

Latent Labor Hospital Admission: Outcomes and Prevention

By

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Latent Labor Hospital Admission: Outcomes and Prevention

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Acknowledgement

For my family

Abstract

Background: Because of a preponderance of evidence that medically low-risk women admitted to the hospital during the latent phase of labor are at risk for increased interventions and procedures, such as cesarean delivery, without a corresponding improvement in maternal or neonatal outcomes, there is a need to quantify the consequences of latent labor hospital admission, explore interventions successful in decreasing latent labor admission, and to consider which theoretical framework may best support understanding how interventions might lead to decreased latent labor admission. Therefore, the overall purpose of this doctoral work was to better define the ramifications of latent labor hospital admission and, subsequently, to build knowledge regarding one intervention with the potential to decrease latent labor hospital admission.

To achieve this purpose, this dissertation engaged four complementary research projects. These included: 1) estimating costs and outcomes incurred through latent labor hospital admission in the U.S.; 2) describing one antenatal care model with promise for decreasing latent labor hospital admission; 3) conducting comparative effectiveness research examining if participation in this antenatal care model is associated with decreasing latent labor hospital admission; and 4) synthesizing the literature regarding one theoretical framework which may influence how this antenatal intervention might decrease latent labor hospital admission.

Methods: First, the cost-effectiveness and utility analysis included in this body of work estimated the annual outcomes and costs of latent labor hospital admission among a medically low-risk U.S. population. Second, review of the group prenatal care model and

Latent Labor Hospital Admission: Outcomes and Prevention

its association with important perinatal outcomes was provided. Third, a comparative effectiveness, retrospective, case control study was used to measure the association of participation with group prenatal care (vs. standard prenatal care) with phase of labor at hospital admission, with mode of delivery, and with indicators of maternal (e.g., estimated blood loss) and neonatal (e.g., Apgar scores) morbidity. Participants were medically low-risk pregnant and birthing women receiving nurse-midwifery care in an urban, University clinic and hospital in the Pacific Northwest region of the United States. Finally, the literature regarding how childbirth self-efficacy has been utilized for perinatal outcomes research was synthesized to inform the examination of this conceptual framework for potential fit with group prenatal care.

Results: The results of this body of work demonstrated that the outcomes and cost consequences of admitting medically low-risk U.S. women to the hospital during latent labor are substantial, described the group prenatal care model and known associations, and demonstrated that women who participated in group prenatal were 73% more likely to be admitted in active labor (OR, 1.73; 95% CI, 1.0-2.9, $P = 0.05$) than women who participated in standard care with no statistically significant differences in morbidity outcomes between groups. Additionally this body of work successfully synthesized the literature regarding childbirth self-efficacy's influence on perinatal outcomes research and conceptualized strengths and weaknesses of this theoretical framework for enlightening group prenatal care.

Conclusions: Framed by the more frequent intervention and procedure rates as well as the increased maternal morbidity and cost consequences of admitting medically

Latent Labor Hospital Admission: Outcomes and Prevention

low-risk U.S. women to the hospital in latent labor, there is clear need for evidence that identifies interventions successful in safely promoting active labor hospital admission in this population. Group prenatal care is one intervention which has been associated with several improved perinatal outcomes. This dissertation found association between group prenatal care and both higher rates of active labor admission as well as approximately 1 cm more advanced cervical dilation at hospital admission without statistically significant differences in mode of delivery or morbidity outcomes. This dissertation study also proposed that childbirth self-efficacy is likely a core, but not singular, theoretical framework for conceptualizing group prenatal care function and effect. Findings from this body of work contribute to the body of literature defining risk-appropriate care for healthy pregnant women in the U.S.

TABLE OF CONTENTS

Chapter I: Latent Labor Hospital Admission: Outcomes and Prevention Introduction (p. 8)

Chapter II: Cost-Effectiveness Analysis of Latent Versus Active Labor Hospital Admission for Medically Low-Risk, Term Women (p. 30)

Chapter III: Group Prenatal Care: Review of Outcomes and Recommendations for Model Implementation (p. 54)

Chapter IV: The Influence of Group Versus Individual Prenatal Care on Phase of Labor at Hospital Admission (p. 84)

Chapter V: Childbirth Self-Efficacy to Conceptualize Group Prenatal Care (p. 113)

Chapter VI: Latent Labor Hospital Admission: Outcomes and Prevention Discussion, Summary, and Implications (p. 144)

List of Tables

1. Table 1 Chapter 1, p. 15: Prenatal Care, Timing, and Topics
2. Table 2 Chapter 1, p. 16: Essential Elements of CenteringPregnancy
3. Table 3 Chapter 1, p. 21: Specific Aim, Paper Title
4. Table I Chapter 2, p. 41: Model Inputs
5. Table II Chapter 2, p.44: Outcomes
6. Table 1 Chapter 3, p. 66: Essential Elements of CenteringPregnancy
7. Table 2 Chapter 3, p.69: Group prenatal care vs. individual prenatal care, Preterm birth
8. Table 3 Chapter 3, p. 71: Group prenatal care vs. individual prenatal care, Low birth weight
9. Table 4 Chapter 3, p. 72: Group prenatal care vs. individual prenatal care, Breastfeeding
10. Table 5 Chapter 3, p. 74: Group prenatal care vs. individual prenatal care, Mode of delivery
11. Table 6 Chapter 3, p. 75: Group prenatal care vs. individual prenatal care, Satisfaction and knowledge
12. Table 1 Chapter 4, p.101: Essential elements of CenteringPregnancy
13. Table 2 Chapter 4, p. 102: Prenatal Care, Timing and Topics
14. Table 3 Chapter 3, p. 104: Demographics and Outcomes of Women Receiving Prenatal Care (n=375)
15. Table 4 Chapter 3, p. 105: Determinants of Cervical Dilation (cms) at Hospital Admission
16. Table 5 Chapter 3, p. 106: Determinants of Active Labor Hospital Admission
17. Table 6 Chapter 3, p. 107: Determinants of Cesarean Delivery

Latent Labor Hospital Admission: Outcomes and Prevention

18. Table 1 Chapter 5, p. 136: Sample

19. Table 2 Chapter 5, p. 140: Outcomes

List of Figures

1. Figure 1 Chapter 2, p. 38: Cost-Effectiveness Model Comparing Latent Versus Active Labor Admission
2. Figure 2 Chapter 2, p. 45: One-way sensitivity analysis on IUFD probability
3. Figure 3 Chapter 2, p. 46: Two-way sensitivity analysis of the CD rate in latent labor vs. CD rate in active labor
4. Figure 4 Chapter 2, p. 47: Monte Carlo Simulation

Chapter I

Latent Labor Hospital Admission: Outcomes and Prevention Introduction

Background and Significance

Nearly one-third of US births are via cesarean delivery (CD), annually affecting 1.3 million women of all socio-demographic categories (Boyle & Reddy, 2012; Hamilton, Martin, & Ventura, 2012). This CD rate represents a 60% increase since 1996. With a 2013 rate of CD at 32.8% (Martin, Hamilton, Osterman, Curtin, & Matthews, 2015) CD is the most common surgical procedure in the U.S. (Podulka, 2011), yet without any corresponding evidence of improvement in maternal or neonatal outcomes.(Declerq, 2011). In fact, maternal morbidity and mortality have *increased* during the same time period.(Kassebaum, 2014) Higher CD rates increase both short(Menacker & Hamilton, 2010) and long term(Silver, 2012) maternal morbidity and mortality as well as significantly inflate costs (Barrett, 2013; Menacker & Hamilton, 2010).

Our current relatively high CD rate, which predominantly affects medically low-risk women,(Barber et al., 2011; Brennan, Murphy, Robson, & O'Herlihy, 2011) is not associated with improvements in maternal or neonatal outcomes (Declerq, 2011) and creates an environment in which healthy women enter pregnancy as lower risk patients and end pregnancy as higher risk patients. Importantly, there are multiple immediate (Menacker & Hamilton, 2010) and long term(Silver, 2012) (Bauer & Bonanno, 2009; Bonanno, Clausing, & Berkowitz, 2011) serious risks for a woman delivering via CD and for her subsequent pregnancies, including infection, hemorrhage, pulmonary embolus, abnormal placentation (placental growth into or through the uterine wall), and uterine rupture (Bauer & Bonanno, 2009; Jauniaux & Jurkovic, 2012; Silver, 2012).

Latent Labor Hospital Admission: Outcomes and Prevention

If the CD rate continues to rise at its current trajectory, by 2020 an additional projected 130 U.S. maternal deaths will occur annually specific to CD (Solheim et al., 2011). Immediate costs incurred for a primary CD are approximately twofold those of a vaginal delivery (Barrett, 2013; Menacker & Hamilton, 2010). Current US trends demonstrate the decreasing availability of VBAC (vaginal birth after cesarean); while VBAC represented 28% of all US births in 1996, it represented only 8% in 2007, and newer evidence suggests continuing decline (MacDorman, Declercq, & Menacker, 2011). This decline in VBAC compounds the previously described risks and costs of CD which dramatically increase with the number of CDs a woman undergoes (Allen, O'Colleen, & Baskett, 2006; Solheim et al., 2011). Contributing to the rise in CD is early admission to the hospital during latent labor.

Studies including a U.S. population report that 40-49% of medically low-risk women present to the hospital during latent labor. (Hodnett et al., 2008; Jackson, Lang, Ecker, Swartz, & Heeren, 2003) This is significant because 29 years of research demonstrates that medically low-risk women admitted to the hospital during traditionally defined latent labor are at significantly higher risk for CD than medically low-risk women admitted during active labor (Bailit, Dierker, Blanchard, & Mercer, 2005; Boyle & Reddy, 2012; Davey, LMclachlan, Forster, & Flood, 2013; Gharoro & Enabudso, 2006; Hemminki & Simukka, 1986; Holmes, Oppenheimer, & Wen, 2001; Klein, Kelly, Kaczorowski, & Grzybowski, 2004; Lundgren, Andren, Nissen, & Berg, 2013; McNiven, Williams, Hodnett, Kaufman, & Hannah, 1998; Rahnama, Ziaei, & Faghihzadeh, 2006).

