with the entire RN staff occurred over a period of 4 weeks with a questionnaire distributed for feedback about use at the close of the implementation phase. Distribution was to all full-time, part-time, and per diem RN staff working on the unit (N=80).

Finally, in this facility, an official change in practice required physician approval for full implementation. This approval was obtained in October 2016, five months following completion of the pilot work. In the interim between pilot completion and physician approval, it was anecdotally noted that many unit nurses began using the algorithm. A random chart audit was

conducted four weeks after the pilot period to gauge sustainability of the practice change, and again five months later.

Results

Sample Characteristics

RNs who used the CWLA were all female and ranged in age from 22 to 55 years. All participants were educated at the bachelor's or graduate level and had an average of nine years L&D experience (range = 0-24 years).

CWLA Use: Pre- and Post-Surveys

Surveys generated both quantitative and qualitative data, allowing participants to elaborate on various topics. The initial assessment of cultural readiness for change was informally distributed to all unit RNs by the nurse educator and unit manager two weeks prior to project implementation. As noted, the hospital has a preexisting culture of change to promote evidence-based practice. Approximately 30% (n=24) of the unit RNs, including all members of the pilot group (N=18), completed the readiness for change tool, responding positively.

A mid-implementation survey was administered to all members of the pilot group (N=18). Of these, eight were returned for a response rate of 44%. Most respondents (88%, n=7) felt use of the CWLA was beneficial for the patient and allowed them to assess a laboring woman more clearly. Three-quarters (75%, n=6) felt that the CWLA was an improvement in assessing and documenting labor pain when compared to the NRS. The majority (88%, n=7) had no suggestions for improvement of charting CWLA findings in the EHR. Of note, only one participant did not think the CWLA was beneficial or that it allowed her to assess the patient more clearly, noting "I was already using it." This contradictory statement indicated that the CWLA was likely beneficial.

Based on the pilot group's positive experience with use, the CWLA was readily adopted for use by all RNs across the unit. After four weeks of further use, a post-implementation survey was distributed to all RNs (N=80) to determine thoughts about use of the tool and related

practice change. Of the surveys distributed, 25 were returned for a response rate of 31%; 16% (n=4) had been in the pilot group. In general, respondents (96%, n=24) felt that the CWLA was beneficial for the patient. In addition, most (92%, n=23) felt that the CWLA allowed greater clarity in assessing the laboring patient, and 84% (n=21) felt that the CWLA improved pain assessment and documentation when compared with NRS use. Over three-quarters (76%, n=19) denied suggestions for improvement of the CWLA, and there were no suggestions for how EHR documentation of CWLA use could be improved.

Qualitative Data

Comments were sought from RN staff to better understand issues related to implementation of this change project. While not a qualitative research project, comments were examined by the DNP project leader to determine where comments clustered; three were noted. The first cluster of comments related to *helpfulness.* Comments included the following, “I feel it was helpful because rating pain on a scale is subjective. I personally just need to adopt the new terminology.” “Pain is necessary and beneficial in labor. We need them [patients] to be able to cope.” “[It allows us to] identify non-coping behavior and interventions to suggest - especially if the patient desires a natural delivery.” “It is an easy question to answer and if [she is] not coping, then we can intervene.” “[It] allows them to verbalize how they feel.”

The second cluster focused on *clarification*. Related comments included “It is better than 0-10.” “It is more elaborate/ specific then using the pain scale.” “Patients don’t really understand the pain scale - even after education.” “Coping gives a better picture of how the patient is actually feeling and dealing - beyond just a number.” “It is more descriptive.” “0-10 is a useless scale that tells me nothing about the patient’s ability to cope.” “It is a very detailed method with suggestions of signs to look for and suggestions for interventions.” “[It is] more specific and includes more interventions.”

The third grouping of comments related to *documentation ease* with representative comments including, “I feel like it is an improvement in charting but not used by everyone.” “Yes

[CWLA is better than NRS] because it is more descriptive, but no, because it is time consuming." "We should have 'coping observed' as an option [for charting]." "Under the 'Discuss Pharmacological Interventions' there should be an epidural option." "Both of our charting systems should have the same documentation."