The one study which did not find an association between latent labor admission and higher CD (Incerti et al., 2011) included women who received individual support

Latent Labor Hospital Admission: Outcomes and Prevention

during labor, a factor independently and strongly associated with decreased risk of CD (Brown, Paranjothy, Dowswell, & Thomas, 2009; Hodnett, Gates, Hofmeyr, & Sakala, 2013). A recent randomized controlled trial (RCT) (n=1532) found that latent labor hospital admission doubled the odds of CD (Davey et al., 2013). State and national organizations have identified decreasing latent labor hospital admission as a vital target for reducing unnecessary CD in the U.S. (Spong, Berghella, Wenstrom, Mercer, & Saade, 2012; Zabari, 2014). Little is understood about how to reach the goal of decreasing latent labor hospital admission.

To our knowledge, only four studies have explored interventions intended to decrease latent labor hospital admission (Hodnett et al., 2008; Janssen et al., 2006; Lumluk & Kovavisarach, 2011; Maimburg, Vaeth, Durr, Hvidman, & Olsen, 2010). Two of these studies examined intrapartum interventions (Hodnett et al., 2008; Janssen et al., 2006) and two examined antepartum interventions (Lumluk & Kovavisarach, 2011; Maimburg et al., 2010). The one trial including a U.S. sample was an RCT (n=5002) randomizing women during latent labor to receive one hour of formalized triage care aimed to delay hospital admission through improving maternal pain, emotional state, and fetal position; however, this study failed to demonstrate decreased latent labor admission (Hodnett et al., 2008).

The other three studies concluded that the interventions examined showed effectiveness in decreasing latent labor hospital admission but not in decreasing CD rates. One Canadian RCT (n=1459) examining an intrapartum intervention in which women in latent labor were randomized to receive either a nursing home visit or nursing triage call found that those randomized to the home visit arm were less frequently admitted in latent

Latent Labor Hospital Admission: Outcomes and Prevention

labor (44.7% vs 52.8%, RR 0.85, 95% CI 0.76-0.94) (Janssen et al., 2006). Despite these promising findings, this trial has not been repeated, possibly due to feasibility and sustainability concerns. A second RCT (n=164) showed that Thai women randomized to receive group based education regarding correct self-diagnosis of latent labor were more frequently admitted to the hospital in active labor than those randomized to standard care (91.8% vs 77.2%, $p = 0.01$) (Lumluk & Kovavisarach, 2011). Lastly, one Danish RCT (n=1162) demonstrated that women randomized to receive a series of group-based prenatal education sessions were 50% more likely to be admitted to the hospital during active (vs. latent) labor (56.0% vs. 38.9%, RR 1.43, 95% CI 1.25-1.64, $p < 0.001$) (Maimburg et al., 2010). Studies involving U.S. women have not examined the association between prenatal educational interventions and timing of hospital admission and this important gap in knowledge sets the stage for the proposed study.

Group prenatal care (GPC) is a relatively new care delivery model, first piloted as 'CenteringPregnancy' in 1993 (Schindler-Rising, 2004). This model incorporates USPHS-identified core elements of prenatal care (education, risk assessment, support) but re-organizes clinical time allocation so that pregnant women receive two hours of group-based interaction and education with each GPC session (Schindler-Rising, 2004). One randomized controlled trial (RCT) and one prospective cohort study found an association between GPC and decreased risk for CD; however stage of labor at the time of hospital admission was not examined (Barr, Aslam, & Levin, 2011; Jafari, Eftekhari, Fotouhi, Mohammad, & Hantoushzadeh, 2010).

Based on this evidence linking latent labor admission with higher risk for CD and this evidence linking GPC participation with decreased risk for CD, it was hypothesized

Latent Labor Hospital Admission: Outcomes and Prevention

that GPC participation is successful in decreasing CD via decreasing latent labor hospital admission. Exploration of this core hypothesis identified several discrete but complementary doctoral projects. Each project drew significance and direction from the overall background informing the core question of the proposed doctoral work but also included background which is unique. Background which is specific to each of the related four doctoral projects is detailed within the chapter devoted to that particular manuscript.

The overarching hypothesis of this dissertation suggests that women who receive GPC prenatal education may increase their knowledge of and skills for coping with latent labor, via enhanced childbirth self-efficacy, which leads to increased confidence for coping when experiencing latent labor at home. This increased confidence to cope is proposed to decrease requests for hospital admission during latent labor and, subsequently, lower CD rates without negatively impacting neonatal outcomes. The case control study component of this doctoral research (Chapter IV, third manuscript) was framed by the other three manuscripts which provide essential context regarding the estimated costs and consequences of latent labor hospital admission among healthy women in the U.S., the nature of the intervention, and knowledge emerging from a synthesis of prior quantitative studies of childbirth self-efficacy for the purpose of identifying a theoretical framework which may enlighten how group prenatal care works.

Medically low-risk pregnant women

In this body of work, ‘medically low-risk’ pregnant women or ‘healthy’ pregnant women refers to pregnant women whose medical condition and medical history fall within the nurse-midwifery scope of practice as defined at Oregon Health and Science

Latent Labor Hospital Admission: Outcomes and Prevention

University. Importantly, these women also have singleton, term (≥ 37 weeks gestation) fetuses in the cephalic presentation and with normally implanted and grown placentas.

Latent labor vs. Active labor

For this dissertation, the term ‘latent labor’ refers to the process of labor beginning with the onset of labor, generally based on maternal identification of regular and painful uterine contractions, and ending when the cervix has reached four centimeters of dilatation. Cervical dilatation greater than four centimeters but less than ten centimeters is categorized as the first stage of active labor; for brevity, this period of time will be referred to as ‘active labor.’ This categorization of the phases of labor is both traditional, stemming from earliest analysis of what constitutes normal progress in human labor (Friedman, 1955, 1978), and is the current predominant categorization utilized when providing clinical care in the U.S. (King, 2012a). These traditional cutoffs between latent and active labor have been those utilized for prior studies examining the association between phase of labor at hospital admission and mode of delivery.

Individual prenatal care

The structure of individual prenatal care was developed in the 1930s and has been widely reproduced since this time (Moos, 2006). It is currently the standard of prenatal care delivery in the U.S. Individual prenatal care involves clinic appointments in which one pregnant woman meets with one obstetric provider. The initial visit, which generally includes a physical exam and review of pertinent medical history, is standardly between 30-60 minutes in length. This is frequently the longest interaction between the pregnant woman and the provider. Return appointments are standardly scheduled to allow for 10-20 minutes of interaction between the pregnant woman and the provider. Routine return

Latent Labor Hospital Admission: Outcomes and Prevention

appointments in the individual care model generally involve collecting information regarding blood pressure, weight, fetal heart tones, fundal height, and estimation of fetal position. Educational topics introduced within the individual prenatal care model are guided by the patient and the provider and there is no overarching curriculum or consistently utilized approach to this education. It is likely that the individual prenatal care educational topics and timing of introducing these topics are similar to the timing and topics introduced in the GPC model. Differences between these two care delivery models may lie in the amount time available for discussion, in the leadership and interaction style, and/or in the social components of the GPC model (Table 1).

Latent Labor Hospital Admission: Outcomes and Prevention

Table 1: Prenatal Care, Timing, and Topics

Prenatal Care, Timing and Topics	Individual Prenatal Care	Gestational age range	Topic
GPC Session <i>This visit is individual care</i>	Initial individual visit (30-60 minutes)	8-15 weeks	Developing fetus, genetic screening options, self-care and nutrition during pregnancy, pregnancy dating
1 (<i>2 hours for each session</i>)	Return individual visit (<i>10-20 minutes for each return visit</i>)	18-22 weeks	Nutrition, exercise, weight gain
2	Return individual visit	26-30 weeks	Fear, strength and coping skills The difference between pain vs. suffering in labor, coping with both
3	Return individual visit	28-32 weeks	
4	Return individual visit	30-34 weeks	Latent labor and the process of normal, physiologic labor
5	Return individual visit	32-36 weeks	Active labor, birth, and delivery of the placenta
6	Return individual visit	34-38 weeks	Newborn procedures and options, breastfeeding, contraception
7	Return individual visit	36-40 weeks	Adjustment to parenthood, postpartum depression
<i>This visit is individual care</i>	Postpartum standard visit	2 weeks postpartum	Screening for postpartum depression. Breastfeeding and adjustment to mothering
<i>This visit is individual care</i>	Postpartum standard visit	6 weeks postpartum	Full physical, screening for postpartum depression, breastfeeding assessment, contraception selection
8 (optional)		1-3 months postpartum	Social gathering outside of clinic

Group Prenatal Care

The structure of GPC was developed in the 1970s and 1980s; earliest publications regarding this model emerged in the 1990s (Rising, 1998). The currently most widely recognized form of GPC is CenteringPregnancy (Rising, Kennedy, & Klima, 2004) though it is unknown how many alternate forms of GPC exist but are not represented in the literature. All publications identified for this doctoral research describe GPC models which are CenteringPregnancy or bear great similarity to CenteringPregnancy. The GPC model examined in the retrospective, case control study does not use CenteringPregnancy

Latent Labor Hospital Admission: Outcomes and Prevention

materials but aligns with the majority of the essential elements of CenteringPregnancy (Table 2).