Finally, there were three comments suggesting difficulty in use of the CWLA. One respondent stated, "It seems like we already assess these things along with the pain assessment." Another wrote, "There is so much that we have to assess, I feel like I was not able to focus on the usefulness." When asked if the CWLA was more beneficial than the NRS in assessing labor pain, one nurse responded, "No, because every labor nurse is different in how they assess pain and coping."

Use of CWLA and Minority Populations

There is limited information about the use of the CWLA among non-Caucasian women (Roberts et al., 2010) and one goal of this project was to explore use with ethnically diverse women. The project unit typically cares for patients of the following race/ethnicity: 35% white/non-Hispanic 54%, Hispanic, 28.5%, African or African-American 12.4%, Asian 2.7%, and 2.3% other (Baylor All Saints, 2013). Where patients do not speak English, a telephone interpreter service is available for RN use in fully evaluating patient coping ability. The full staff of RNs (n=80) were asked if they had used the CWLA in caring for women of six different ethnicities (African, African-American, Caucasian, Hispanic, Indian, and other) and if so, did they find the CWLA to be useful in the assessment of coping. Nurses used a 5-point Likert scale to rate algorithm usefulness and overall, RNs found the CWAL tool useful or somewhat useful in the assessment of coping. Table 3 outlines RN response regarding usefulness of the CWLA with varied populations.

Audits

Charts were audited for a one-week period at one month post-pilot to determine sustained change in use of the CWLA and the need for modifications. Audit found use of CWLA in 88% of

patient charts. A real-time audit at six month's post-pilot found the CWLA being used with three of five patients. Of additional note, however, close to one-third of the audits demonstrated the nurse had documented *both* a NRS pain score and coping status.

Discussion

This project detailed implementation of the CWLA in a large tertiary care facility by RN staff. In addition to acceptability and usefulness of the CWLA, this project evaluated nurse feelings regarding use in laboring women of varied ethnicity. The CWLA was found to be an improvement over use of the NRS and generally useful with ethnically diverse women. Additionally, findings from this project suggest important aspects to consider when planning to adopt use of the CWLA, as well as potential limitations.

Clinical Application

The model used to guide this project, adapted by Roberts (2014) from the work of Deming (1982) and Friedman and Miles (2002), proved highly useful in the accurate identification of key steps and factors needed for implementation of the CWLA. A limitation of the model, however, was failure to identify cost as an important consideration in project planning. For example, modification of the EHR holds potential cost considerations and while modification to the EHR was not a factor in the implementation of this project, it may well be an issue in efforts to eliminate the NRS pain field. Such costs should be considered as an important component for successful initiation in other settings.

Other key factors in success of this project were the previously established team of RNs committed to the implementation of evidence-based care, as well as the unit nurse educator who personally championed the practice change. Work to champion the project included creation of a slide show for use in educating staff about use of the CWLA and ensuring that all new RNs learned about use of the CWLA during orientation to the unit. These findings were not surprising as previous research has stressed the importance of clinical leaders and champions for successful practice change (Stanley et al, 2008; Soo et al., 2009).

Survey of participants was also an important component in project success, as was work to solicit qualitative data. While there was no determination of trustworthiness (Golafshani, 2003) and more rigorous analysis of qualitative data may have reached different conclusions, comments provided an important context for understanding CWLA use. Similarly, survey findings gave evidence supportive of the acceptability and usefulness of the CWLA by RN staff though the survey response rate was small (n=26), Findings were also positive when considering use of the algorithm with patients of varied ethnicity- important preliminary findings when considering use of the tool across broad populations. Research is yet needed, however, to determine use of the tool in ethnically diverse populations, including those where English is a second language, to ensure the accurate identification and assessment of coping cues of these laboring women. Important subtleties in coping may exist and the algorithm may need to be modified for maximum effectiveness. Additionally, use of the algorithm in varied settings and geographic locations should be examined, and patient perspectives should be considered with use as has been noted (Gulliver, Fisher & Roberts, 2008).

Finally, an audit conducted at conclusion of the pilot phase and again at six months post-pilot was crucial in determining the need for further modifications to ensure continued improvement. While survey found the CWLA to be generally acceptable and useful in determining how women coped with labor, audits demonstrated the need to consider elimination of the NRS pain field in the EHR. Dual charting of a NRS pain score and coping status was likely a deterrent to full adoption. Additional robust audits are yet needed and are planned at 12 and 18 months, an important step to ascertain processes needing to be addressed for long-term sustainability of the change (Duke Center for Instructional Technology, 2016). Similarly, expansion of educational efforts to include obstetricians, anesthesiologists, and certified nurse anesthetists, is also planned. The education of key stakeholders, as well as chart audits, is crucial in keeping with Deming's (1982) Act Phase of project implementation. Similarly,

development of unit policy to support CWLA use is needed to foster continued improvement- an activity that is now in progress following the requisite physician approval of a change in practice.

In summary, this project found the CWLA an acceptable and useful tool for use in evaluating how women cope with labor in a large tertiary care setting, including use with women of varied ethnicity. Project results are not generalizable, however, as they may not be representative of RNs working in other settings. The algorithm has been used in limited practice settings and validation is yet needed for use in other settings such as out-of-hospital birth environments.

Summary

Women perceive childbirth pain as challenging, yet understand the inherent need for pain to give birth. Use of the CWLA allows them to embrace the pain of labor to enhance coping abilities (Vander Gucht & Lewis, 2015). As demonstrated in this change project, the CWLA algorithm is a valuable tool for assessing, enhancing, and enabling women to cope with labor. The translation of evidence into clinical practice in a large tertiary care setting provides one of the few accounts of CWLA implementation into clinical care – more are needed to ensure quality care of laboring women.

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The authors have no competing interests to report.

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Figure 1. Roberts' Coping with Labor AlgorithmV2 (Roberts, 2015).