Table 2: Essential Elements of CenteringPregnancy

Essential Elements of CenteringPregnancy
Health assessment occurs within the group space
Women are involved in self-care activities
A facilitative leadership style is used
Each session has an overall plan
Attention is given to the core content; emphasis may vary
There is stability of group leadership
Group conduct honors the contribution of each member
The group is conducted in a circle
Group composition is stable, but not rigid
Group size is optimal to promote the process
Involvement of family support people is optional
Opportunity for socializing within the group is provided
There is ongoing evaluation of outcomes

In GPC, six to ten women are gathered by estimated due date to form one group. Women gather for their first GPC session between 18-21 weeks of pregnancy. All patients arrive at the same scheduled time at the clinic conference room. Tea, healthy snacks, and pregnancy and birth related materials are made available on a table in the center of the room. During the first hour of care, in a corner of the conference room made semi-private with a standing screen, each woman joins the nurse-midwife for brief (5-10 minute) individual exchanges during which blood pressure and weight are reviewed, fetal

Latent Labor Hospital Admission: Outcomes and Prevention

growth measurement and heart tone assessment is accomplished, and any private concerns are shared. Issues requiring extended private care are handled either after the group session or at a separate individual appointment. As each woman is seen individually, the remaining women are encouraged into conversation and socialization by a nurse or a nurse-midwifery student, and various topics are introduced related to pregnancy, labor, or mothering. During the second hour, the nurse-midwife initiates a facilitated conversation pertinent either to questions or concerns women expressed during the first hour and/or to topics pertinent to the collective groups' stage of pregnancy. Facilitated conversation by the nurse-midwife seeks to encourage patient engagement and participation both in leading conversation, in answering group questions, and in sharing thoughts and strategies that each woman finds helpful as she experiences pregnancy and prepares for birth and motherhood. A general outline with ideas for stimulating thought and interaction is available to the nurse-midwife with the following topics to be considered at the given stages of pregnancy (Table 1).

Comparative Effectiveness Framework

A comparative effectiveness framework shaped research design in the analytic portions of the dissertation cohort study. Comparative effectiveness methods provide a framework suitable for examining benefits, harms, and effectiveness of differing health care models (Docteur & Berenson, 2010). While comparative effectiveness methods cannot generate levels of internal validity parallel to the internal validity of experimental studies (Shadish, Cook, & Campbell, 2002), the comparative effectiveness framework has been identified as successful in generating estimations of treatment effect which have increased utility in identifying best clinical care practices (Docteur & Berenson, 2010).

Latent Labor Hospital Admission: Outcomes and Prevention

National and healthcare agencies point to comparative effectiveness research as an essential methodology for identifying healthcare services which optimally benefit patients at the individual and population levels (Ratner, Eden, Wolman, Greenfield, & Sox, 2009).

Childbirth self-efficacy

Self-efficacy is a concept widely utilized in framing and predicting health behavior (Lenz, 2002) and with preliminary promise for decreasing perinatal fear (Bandura, 2004) and anxiety (Khorsandi, 2008). Originally proposed by Bandura (1977), self-efficacy is defined as both the belief that one can successfully accomplish a task (efficacy expectancies) and one's estimation that if the task is accomplished it will lead to specific outcomes (outcome expectancies). Self-efficacy is proposed to be domain specific, which is defined as pertaining to a particular area, and to emerge from four sources: a) performance accomplishments, b) vicarious experience, c) verbal persuasion, and d) emotional arousal (Bandura 1977).

Based on seminal research applying self-efficacy theory to understanding perinatal phenomenon and outcomes (N. Lowe, 1993; Manning & Wright, 1983), childbirth self-efficacy was defined for this dissertation as confidence in one's ability to cope during labor. This theory was identified as important to explore in this dissertation because it is a framework with excellent conceptual fit between both the structure of GPC and the primary outcome of interest in the case control study. Specifically, GPC is a model which seeks to increase individual pregnant women's labor knowledge and labor skills prior to the task of labor, matching self-efficacy's emphasis on the process of an

Latent Labor Hospital Admission: Outcomes and Prevention

individual drawing from the four sources of self-efficacy to modify their efficacy and outcome expectancies prior to enacting a task.

Because exposure to GPC was associated with delayed hospital admission (Aim 3) in this dissertation study, the investigator utilized integrative review of the perinatal outcomes childbirth self-efficacy literature to explore this concept as a potential theoretical framework (Aim 4) to explain this association. This portion of the dissertation sets the stage for future research hypothesizing that GPC increases childbirth self-efficacy and that this enhanced self-efficacy effectively alters women's perceptions of suffering and pain during early labor and, through this, increases a woman's capacity to cope well which shapes her decision to stay home during latent labor.

While this broader question is not addressed in this body of work, this dissertation further framed the significance of this project (Aim 1), described the proposed GPC intervention and prior literature regarding this intervention (Aim 2), identified that prospective study design may be warranted (Aim 3), and explored one theoretical framework with potential to explain the relationship between GPC and associated improved perinatal outcomes (Aim 4).

Purpose and Specific Aims

The purpose of this body of work was to better define the problem of latent labor hospital admission and, subsequently, to conduct a comprehensive literature synthesis and employ both descriptive and comparative effectiveness methods to build knowledge regarding one intervention with promise for decreasing latent labor hospital admission.

Latent Labor Hospital Admission: Outcomes and Prevention

To accomplish this, four specific aims were identified (see Table 3). The first aim was to assess the outcomes and costs of hospital admission during the latent versus the active phase of labor. To address this aim, decision and cost-effectiveness modeling utilizing a cost utility approach were performed. Quantifying costs and outcomes of phase of labor at hospital admission was integral to this body of work because it provided specific information comparing the effectiveness, consequences, and societal costs of latent labor versus active labor admission. Findings from this analysis contribute significantly to understanding the problem of hospital admission prior to active labor.

The second aim was to synthesize what is known about the GPC model and to describe research demonstrating the impact of this model on important perinatal outcomes. This makes important contributions to the purpose of this dissertation through reviewing essential elements of a novel prenatal care model and what is known about associations between this model and key perinatal outcomes.

Latent Labor Hospital Admission: Outcomes and Prevention

Table 3: Specific Aim, Paper Title

Specific Aim	Title of Paper Addressing Aim
<p>1) Quantify the outcomes and costs of admitting medically low-risk patients to the hospital during the latent versus the active phase of labor</p> <p><i>Hypothesis: Delaying hospital admission until medically low-risk patients are in active labor is a dominant strategy resulting in both better perinatal outcomes and lower healthcare costs.</i></p>	<p>Chapter II: Cost-Effectiveness Analysis of Latent Versus Active Labor Hospital Admission for Medically Low-Risk, Term Women</p>
<p>2) Review what is known about the Group Prenatal Care model regarding the association between this model of care and key perinatal outcomes</p> <p><i>Hypothesis: group prenatal care is a novel model for providing antenatal care which is associated with several equal or improved perinatal outcomes compared to standard prenatal care</i></p>	<p>Chapter III: Group Prenatal Care: Review of Outcomes and Recommendations for Model Implementation</p>
<p>3) Analyze the association between participation in group prenatal care versus individual prenatal care and phase of labor at hospital admission in a population of low-risk women receiving nurse-midwifery care</p> <p><i>Hypothesis: Participation in group prenatal care is associated with lower rates of latent labor hospital admission, lower rates of CD, and non-inferior neonatal outcomes</i></p>	<p>Chapter IV: The Influence of Group Versus Individual Prenatal Care on Phase of Labor at Hospital Admission Among Medically Low-Risk Women</p>
<p>4) Synthesize knowledge regarding childbirth self-efficacy's influence on perinatal outcomes; this creates a necessary foundation for future research exploring the suitability of childbirth self-efficacy for understanding group prenatal care</p> <p><i>Hypothesis: synthesized knowledge regarding childbirth self-efficacy's influence on perinatal outcomes will identify other potential intervention targets to guide the design of a prospective trial examining the influence of group prenatal care on timing of hospital admission during labor</i></p>	<p>Chapter V: Childbirth Self-Efficacy to Conceptualize Group Prenatal Care</p>

Latent Labor Hospital Admission: Outcomes and Prevention

The third aim was a quasi-experimental, retrospective, case control study investigating the association between participation in GPC and phase of labor at hospital admission within a population of healthy women self-selecting to nurse-midwifery care. Preliminary results from an initial sample in this study ($n = 253$) indicated, after controlling for confounders, that women who participated in GPC were 1.7 times more likely than women who participated in individual care to be admitted to the hospital during active labor (OR=2.72, 95% CI=1.41–5.26, $p=0.003$). Final analysis demonstrated that women within the entire sample ($n=375$) who received GPC were admitted to the hospital with significantly greater cervical dilation (mean (SD) 5.73 (2.49) cm vs. 5.08 (2.28) cm, $P < .005$) and were 73% more likely (OR, 1.73; 95% CI, 1.0-2.9, $P = 0.05$) to be in active labor (≥ 4 cm of cervical dilation) compared with women who received standard prenatal care, controlling for multiple covariates and propensity for group vs. individual care selection. These results make novel contributions to the science through identifying GPC as one intervention with promise for effectively decreasing latent labor hospital admission in a medically low-risk, U.S. population.

The fourth aim involved a synthesis of the literature regarding measurement of childbirth self-efficacy for the purpose of examining childbirth self-efficacy as a potential theoretical framework for understanding GPC. Childbirth self-efficacy is a psychosocial concept which has been identified as an important predictor of laboring women's perceptions and experiences, most significantly of pain and suffering, but also of their satisfaction with birth as well as their positive transition to motherhood. Because this doctoral research showed an association between GPC participation and delayed hospital admission, it is proposed that this occurred because GPC increased women's childbirth

Latent Labor Hospital Admission: Outcomes and Prevention

self-efficacy which subsequently diminished women's experience of pain and suffering during latent labor leading to improved coping with latent labor at home and, thus, delayed presentation to the hospital requesting admission. This portion of the dissertation built the foundation for a future prospective trial exploring both the relevance of childbirth self-efficacy as a psychosocial concept and theoretical framework for GPC.