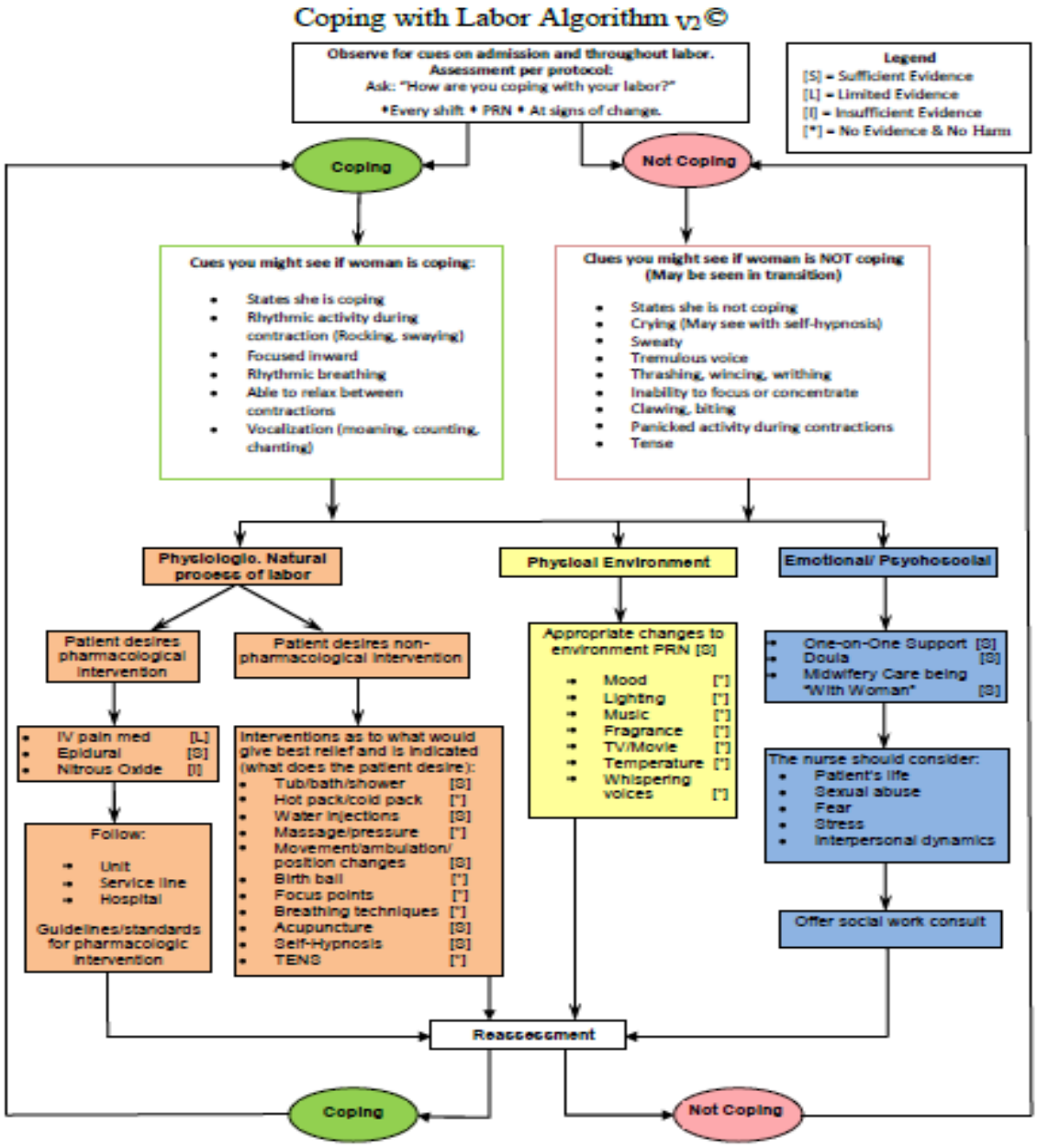

Figure 2. Theoretical Basis for Project Improvement: Stakeholder Theory and Plan-Do-Check-Act Cycle (adapted by L. Roberts, 2014; used with permission).