Summary

The collective body of dissertation work moves the nursing science regarding latent labor versus active labor hospital admission among healthy women forward in several essential ways. First it estimated the public health impact regarding when to admit laboring women in terms of utilization of medical resources, rates of surgical delivery, rates of maternal death related to mode of delivery, and the accumulated annual costs of each outcome among a theoretical cohort of medically low-risk women delivering in the United States. Secondly, this work described the concept and structure of GPC as well as reviewed the perinatal outcomes literature regarding GPC. Thirdly, this work generated non-experimental, comparative effectiveness research assessing if this novel model of prenatal care delivery is associated with successfully delaying latent labor admission in a population of medically low-risk women. Because prior studies involving U.S. women have not examined the association between prenatal interventions and phase of labor at hospital admission, results of this study made an important scientific contribution. Finally, this work synthesized the literature regarding childbirth self-efficacy, a potentially salient theory informing how GPC could build a women's capacity to

Latent Labor Hospital Admission: Outcomes and Prevention

confidently experience latent labor at home thus delaying admission to the hospital until active labor.

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Latent Labor Hospital Admission: Outcomes and Prevention

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Chapter II

Cost-Effectiveness Analysis of Latent Versus Active Labor Hospital Admission
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Latent Labor Hospital Admission: Outcomes and Prevention

Abstract

Objective: To assess the outcomes and costs of hospital admission during the latent versus active phase of labor. Latent labor hospital admission has been consistently associated with elevated maternal risk for increased interventions, including epidural anesthesia and cesarean delivery, longer hospital stay, and higher utilization of hospital resources.

Methods: A cost-effectiveness model was built to simulate a theoretic cohort of 3.2 million term, medically low-risk women either being admitted in latent labor (<4cm dilation) or delaying admission until active labor (\geq 4cm dilation). Outcomes included epidural use, mode of delivery, stillbirth, maternal death, and costs of care. All probability, cost, and utility estimates were derived from the literature, and total quality-adjusted life years (QALYs) were calculated. Sensitivity analyses and a Monte Carlo simulation were used to investigate the robustness of model assumptions.

Results: Delaying admission until active labor would result in 672,000 fewer epidurals, 67,232 fewer cesarean deliveries, and 9.6 fewer maternal deaths in our theoretic cohort as compared to admission during latent labor. Additionally, delaying admission results in a cost savings of \$694 million annually in the U.S. Sensitivity analyses indicated the model was robust within a wide range of probabilities and costs. Monte Carlo simulation found that delayed admission was the optimal strategy in 76.79% of trials.

Latent Labor Hospital Admission: Outcomes and Prevention

Conclusion: Delaying admission until active labor is a dominant strategy, resulting in both better outcomes and lower costs. Issues related to clinical translation of these findings are explored.

Introduction

Approximately one-third of U.S. births culminate in cesarean delivery (CD) (Boyle & Reddy, 2012) with wide variation in rates across U.S. hospitals (Kozhimannil, Law, & Virnig, 2013). The most common reason offered for inter-hospital variations in CD rates is labor dystocia (Brennan, Robson, Murphy, & O'Herlihy, 2009; Main et al., 2006). Correct diagnosis of latent labor, correct diagnoses of active labor, and delayed hospital admission until active labor are practice patterns which have been identified as likely to decrease rates of CD due to the diagnosis of dystocia' and to result in fewer interventions during labor (King, 2012b; "Obstetric Care Consenses: Safe Prevention of the Primary Cesarean Delivery," 2014).

Over the past three decades evidence indicates that women admitted to the hospital during traditionally defined latent labor (< 4 cm) have a significantly higher risk of delivering via CD than women who are admitted to the hospital during active labor (Bailit et al., 2005; Boyle & Reddy, 2012; Hemminki & Simukka, 1986; Holmes et al., 2001; McNiven et al., 1998). A secondary analysis of a study which randomized women to caseload midwifery versus standard care involving 1532 medically low-risk pregnant women planning vaginal birth and in spontaneous labor found that latent labor hospital admission increased the odds of CD by 2.4 (Davey et al., 2013).

One study which did not find an association between latent labor admission and higher CD (Incerti et al., 2011) included women who received individual support during labor which is independently and strongly associated with decreased risk of CD (Brown et al., 2009; Hodnett et al., 2013). Continuous support also confounds the association

Latent Labor Hospital Admission: Outcomes and Prevention

between latent labor hospital admission and mode of delivery in studies on active management of the first stage of labor (O'Driscoll, Meagher, & Boylan, 1993). And though the majority of accumulated evidence finding an association between latent labor admission and CD is retrospective, the consistency of results suggest that timing of hospital admission during labor could be a variable worth careful consideration, perhaps helping elucidate the decision to diagnose 'labor dystocia' and, subsequently, the decision to move to operative delivery.

Obstetric providers may encounter challenges in postponing hospital admission until the onset of active labor, including concerns regarding safety, difficulty in accurately differentiating latent versus active labor, pressure from patients seeking latent labor admission for reassurance or analgesia, and medical-legal pressures (Greulich & Tarrant, 2007; King, 2012b; Neal, Lowe, Patrick, Cabbage, & Corwin, 2010; Socol, 2012). As well, cost containment and resource allocation are increasingly shaping medical care (Berwick, Nolan, & Whittington, 2008). Given recent attention to the importance of preventing primary cesareans and the downstream complications resulting from prior CD, (Jauniaux & Jurkovic, 2012; Solheim et al., 2011) the public health impact of delaying admission to labor and delivery is immediate, far-reaching, and needs to be quantified. Framed by this background, the purpose of this study was to assess the outcomes and costs of admitting low-risk patients to the hospital during the latent versus the active phase of labor.

Materials and methods

A decision-analytic model was developed using TreeAge Pro 2013 software (TreeAge, Cambridge, MA) that compared admission during the latent phase of labor versus delayed admission until active phase of labor. The size of our theoretical cohort was 3.2 million women, reflecting the number of term deliveries among women without prior CD each year in the United States. Because the study did not use any human subjects, it was not submitted to the institutional review board at Oregon Health & Science University.

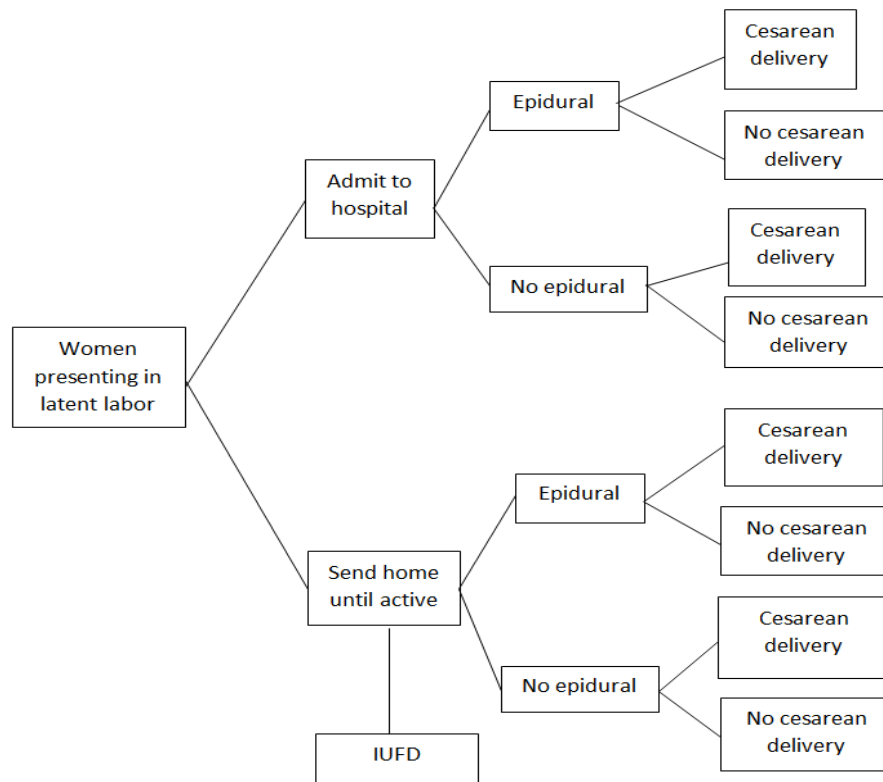
The model begins with the low-risk woman at a term gestational age in latent labor either being admitted to the hospital or being sent home (Figure I). The strategy involving delayed admission accounted for the probability of stillbirth occurring in the period of time between initial triage assessment and readmission for active labor. Based on a 2001 study of 3220 women in spontaneous labor, an average of 12.5 hours was the assumed amount of time that women in latent labor spend out of the hospital between discharge from triage and active labor hospital admission (Holmes et al., 2001). Therefore, we modeled 12.5 hours of costs of inpatient care among women admitted during latent labor.

Latent Labor Hospital Admission: Outcomes and Prevention

Figure I: Cost-Effectiveness Model Comparing Latent Versus Active Labor Admission

The theoretical model included women presenting in latent labor who were either admitted to the hospital or sent home until active labor. Outcomes evaluated included epidural use, cesarean or vaginal birth, maternal death by mode of delivery, and IUFD for those sent home in latent labor.

Figure I:



Similarly, we modeled 12.5 hours of outpatient intrauterine fetal demise (IUFD) risk after a reassuring normal non-stress test among women sent home during latent labor. Among medically low-risk women, latent labor is not associated with increased risk for fetal demise (Devane, Lalor, Daly, McGuire, & Smith, 2012). Therefore, we

Latent Labor Hospital Admission: Outcomes and Prevention

assumed that only rare and emergent events, such as severe abruption, would lead to IUFD within 12.5 hours of latent labor after a normal non-stress test. In an inpatient setting, signs of emergent events would likely stimulate prompt intervention. In a non-clinical setting, intervention would likely be delayed. The probability of term, IUFD among low-risk women in a hospital setting during active labor was not included in this model because it is difficult to estimate from the literature, it is likely extremely rare, and it would be equal between our two theoretical cohorts as both are admitted during active labor. For these reasons, IUFD costs and outcomes were modeled only for latent labor in a non-clinical setting. Additional outcomes compared included cesarean delivery, stillbirth, maternal death, epidural use, and costs of care.