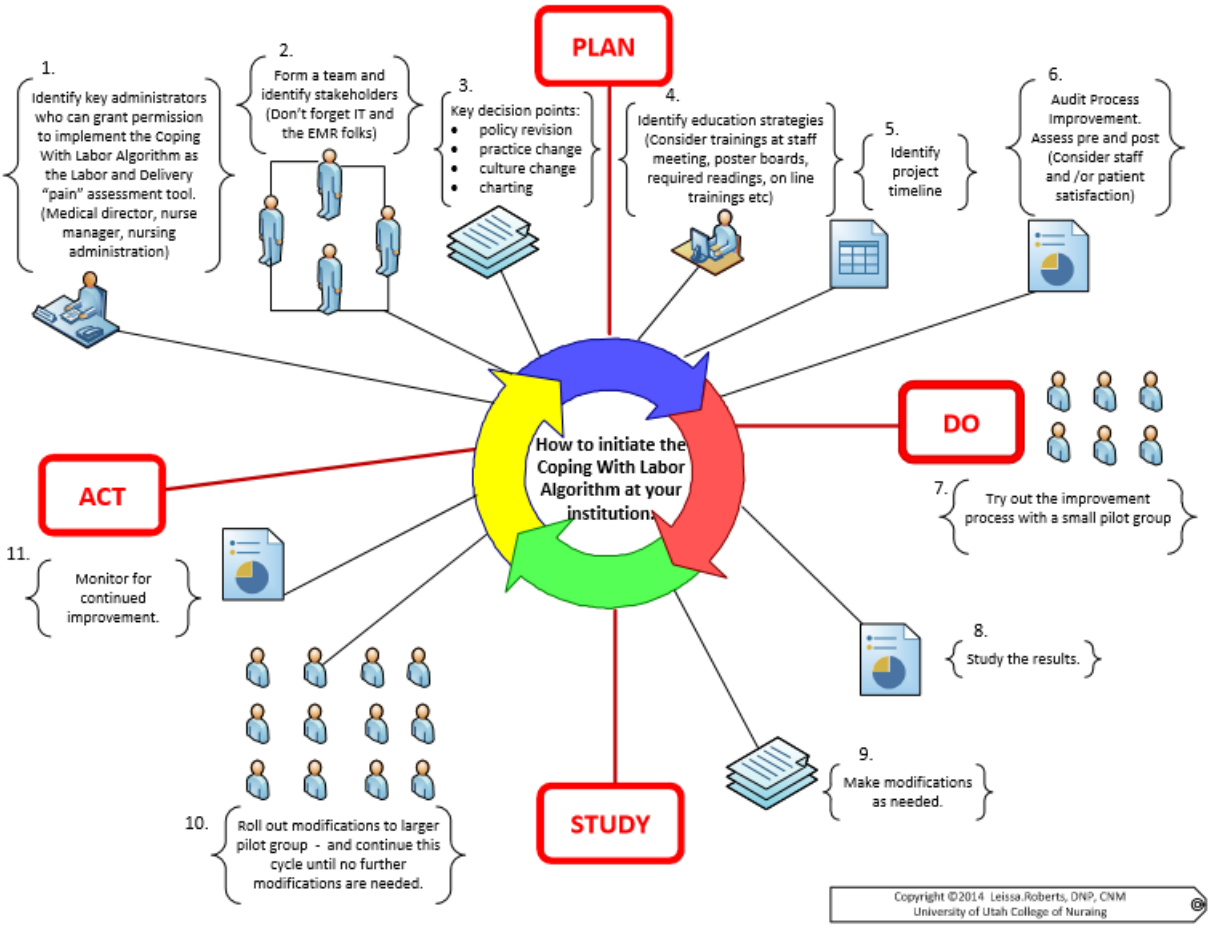

Table 1. Level of Evidence for Varied Pain Intervention Methods.

Author/ Year	Level of Evidence*	Type of Study	Participant Number	Description of Work and Findings
Acupuncture/ Acupressure				
Borup, Wurlitzer, Hedegaard, Kesmodel & Hvidman (2009)	II	RCT	607	Women received acupuncture, TENS, or traditional analgesics. Found that use of pharmacological and invasive methods was lower in acupuncture group with higher 5 min APGAR and higher umbilical cord pH.
Hajiamini, Masoud, Ebadi, Mahboubh & Matin (2012)	III	Quasi-experimental study	30	Women in active labor received either acupressure, ice massage, or placebo. Ice massage and acupressure were effective, but ice massage provided more persistent pain relief.
Lee & Ernst (2004)	I	Systematic review of three RCTs	258	Acupuncture was found to alleviate labor pain and reduce use of analgesia.
Levett, Smith, Dahlen & Bensoussan	I	Comparison of four systematic reviews	4,820	Systematic reviews looked at different outcomes, making comparison difficult. Acupuncture and acupressure may be useful to help women avoid unnecessary use of

(2014)				pharmacological interventions. More research is needed.	
Mucuk & Baser (2014)	III	Experimental study with a control group	120	Women in active labor were divided into three groups: one receiving TENS stimulation to acupuncture points in the lumbar spine, one receiving TENS stimulation to acupuncture points in the legs, and one receiving no stimulation. Results were not statistically significant, but did reveal slightly lower pain levels in those who received the TENS stimulation to acupuncture points in the lumbar spine.	
Aromatherapy					
Kaviani, Azima, Alavi & Tabaei (2014)	II	RCT	160	Having a tissue with lavender oil attached to her clothing near her face was found to be significantly more effective than a tissue with water (no scent) for pain relief in laboring women.	
Smith, Levett, Collins & Crowther (2011)	I	Systematic review of two RCTs	535	Compared aromatherapy with placebo, no treatment or other non-pharmacological methods. Found no statistically significant difference in pain intensity, assisted vaginal birth, cesarean section, use of pharmacological method use, vaginal delivery, or length of labor.	
Biofeedback					

Barragan Loayza, Sola & Prats (2011)	I	Systematic review of four RCTs	186	No significant evidence of a difference between biofeedback and control groups (regarding numbers of assisted vaginal births, cesarean section, labor augmentation, or use of pharmacologic methods). Outcome measures were different and studies were of poor quality.	
Educational/ Self Efficacy Methods					
Beebe, Lee, Carrieri-Kohlman & Humphreys (2007)	IV	Longitudinal descriptive study	35	Higher levels of prenatal anxiety were significantly related to lower levels of self-efficacy for childbirth, more labor pain, fewer number of hours labored at home, and less cervical dilation at admission.	
Cook & Loomis (2012)	VI	Qualitative, descriptive study with phenomenological approach	15	Women's positive and negative memories of their birth experiences are related to feelings of ability to make choices than any other single factor of the birth experience.	
Ip, Tang, & Goggins, (2009)	II	RCT	113	Women who received two 90-min sessions of labor and delivery education demonstrated higher levels of self-efficacy, lower anxiety, and lower pain levels in labor than those who did not.	

Pennell, Salo-Coombs, Herring, Spielman & Fecho (2011)	IV	Prospective cohort study	63	Women reported that having a birth plan enhanced their birth experiences, added a sense of control, clarified their thoughts, and improved communication with providers whether or not the plan was followed.	
Werner, Uldbjerg, Zachariae, Rosen & Nohr	II	RCT	1,222	Self-hypnosis was not found to reduce use of epidural analgesia when compared against self-led relaxation or normal antepartum care.	
Epidural					
Adams, Frawley, Steel, Broom & Sibbritt (2015)	IV	Sub-survey of data from a cohort	1,835	Use of epidural in labor was associated with an increased risk of neonatal admission to special care nursery and instrumental childbirth. Use of epidurals was linked to decreased rates of breastfeeding.	
Craig, Grant, Tao, McIntire & Leveno (2015)	II	Prospective, double-blinded, parallel-armed RCT	310	Compared epidural with fentanyl alone vs. fentanyl and bupivacaine. When given without bupivacaine, it takes five times more fentanyl to achieve similar degrees of analgesia.	
Ngan et al. (2014)	II	RCT	300	Combinations of fentanyl and bupivacaine produced greater pain relief than either medicine alone, concluding that there is a synergistic effect with these two medicines when given	

				intrathecal.	
Simmons, Taghizadeh, Dennis, Highes & Cyna (2012)	I	Meta-analysis of 27 RCTs and cluster-randomized trials	3,274	Comparison of combined spinal-epidural (CSE) technique to standard epidural analgesia revealed that CSE was associated with faster onset of analgesia, less need for rescue analgesia, less urinary retention, and lower rate of instrumental delivery. Traditional epidural was associated with better umbilical venous pH and less maternal itching. There was no difference in maternal satisfaction.	
Sng et al. (2014)	I	Systematic review of nine studies	15,752	When comparing starting an epidural early in labor (<4 cm) vs. late in labor (>4 cm), there was no significant difference in terms of: cesarean section rates, instrumental births, duration of second stage, Apgar scores, umbilical arterial pH, or umbilical venous pH.	
Zhang & Xu (2015)	I	Systematic review and meta-analysis of four case-control studies.	280	The addition of epidural clonidine and neostigmine significantly prolonged initial analgesic effects and reduced use of hourly local anesthetics and opioids for laboring women.	
Hydrotherapy					
Cluett & Burns	I	Systematic review	3146	Hydrotherapy in the first stage of labor was associated with a	

(2009)		of 11 RCTs		significant reduction in the use of pharmacologic methods. There was no statistically significant difference in rates of assisted vaginal deliveries, cesarean sections, perineal trauma, maternal infection, Apgar scores or neonatal infection rates. Study limited by variations in the RCTs.	
Lee, Liu, Lu & Gau (2013)	II	RCT	80	Test group received access to showers during labor. This was associated with decreased reports of pain and improved reports of overall childbirth experience.	
Nutter, Meyer, Shaw-Battista & Marowitz (2014)	I	Systematic review of 38 studies	>31,000	Water birth is associated with high levels of pain relief, maternal satisfaction, and intact perineum postpartum. It is associated with decreased rates of episiotomy, severe perineal lacerations and postpartum hemorrhage. There was no statistically significant difference in rates of maternal or neonatal infection rates between water births and land births.	
Hypnosis					
Madden, Middleton, Cyna, Matthewson & Jones (2012)	I	Systematic review of seven RCTs and quasi-RCTs	1,213	No statistically significant difference was found with use of hypnosis in labor in terms of use of pharmacological pain relief, spontaneous vaginal birth, or improving coping with labor. Limited evidence supported improvements in pain intensity and shortened duration of labor.	

Inhaled Analgesics					
Klomp, van Poppel, Jones, Di Nisio, Lagro-Janssen (2012)	I	Systematic review of 26 RCTs	2959	Flurane derivatives offered better pain relief, more drowsiness, and less nausea than nitrous oxide in first stage of labor. Nitrous was found to be more effective than placebo for pain control, but was linked with more nausea, vomiting, and drowsiness than placebo.	
Massage					
Silva Gallo et al. (2013)	III	Randomized trial with concealed allocation	46	Test group had a 30 min. lumbar massage by physiotherapist in active phase, compared to 30 min talk by physiotherapist in active phase for control group. Massage was associated with a statistically significant reduction in pain.	
Smith, Levett, Collins & Jones (2012)	I	Meta-analysis of six RCTs	326	Massage in labor was associated with reduced pain and reduced anxiety as compared to standard care. Massage was found to be more effective in labor pain reduction than music.	
Mixed/ Other CAMs					
Dhany, Mitchell &	IV	Retrospective	1,079	Combined aromatherapy and massage into one therapy (AMIS). Use of AMIS was associated with higher rates of use	