Probability and Cost Inputs

All probability and cost estimates were derived from the literature (Table I). The probabilities regarding resource utilization and mode of delivery were obtained from a retrospective study of 3220 low-risk, term pregnancies examining the relationship between cervical dilation at presentation to care and subsequent obstetric outcomes (Holmes et al., 2001). Because we noted that mode of delivery outcomes in this study followed similar patterns, with higher CD associated with smaller dilation upon admission regardless of parity, we chose to utilize weighted averages of nulliparous and multiparous CD outcomes to determine CD probabilities. Additionally, because large, randomized, controlled trials have not demonstrated a difference in CD in the setting of epidural use, epidural rates did not impact CD rates in the model, but did contribute to increased cost of care. In this study, women were defined as being in latent labor if their

Latent Labor Hospital Admission: Outcomes and Prevention

cervical exam was < 4 cm and as being in active labor if their cervical exam was ≥ 4 cm; weighted averages of reported rates of epidural use and mode of delivery were used as baseline values in our model. In the delayed admission strategy, weekly risk for IUFD after a non-stress test (Haws et al., 2009) and risk of term IUFD (Rosenstein, Cheng, Snowden, Nicholson, & Caughey, 2012) informed the hourly risk for outpatient IUFD after assumed reassuring antenatal testing during latent labor triage. Risk of maternal death related to vaginal delivery or CD was obtained from the literature (Clark et al., 2008).

Costs of labor and each mode of delivery were derived from an 18-year cohort study of 27,613 pregnant and laboring nulliparous women with singleton, cephalic, term fetuses (Allen et al., 2006). Costs of maternal death were calculated using longevity and productivity projections based on research by the CDC, the Bureau of Labor Statistics, and the Center for Retirement Research. Costs of IUFD were derived from the literature (Gold, Sen, & Xu, 2013). The Consumer Price Index was utilized to convert all costs to 2014 U.S. dollars. Financial inputs were based on actual costs, not hospital charges or insurance reimbursement.

Latent Labor Hospital Admission: Outcomes and Prevention

Table I: Model Inputs

Input	Baseline Definition	Range
<i>Probabilities</i>		
Probability CD if active labor admit(Holmes et al., 2001)	0.10828	0.1 – 0.2
Probability CD if latent labor admit(Holmes et al., 2001)	0.129288	0.0 – 0.5
Probability maternal death if vaginal delivery(Clark et al., 2008)	0.000017	0.0 – 0.00003
Probability maternal death if cesarean delivery(Clark et al., 2008)	0.000163	0.0 – 0.0003
Probability of intrauterine fetal death(Haws et al., 2009; Rosenstein et al., 2012)	0.0001786	0.0 – 0.001
Probability epidural if active labor admit(Holmes et al., 2001)	0.60955	0.0 – 0.60955
Probability epidural if latent labor admit(Holmes et al., 2001)	0.82019	0.0 – 0.82019
<i>Costs(Allen et al., 2006)</i>		
Cost of CD(Allen et al., 2006)	\$11,718.17	
Cost of vaginal delivery(Allen et al., 2006)	\$8,967.04	
Cost of epidural if CD(Allen et al., 2006)	\$541.62	
Cost of epidural if VD(Allen et al., 2006)	\$379.13	
Cost of hospital stay if latent labor admission(Allen et al., 2006)	\$1,307.07	
Cost of hospital stay if active labor admission(Allen et al., 2006)	\$1,022.93	
Cost of triage care(Allen et al., 2006)	\$199.23	
Cost of maternal life expectancy ^{see text}	\$1,319,741.29	
Cost of IUFD ²⁹	\$7,622.64	

Utility and QALY Inputs

Quality adjusted life years are an outcome measure routinely used in decision and cost-effectiveness analyses to evaluate the impact of different health outcomes on quality of life. Quality adjusted life years are derived from both utility and life expectancy estimates (Naglie, Krahn, Naimark, Redelmeier, & Detsky, 1997). The concept of utility is conventionally represented in values ranging from 0, or the poorest possible outcome, to 1, or the best possible outcome (Naglie et al., 1997). Utilities can be defined as a value

Latent Labor Hospital Admission: Outcomes and Prevention

for a specific health state or a measure of satisfaction; for this analysis, a utility of 1 was defined as vaginal birth and no maternal death, a utility of 0.99 was defined as cesarean delivery and no maternal death, a maternal utility of 0.91 was defined as intrauterine fetal death based on the previously reported utility of a procedure-related loss (Kuppermann et al., 2000) and a utility of 0 was defined as maternal death. Because our primary focus involves maternal outcomes, IUFD utility was framed in relation to projected impact on the mother only. Utilities were applied to discounted life expectancy at a rate of 3% to generate quality adjusted life years. We assumed that women were 25 years of age on average when birthing and projected an average of 56 additional years of life after childbirth.

Analysis

We calculated the clinical outcomes, total costs, and quality-adjusted life years with our baseline assumptions from the societal perspective. The incremental cost-effectiveness ratio comparing delaying admission until cervical dilation was 4 cm or greater compared to admission prior to 4 cm was calculated and compared to a cost-effectiveness threshold of \$100,000 per quality adjusted life year .

Because all model inputs are vulnerable to some degree of uncertainty, confidence in model outcomes must be addressed. Thus, in order to evaluate the robustness of our model and baseline assumptions, we performed sensitivity analyses. Sensitivity analysis is a tool which allows the input parameters to be varied over their potential ranges to assess if such variations alter model conclusions (Krahn, Naglie, Naimark, Redelmeier, & Detsky, 1997). Both one-way and multivariate sensitivity analyses were completed for

Latent Labor Hospital Admission: Outcomes and Prevention

this cost-effectiveness model including a two-way sensitivity analysis in which probability of cesarean delivery in active labor and in latent labor were both varied.

In order to incorporate multiple levels of uncertainty into the baseline model, a Monte Carlo micro-simulation was performed to vary all model inputs simultaneously. One trial represents a woman being admitted to the hospital in either latent or active labor; probabilities, costs, and utilities were randomly chosen from pre-specified distributions derived from the literature. All probability and utility inputs were modeled within beta distributions, and costs were modeled within gamma distributions. Of note, because it is highly implausible that the CD rate for latent labor would be lower than the CD rate for active labor, the distribution for the probability of CD in active labor was linked to be 0.83 times the latent labor distribution, reflecting the ratios of the two CD rates used in our baseline assumptions. The Monte Carlo simulation was then repeated 10,000 times, each choosing randomly from the various input distributions. Thus, the aggregate results represent a theoretical cohort of women.

Results

In the theoretic cohort of 3.2 million pregnancies in the U.S., delaying admission until active labor versus admitting women during latent labor would result in 672,000 fewer epidurals, 67,232 fewer cesarean deliveries, and 9.6 fewer maternal deaths every year. Active labor admission would lead to 18,368 more quality adjusted life years in the population. Additionally, there would be an annual cost savings of \$694 million from delaying admission until active labor (Table II). When examining the cost-effectiveness

Latent Labor Hospital Admission: Outcomes and Prevention

ratio, delaying admission is a dominant strategy, meaning lower costs and better outcomes are simultaneously achieved.

Table II: Outcomes

Outcomes after Admission During Latent & Active Labor in a Population of 3.2 Million Women			
Outcomes	Latent Labor Admission	Active Labor Admission	Difference
Cesarean Deliveries	413,721.6	346,489.6	67,232
Maternal Deaths	115.2	105.6	9.6
IUFD in 12.5 h	42	0	42
Epidurals	2,624,000	1,952,000	690,000
Costs	\$36,364,127,000	\$35,669,414,000	694,713,000
QALYs	86709078.4	86727446.4	18,368

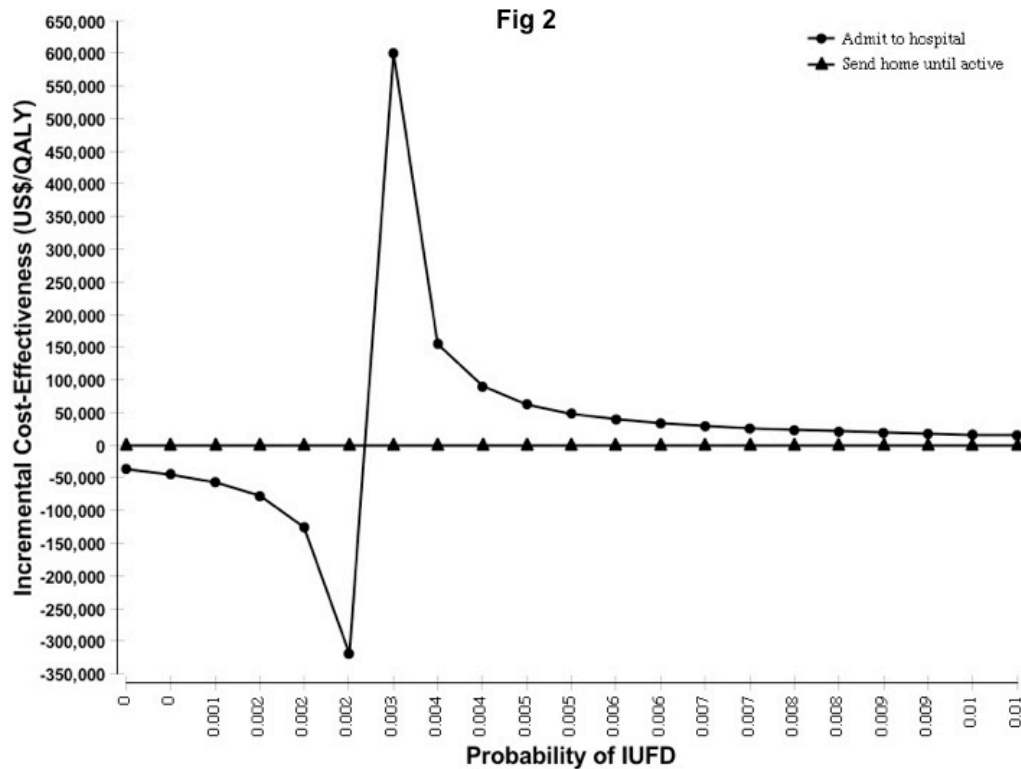
In order to examine the robustness of our model, we conducted sensitivity analyses. First, we conducted univariate sensitivity analyses varying the model inputs over the range identified during literature review and then we conducted two-way sensitivity analyses. When we varied the number of triage visits that an individual might experience by delayed admission, sensitivity analysis demonstrated that delaying hospital admission until active labor remained a cost-effective strategy even if women were triaged and sent home four times prior to returning in active labor. Our baseline risk for IUFD was 1.7/10,000 per week. When we varied the risk of IUFD per week from 0 to 10/10,000, the model was robust over the entire assumed range (Figure II). Further, when we conducted a threshold analysis to determine the risk of IUFD, we found that latent labor admission yielded better outcomes only once the risk of IUFD was 30/10,000 per week (18 times the assumed baseline rate) though it was still not cost effective to do so. It

Latent Labor Hospital Admission: Outcomes and Prevention

became cost-effective to admit women in latent labor if the risk of IUFD was 40/10,000 per week or greater, more than twenty times our baseline assumption.

Figure II:

One-way sensitivity analysis on IUFD probability during 12.5-hr estimated period between initial latent labor triage presentation and readmission once in active labor. Delayed admission until active labor was cost-effective until the probability of IUFD in women discharged home exceeded 40/10,000 per week.



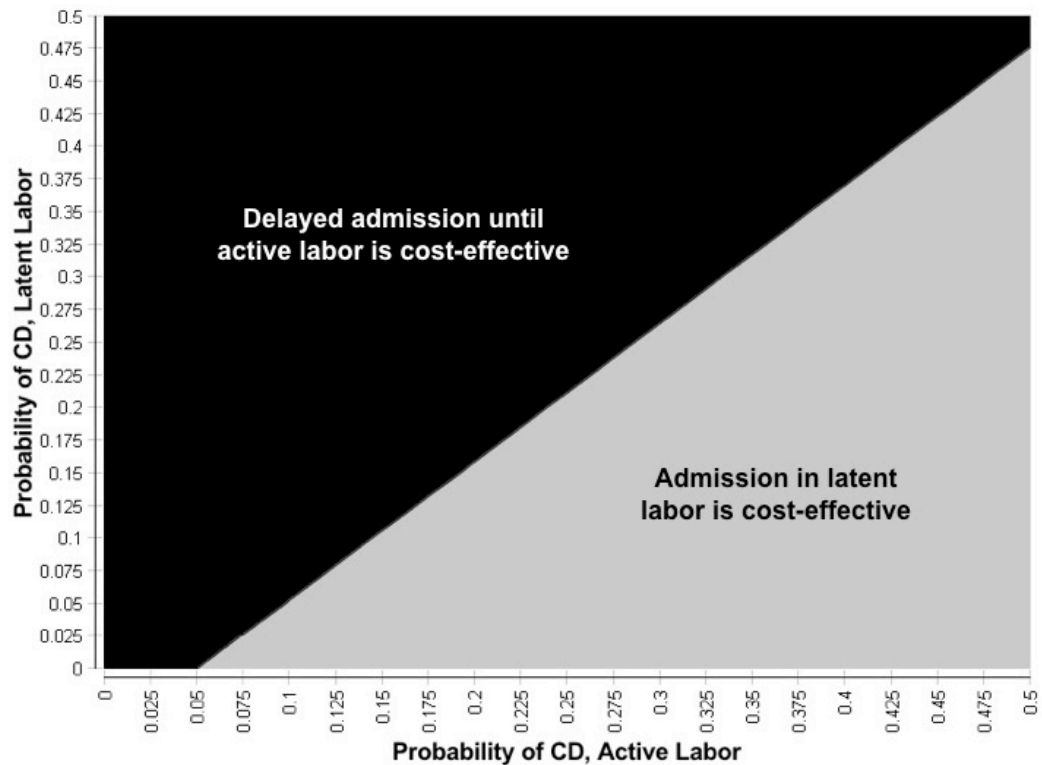
Our baseline risk for CD with active labor admission was 10.8% and our baseline risk for CD with latent labor admission was 12.9%. To explore CD outcomes based on

Latent Labor Hospital Admission: Outcomes and Prevention

risk for both active and latent labor admission simultaneously, we conducted a two-way sensitivity analysis in which the risks of CD with active labor admission were varied from 10% - 20% and the risks of CD with latent labor admission were varied from 0% - 50% (Figure III). This analysis supports our findings that delaying admission until active labor is a dominant strategy within a wide range of CD probabilities.

Figure III:

Two-way sensitivity analysis of the CD rate in latent labor vs. CD rate in active labor. Dark region represents where delayed admission until active labor is cost-effective.

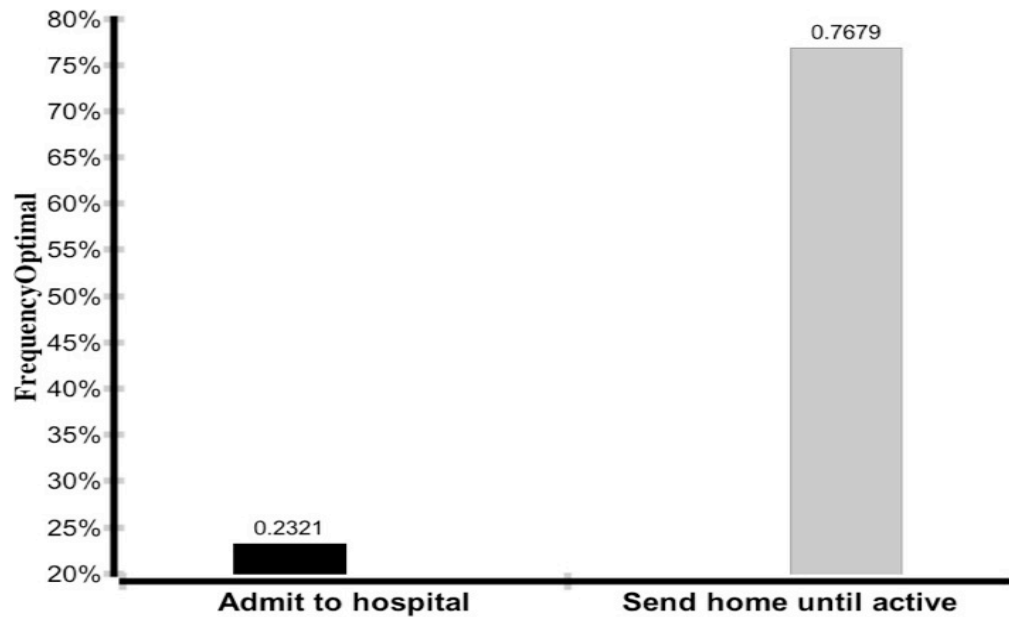


Latent Labor Hospital Admission: Outcomes and Prevention

Because clinical scenarios may incorporate significant variation in probabilities, we created a Monte Carlo simulation to explore outcomes related to these theoretically wide variations in probabilities. Based on the Monte Carlo probabilistic sensitivity analysis simulation, a willingness-to-pay acceptability curve showed that in 76.79% of trials, delaying admission until active labor would be cost-effective given a threshold of \$100,000 per quality adjusted life years (Figure IV).

Figure IV:

Monte Carlo Simulation



Discussion

The U.S. health care system is pushing to achieve the Triple Aim of higher quality, greater access, and lower costs (Berwick et al., 2008). In our analysis, delaying admission to labor and delivery until the onset of active labor would prevent 67,232 cesarean deliveries and 9.6 maternal deaths while saving more than \$600 million annually. Importantly, these would be primary cesareans, carrying the downstream complications of repeat cesarean, and increased morbidity and mortality (Silver, 2012; Solheim et al., 2011). Our findings suggest that a labor management strategy which admits low-risk women only when they are in active labor would move obstetric care toward Triple Aim goals.

Translating these findings may raise concerns. Perceptions that electronic fetal monitoring during latent labor might lead to improved fetal safety could influence providers' decisions. No literature to date has identified latent labor as a time of increased risk for poor fetal outcomes in term, low-risk women, nor electronic fetal monitoring as a reliable option for mitigating latent labor safety concerns (King, 2012b; Devane et al., 2012). This may give the triaging provider more confidence that latent labor does not pose an identifiable risk to term fetuses in this population.

Vague definitions of latent labor, as well as evidence of wide individual variations in labor length and symptomology, create difficulty in prospectively differentiating active labor from latent labor. Seminal labor research, (Friedman, 1955) identifying 4 cm of cervical dilation as the onset of active labor, has been challenged by recent investigations proposing 6 cm of cervical dilation as the more appropriate marker of active labor onset

Latent Labor Hospital Admission: Outcomes and Prevention

(Neal, Lowe, Ahijevych, et al., 2010; Neal, Lowe, Patrick, et al., 2010; "Obstetric Care Consensus: Safe Prevention of the Primary Cesarean Delivery," 2014; Zhang, Landy, et al., 2010; Zhang, Troendle, & Yancey, 2002). A recent study suggests that active labor cannot be identified with one cervical exam, regardless of dilation, and should only be determined based on evidence of progressive cervical dilation over time (Neal et al., 2014). This evidence may support clinicians in moving toward a more conservative determination of active versus latent labor and extended outpatient evaluation. Given the heterogeneity of latent labor and the challenge of determining which women who are 4 cm to 6 cm dilated are in active labor, we do not advocate delaying admission to such women.

Some women experience latent labor as painful and may seek admission in pursuit of analgesia; we are not suggesting that appropriate analgesia be denied these women. Additionally, laboring women often perceive the latent phase as a period of great uncertainty (Greulich & Tarrant, 2007) manifesting in confusion regarding when to enter the hospital (Cheyne et al., 2007). In the context of medical-legal concerns, patient uncertainty during latent labor may shape the triaging provider's decisions. (Socol, 2012) One study found that participants were content to remain home in latent labor if this led to lower risk for immobilization during labor, for surgical or instrumental delivery, or shorter hospital stay (Scotland, McNamee, Cheyne, Hundley, & Barnett, 2011). Informing pregnant women about the benefits of active labor admission could decrease requests for latent labor admission.