Foy (2012)		chart review		of TENS and nitrous oxide use, and lower rates of epidural, spinal or general anesthesia.	
Gayeski, Bruggemann, Monticelli & dos Santos (2015)	III	Cross-Sectional Study	188	Evaluated use of CAMs with primiparous women. Emotional support from her companion was most used method, then warm showers. Most satisfaction derived from focused attention.	
Shirvani & Ganji (2014)	II	RCT	64	Application of a cold pack to the laboring woman's abdomen and back for 10 min every 30 min during first phase of labor, then also over the perineum for 5 min every 15 min in second phase. Compared with no ice pack, the intervention was associated with shorted length of each stage and lower pain scale ratings.	
Smith, Collins, Cyna & Crowther (2006)	I	Meta-analysis of 14 RCTs	1,448	Use of acupuncture and self-hypnosis was associated with decreased pain and less use of pharmacologic methods, but not statistically significant benefit was found with use of aromatherapy or audio analgesia.	
Smith, Levett, Collins & Crowther (2011)	I	Meta-analysis of 11 RCTs	1,374	Both relaxation and yoga are associated with reduced pain in latent and active phase.	
Steel, Adams, Sibbritt, Broom,	IV	Longitudinal analysis of survey	1,835	Use of CAMs in pregnancy (such as herbal teas or aromatherapy) did not significantly impact use of	

Frawley & Gallois		data in a cohort		pharmacologic or non-pharmacologic methods of analgesia in labor. There was an increased likelihood to try non-pharmacologic methods among women who had used CAMs in pregnancy.	
Music					
Phumdoung & Good (2003)	II	RCT	110	Listening to three hours of soft music without lyrics in active phase of labor was associated with statistically significant reduction in sensation of pain and distress.	
Non-opioid vs Opioid Drugs (Parenteral)					
Othman, Jones & Neilson (2012)	I	Systematic review of 19 RCTs	2863	Non-opioid drugs (sedatives) were associated with better pain relief, better satisfaction with pain relief, and better satisfaction with childbirth experience than placebo. Women receiving opioids reported better pain relief than those on non-opioids. Hydroxizine was associated with better pain control than promethazine. Sedatives were associated with more satisfaction in pain relief than antihistamines.	
Other Opioids					

Fleet, Jones & Belan (2014)	IV	Case control; Pilot study	10	Administration of subcutaneous fentanyl was effective in reducing labor pain, but was also associated with longer labors. No evidence of impact on neonates.	
Pudendal Nerve Block					
Anderson (2014)	VI	Review of literature and case study	1	Pudendal nerve block can be effective analgesia for women without epidural or spinal who want pain relief at end of the second stage, with operative vaginal birth, or with perineal repair.	
Personal/ Psychological Factors					
Hodnett, Gates, Hofmeyr & Sakala (2013)	I	Systematic review of 22 RCTs	15,288	Continuous support in labor was associated with higher rates of vaginal birth, less intrapartum analgesia, shorter labors, less regional anesthesia, less instrumental birth, less cesarean birth, and higher overall satisfaction.	
Kozhimannil, Johnson, Attanasio, Gjerdingen & McGovern (2013)	III	Systematic review (logistic regression) of a cohort	1,382	Approximately 30% of women evaluated used nonmedical methods to start labor. More than 70% use non-pharmacologic analgesia. Doula support was the strongest predictor of use non-pharmacological labor pain management.	