Latent Labor Hospital Admission: Outcomes and Prevention

Additional benefit may arise from improved antenatal preparation. Specific areas of intervention could include: helping women develop realistic expectations regarding the range of latent labor length and symptomatology, teaching labor pain management skills, garnering family, friend, or doula support at home, and communication about optimal timing of hospital based analgesia (Lumluk & Kovavisarach, 2011; Maimburg et al., 2010). Maimburg et al. demonstrated that pregnant women randomized to a group-based, antenatal education program were almost 50% more likely to present to the hospital in active labor than women not receiving this intervention (RR 1.45, 95% CI 1.26-1.65, $p < 0.001$) (Maimburg et al., 2010); it is possible that these findings are related to enhanced latent labor preparation.

Our study is not without limitations. One limitation of cost-effectiveness analyses is that model inputs are dependent upon the accuracy of the existing literature. For example, the estimate for maternal mortality, which is a rare outcome, is from a single large study (Clark et al., 2008). However, sensitivity analyses utilized a broad range around this estimate and results remained robust across a wide and clinically plausible range. For example, the actual risk of IUFD would have to be more than 20 times our baseline assumption before latent labor admission would become a cost-effective strategy. Furthermore, decision-analytic models cannot thoroughly represent the complexity of clinical scenarios. For this reason, we sought to incorporate key clinical aspects, including operative delivery and related complications and costs. Each laboring woman weighs personal benefits and consequences when deciding to seek hospital admission, which cannot be accounted for in this analysis. While important, the intent of this study was to examine the global impact of a broad policy change in clinical practice.

Latent Labor Hospital Admission: Outcomes and Prevention

Another limitation involves the range of potential complications among women experiencing latent labor at home. We chose to include stillbirth as a representative outcome that is rare, but severe, and would be of concern to providers and patients alike.

Another limitation of our findings relates to what constitutes ‘low-risk.’ The heterogeneity of criteria utilized for defining low-risk pregnancy presents challenges when seeking to investigate pregnancy and birth outcomes for the majority of healthy women. Our probabilities for CD were derived from a study in which the inclusion criteria and the definition of low-risk may not match those used in other literature cited (Holmes et al., 2001). And given these variations in the literature defining low-risk (Institute of Medicine, 2013), we selected no history of cesarean delivery as one essential and widely utilized criteria constituting low-risk and, thus, chose to create our theoretic cohort of low-risk women based on the annual number of pregnant women without history of cesarean delivery. These limitations highlight the need for increased engagement and consensus building regarding defining low-risk pregnancy.

The cost savings and improved patient outcomes identified in our analysis support further work to encourage hospital admission only with the onset of active labor. Identifying antenatal opportunities to help women formulate realistic expectations about latent labor and build capacity to cope confidently during latent labor may lead to decreased patient requests for admission prior to the active phase. Additionally, identifying cultural and systems level factors to support triaging clinicians in decision-making related to ideal timing of hospital admission during labor may assist clinicians in

Latent Labor Hospital Admission: Outcomes and Prevention

admitting medically low-risk women when the hospital setting poses maximum benefit and minimum harm.

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Chapter III

Group Prenatal Care: Review of Outcomes and Recommendations for Model Implementation

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This manuscript replaced essential elements of the review of the literature and discussion sections within the traditional dissertation. Ellen Tilden is the primary author of this paper and completed the literature review and synthesis under the direction of Dr. Caughey, who is the senior author. This paper was submitted as an invited manuscript, peer reviewed, and subsequently published in the *Obstetrical and Gynecological Survey* which has an impact factor of 2.361. The readership of this journal includes nurses caring for women during their reproductive years, nurse-midwives, family practice physicians, obstetricians/gynecologists, and maternal-fetal medicine specialists.

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Abstract

The intent and delivery of prenatal care has evolved since its formal inception in the early 1900s. Group prenatal care offers an alternative care delivery model to the currently dominant prenatal care model. The group model has been associated with a number of improved perinatal outcomes including decreased preterm birth, higher birth weight, improved breastfeeding initiation and duration, decreased cesarean delivery, and greater patient satisfaction. This article outlines the tenets of CenteringPregnancy, the current dominant form of group prenatal care, reviews literature regarding perinatal outcomes related to group prenatal care, suggests future research agendas, and highlights relevant considerations when implementing this alternate model of prenatal healthcare delivery.

Introduction

The intent of prenatal care is surveillance aimed at preventing poor perinatal outcomes and educating and supporting pregnant women as they prepare for birth and motherhood. We have yet to determine an ideal model able to consistently realize these goals (1, 2). Given the increasing constraints on clinical and patient interaction, achieving a satisfactory and evidence-based interpersonal communication with patients in prenatal clinic can be challenging. Group prenatal care offers a promising alternative model for reaching these goals and improving both patient and provider satisfaction.

Group prenatal care has been widely adopted in the certified nurse-midwife (CNM) community, but has yet to gain wider traction with other obstetric providers. While conceived of as a care model that might provide greater emotional support to pregnant women, a number of specific obstetric outcomes have been shown to improve in women who have received care in this fashion. Three randomized controlled trials demonstrate reduced preterm birth and cesarean delivery rates, higher birth weights of infants born term and preterm, increased breastfeeding rates, enhanced prenatal knowledge, and greater satisfaction with care in women who received prenatal care in a group format (3-5). Recent retrospective cohort studies yielded a 47% reduction in preterm birth among women cared for in the CenteringPregnancy model (6) and a significant reduction in cesarean section in women cared for by residents trained in the CenteringPregnancy model (7).

The group prenatal care model also improves the efficiency of clinic time for patients and providers. Patients do not wait for care. Provider efforts are maximized

Latent Labor Hospital Admission: Outcomes and Prevention

which avoids the repetition of information inherent in the traditional care delivery model. One expert of group prenatal care suggests that the “strength of group prenatal care is the enhanced *quantity* of time... permitting enhanced *quality* of care” (8). Recent research regarding physicians’ experiences with providing prenatal care highlights the need to consider new models of health care delivery. Physicians who carry front line care responsibilities and who cope with clinical system inefficiencies are at significant risk for burnout (9). Efforts to address this problem have been inconsistently effective and emphasize physician-oriented interventions, such as stress reduction training (9). Organizational change may be a more appropriate target than individual interventions, and group prenatal care may serve this purpose (9). This article outlines the tenets of the dominant group prenatal care model, CenteringPregnancy, reviews literature regarding perinatal outcomes associated with group prenatal care, makes recommendations for future research, and highlights relevant considerations when implementing a group prenatal care model.

Evolving Goals of Prenatal Care in the US

Prenatal care originated in 1902 as a strategy to reduce fetal teratogen exposure and evolved to promote early identification of risks for eclampsia (1). In the 1920s, public health nursing took the lead in providing prenatal care and developed the expectation of offering maternal education regarding nutrition, exercise, and infant care (1). By the 1930s, physicians assumed a central role in providing prenatal care; the basic framework of care created at that time remains the model in standard use today (1).

Latent Labor Hospital Admission: Outcomes and Prevention

The majority of modern reductions in infant mortality are attributed to advances in medications or life-saving technology rather than to prenatal prevention efforts (10, 11). There is some evidence for the effectiveness of prenatal surveillance in identifying preeclampsia, but other outcomes of interest have been more difficult to impact (12). While progress has been made in decreasing risks for women with a history of preterm birth, there is currently no effective method for reducing preterm birth in low risk pregnancies (13-15). The number of prenatal visits in the traditional care model in the U.S. exceeds most other countries, but infant morbidity and mortality rates are above many other developed nations (1).

The US Public Health Service (USPHS) and the Institute of Medicine (IOM) addressed concerns about current prenatal care delivery in the 1989 document *Caring for Our Future: The Content of Prenatal Care*, which asserts that the three main components of PNC should be risk assessment, education, and support (16). In the IOM's 2001 document, *Crossing the Quality Chasm: A New Health System for the 21st Century*, the following components of new healthcare models were recommended: continuous healing relationships; customization of care to patient values/needs; patient as source of control; free flow of information; care decisions based on evidence; safety as a systems priority; transparency is necessary; needs anticipation; decrease of waste; and clinician cooperation (17). Group prenatal care is an option that has the potential to encompass these components in pregnancy care. Group medical visits are being employed for similar purposes to care for people of different populations and with various medical concerns (18-26).

History of CenteringPregnancy

The CenteringPregnancy model was first piloted in 1993 by Sharon Schindler-Rising, a certified nurse midwife (CNM). She further refined the specific components of the CenteringPregnancy care model, trademarked the term, and conducted initial evaluation regarding the model. In 2006, Schindler-Rising founded the 'Centering Healthcare Institute Inc.' (CHI) to reflect the broadening scope of its mission. The CHI offers training, implementation support, and approval for its now multiple group care models, of which CenteringPregnancy is one.

Structure of Centering Pregnancy Model:

CenteringPregnancy incorporates the three USPHS identified essential elements of PNC (risk assessment, education, support) in a group care format. Groups are facilitated by a practitioner (CNM, NP, or MD) and co-facilitated by another professional (i.e. nurse, MA, social worker). After an initial, private prenatal visit that includes history, blood work, physical and pelvic exams, expectant mothers between 12 and 16 weeks of gestation are placed in groups of 8-12 women. Each of the ten sessions is two hours long and groups may include a postpartum session. Sessions begin with the risk assessment component during which each woman records her blood pressure and weight and calculates her gestational age. The provider meets with each woman for approximately 5 minutes in a semi-private area of the room to check fundal height, listen to fetal heart tones and assess if there are any concerns more appropriately addressed apart from the group. As these short private visits are occurring, others in the group socialize, fill out private assessment forms or diaries, or peruse pertinent books and

Latent Labor Hospital Admission: Outcomes and Prevention

articles. If any issue requires a physical exam or more time for discussion, plans are made for a follow-up visit after group or at another time (27).