Quinn, Spiby & Slade (2015)	VI	Individual qualitative study	81	Used pre and post-delivery questionnaires. There is a possible association between maternal/infant attachment and the experience of pain in childbirth.	
Van der Gucht & Lewis (2015)	V	Critical review of 10 qualitative research studies	138	Women felt vulnerable in labor and felt that their pain with labor was challenging. They valued relationships with health professionals and were able to accept the pain as necessary to birth their child. This enhanced their coping abilities.	
Sterile Water Injections					
Lee et al. (2013)	II	RCT	305	Women in active labor received either one or four sterile water injections with a goal of determining the most effective dose. The four injection dose was associated with better analgesia at 30 min post injection, but also with a greater degree of injection pain.	
Peart (2008)	IV	Individual cohort study	60	Women reported that they were “very satisfied” or “satisfied” with relief from back pain with use of four intradermal injections of sterile water into the lower back.	
TENS Units					

McMunn et al. (2009)	VI	Mailed questionnaire	139	Asked CNMs about their opinions/experience with TENS use in labor for pain. TENS was recommended.	
Sever & Akyuz (2015)	II	RCT	124	Use of the TENS unit in labor was associated with reduced pain, shortened labor, and had no side effects as compared with control group.	
Yoga					
Beddoe, Yang, Kennedy, Weiss & Lee (2009)	IV	Individual cohort study measured pre and post intervention	16	Intervention was a 7-week mindfulness-based yoga class practiced in the second and third trimester. Participants reported reduced pain and decreased stress and anxiety.	
Chuntharapat, Petpichetchian & Hatthakit	II	RCT	74	A program of 6 weekly yoga classes was associated with higher levels of comfort in labor, shorter duration of first stage of labor, and shorter duration of total labor.	

*Level of evidence is based on Rating System for the Hierarchy of Evidence for Intervention/ Treatment Questions (Melnyk, Fineout-Overholt, 2011):

I - systematic review of all relevant randomized controlled trials (RCT's), or evidence-based clinical practice guidelines based on systematic reviews of RCT's

II - at least one well-designed Randomized Controlled Trial (RCT)

III - well-designed controlled trials without randomization, quasi-experimental

IV - well-designed case-control and cohort studies

V - systematic reviews of descriptive and qualitative studies

VI - single descriptive or qualitative study

VII - opinion of authorities and/or reports of expert committees

Table 2. Phases in Project Implementation and Evaluation of CWLA.

Phase	Responsible Person(s)	Time Frame
Plan Phase		
Identification of Key Administrators & Stakeholders	Project Leader Unit Educator	Week 1-3
Determination of Readiness for Change	Unit Educator	Week 3-4
Formation of Change Team/Change Champions	Unit Educator	Week 4-6
Review of Key Decision Points (e.g, documentation)	Project Leader Unit Educator	Week 4-6
Do Phase		
Pilot Team		
Education of 18-member pilot team, new hires	Unit Educator Project Leader	Week 8
Detail of project timeline	Project Leader Unit Educator	Week 8
Pilot period of CWLA (2-week period)	Project Leader Unit Educator	Week 10-11
Mid-point survey of pilot members (end week #1)	Unit Educator	Week 11
Pilot team meeting about use (end week #2)	Unit Educator	Week 12
Modification of implementation plan	Project Leader Unit Educator	Week 13
Full RN Staff		
Education of full 80-member staff	Unit Educator	Week 14
Use by full RN staff on trial basis (4-week period)	Unit Educator Project Leader RN staff	Week 15-18
Formal Adoption of CWLA	Physician Committee	Week 36
Study Phase		
Preliminary chart audit	Unit Educator	Week 16
Survey of full RN staff regarding CWLA use	Project Leader	Week 19
Audit for sustainability	Unit Educator Project Leader	6-months post pilot
Act Phase		
Audit for long-term sustainability	Unit Educator	12 and 18 months post pilot
Revision of unit policies to support CWLA use	Unit Educator Nurse Manager	In process

Table 3. Nurse (N=25) Responses Regarding Usefulness of CWLA with Women of Varied Ethnicity.

Ethnicity	Number of Nurses Using CWLA with Ethnic Women	Range Likert Responses	Mean Likert Responses	Median Likert Responses	Mode Likert Responses
African	6 (24%)	3-5	3.6	3	3
African-American	12 (48%)	1-5	3.4	3	3
White/non-Hispanic	21 (84%)	1-5	3.69	4	3
Hispanic	17 (68%)	1-5	3.86	4	5
Indian	5 (16%)	2-5	3.5	3.5	N/A
Other	3 (12%)	3-5	4	4	N/A

(Likert Scale: 1= not useful, 3= somewhat useful, 5= very useful)