Fidelity to the CenteringPregnancy model is defined by a) successfully accomplishing and maintaining site approval through the CHI and b) prioritizing the thirteen essential elements of the program (28)(see table 1). It is noteworthy that ten of these essential elements emphasize process concerns, such as interaction style, participant behaviors, and group participants' position in the room whereas content, highlighted in many other prenatal interventions, is deemphasized. Other group prenatal care models have been investigated, some of which incorporate a range of aspects of the CenteringPregnancy model; however, description of these alternate models vary in specificity, at times making comparison challenging.

A recent secondary analysis of Ickovic's 2007 RCT assessed the association between CenteringPregnancy model fidelity and perinatal outcomes (42). Greater process fidelity, meaning greater evidence that providers emphasized a facilitative leadership style in addition to increased participation of women receiving group prenatal care, was significantly associated with decreased preterm birth. Greater content fidelity was not significantly associated with improved perinatal outcomes. Despite several study limitations, including necessarily subjective evaluation of the groups, this study is the first to evaluate the functional aspects of CenteringPregnancy and to begin exploring which aspects of this model may be leading to improved outcomes.

Table 1: Essential Elements of CenteringPregnancy

Essential Elements of CenteringPregnancy
Health assessment occurs within the group space
Women are involved in self-care activities
A facilitative leadership style is used
Each session has an overall plan
Attention is given to the core content; emphasis may vary
There is stability of group leadership
Group conduct honors the contribution of each member
The group is conducted in a circle
Group composition is stable, but not rigid
Group size is optimal to promote the process
Involvement of family support people is optional
Opportunity for socializing within the group is provided
There is ongoing evaluation of outcomes

Group Prenatal Care and Perinatal Outcomes:

The CenteringPregnancy model of prenatal care has been associated with several improved perinatal outcomes. Studies regarding CenteringPregnancy and group prenatal care are of varying methodological design and strength. Three recent review articles offer thorough bibliographies identifying the complete qualitative and quantitative literature regarding CenteringPregnancy and group prenatal care (29-31). In this section, ten studies assessing clinically relevant outcomes and with stronger designs or larger sample sizes are reviewed.

Preterm birth

Preterm birth (PTB) has been the most consistently evaluated perinatal outcome, and all but one study have demonstrated lower rates of PTB in women receiving group care (Table 2). Ickovics et al. (2007) randomly assigned pregnant teens and women to group vs. individual care at two university hospital clinics. The significant reduction of birth prior to 37 weeks gestation found for those randomized to group care was even more pronounced for African-American women who experienced 15.8% PTB when they received individual care versus 10.0% PTB when they received group care ($p = 0.02$). A 2010 study employed a cluster randomized control design in which 14 urban Iranian health centers were randomized to provide only individual care or only group care; this is the only study selected for review which was not conducted at a CenteringPregnancy approved site (4). While this study found a lower rate of PTB among those women randomized to group prenatal care as compared to the individual care model (6.3% vs., 9.7%), this difference was not statistically significant ($p = 0.19$). A recent clinical trial (2011) which randomized women from US Navy and Air Force communities to group or individual care did not yield a significant reduction in preterm birth for those women who received group care (7.8% vs. 5.5%, $p = 0.46$); one significant limitation noted by the investigators was the high likelihood of cross-contamination given the close social connections within these military communities (36).

Similar reductions in PTB were found in studies using quasi-experimental designs. A 2011 retrospective cohort study compared outcomes of women cared for by residents educated under the traditional prenatal care curriculum versus residents

Latent Labor Hospital Admission: Outcomes and Prevention

educated under the CenteringPregnancy model and found that women cared for by residents trained with CenteringPregnancy experienced a 4.2% risk of PTB whereas those cared for by residents trained in the traditional model experienced a 8.3% risk for PTB ($p = 0.045$) (7). A second retrospective cohort study included women in South Carolina, a population with 16.4% risk of PTB, who self-selected to prenatal care modality. Those who selected CenteringPregnancy were at higher risk for PTB than those who selected individual care yet women receiving group care experienced a 47% reduction in PTB (7.9% vs. 12.7%, $p = 0.01$) (6). This study, similar to Ickovics et al. (2007), found that the decreased PTB effect was more pronounced in African-American women, suggesting that US racial disparities in PTB may be diminished when women receive group prenatal care.

Table 2: Group prenatal care vs. individual prenatal care, Preterm birth

	PTB < 37 weeks			PTB < 33 weeks		
	group	individual	P value	group	individual	P value
Ickovics et al., 2007 Multisite randomized controlled trial Group = 623 Individual = 370	9.8%	13.8%	.045	-	-	-
Jafari et al., 2010 Cluster randomized control trial Group = 320 Individual = 308	6.3%	9.7%	.19	-	-	-
Kennedy et al., 2011 Randomized clinical trial Group N = 162 Individual N = 160	7.8%	5.5%	.46	-	-	-
Barr et al., 2011 Retrospective cohort Group = 195 Control = 184	4.2%	8.3%	.045	-	-	-
Picklesimer et al., 2012 Retrospective cohort Group = 316 Individual = 3767	7.9%	12.7%	.01	1.3%	3.1%	.03

- = not reported

Low birth weight

Studies that evaluated PTB also evaluated low birth weight (LBW). The outcomes were similar to those for PTB (Table 3). The RCT including military women did not find that the group intervention was effective in decreasing the incidence of low birth weight. (4.6% vs. 4.6%, $p = 1.00$) (36). Yet the downward trend of LBW among infants whose mothers received group care, while not reaching significance in most studies, is consistent across the remaining samples, the majority of which included women at disproportionate risk for LBW. After controlling for intrauterine growth restriction, gestational age at birth, parity and history of LBW, the RCT conducted in Iran

Latent Labor Hospital Admission: Outcomes and Prevention

determined that women randomized to group care clinics experienced significantly higher neonatal birth weight than women randomized to individual care clinics ($p = 0.011$) (4).

Given the higher rates of neonatal death and lower availability of technologies for support of preterm and low birth weight infants in certain communities sampled, these findings suggest that group prenatal care may have benefit for women and infants at risk for health disparities in birth outcomes both domestically and internationally.

Table 3: Group prenatal care vs. individual prenatal care, Low birth weight

	LBW < 2500g			LBW < 1500g		
	group	individual	P value	group	individual	P value
Kennedy et al., 2011 Randomized clinical trial Group N = 162 Individual N = 160	4.6%	4.6%	1.00	-	-	-
Jafari et al., 2010 Cluster randomized control trial Group = 320 Individual = 308	6.3%	9.1%	.011	-	-	-
Ickovics et al., 2003 Prospective matched cohort Group = 229 Individual = 229	7.0	10.0%	.38	1.3%	2.6%	•
Ickovics et al., 2007 Multisite randomized controlled trial Group = 623 Individual = 370	11.3%	10.7%	.9	-	-	-
Barr et al., 2011 Retrospective cohort Group = 195 Control = 184	4.8%	8.5%	.15	-	-	-
Picklesimer et al., 2012 Retrospective cohort Group = 316 Individual = 3767	7.3%	8.4%	.26	1.6%	3.0%	.26

• = not reported

Breastfeeding:

Breastfeeding initiation and/or duration has been measured in several studies and group care participants have shown significantly improved outcomes in two of three RTCs (see table 4). The only RCT with non-significant findings (94% vs. 94%, $p = 1.00$) was the study involving a military population (36). Teens at a Missouri clinic that utilized CenteringPregnancy were compared with teens receiving individual care at a different center but delivering at the same hospital (37). Teens who were exposed to

Latent Labor Hospital Admission: Outcomes and Prevention

group care showed an almost two-fold increase in breastfeeding initiation (46% vs. 28%, $p = 0.02$). Iranian women randomized to group prenatal care demonstrated significantly increased breastfeeding duration at 8 weeks postpartum. The authors note that the impact on breastfeeding duration was even more remarkable given Iranian cultural pressures against breastfeeding (94.3% vs. 86.7%, $p = 0.001$) (4). Further, significantly more women in the intervention group were exclusively breastfeeding at 8 weeks postpartum (65.2% vs. 41.1%, $p = 0.001$).

Table 4: Group prenatal care vs. individual prenatal care, Breastfeeding

	Increased breastfeeding initiation			Increased breastfeeding duration		
	group	individual	P value	group	individual	P value
Kennedy et al., 2011 Randomized clinical trial Group N = 162 Individual N = 160	94%	94%	1.00	56%	56%	1.00
Grady et al., 2004 Descriptive, pilot Group N = 124 Individual N1 = 144 Individual N2 = 233	46%	N1- data not available N2=28%	Group vs N2=.02	-	-	-
Jafari et al., 2010 Cluster randomized control trial Group = 320 Individual = 308	97.2%	93.8%	.314	94.3%	86.7%	.001
Ickovics et al., 2007 Randomized Controlled Trial Group = 623 Individual = 370	66.5%	54.6%	.001	-	-	-
Kilma et al., 2009 Descriptive, pilot Group N = 61 Individual N = 207	44.3%	31.2%	.05	-	-	-

Latent Labor Hospital Admission: Outcomes and Prevention

Mode of delivery:

Four studies evaluated mode of delivery in relation to prenatal care model (see table 5). One descriptive study and one RCT did not show significant differences in mode of delivery outcomes between women who received individual versus women who received group prenatal care (36-37). A second RCT showed that women randomized to group care had a significantly lower rate of cesarean delivery (32.8% vs. 40.9%, $p = 0.031$) (4). A 2011 cohort study showed a significant decrease in cesarean rates for women cared for by family practice residents trained in CenteringPregnancy (17.5% vs. 26.9%, $p = 0.028$); this study raises questions regarding whether group prenatal care training or utilization may influence provider perceptions and clinical decision making (7).

Table 5: Group prenatal care vs. individual prenatal care, Mode of delivery

	Cesarean delivery	Cesarean delivery	
	group	individual	P value
Kennedy et al., 2011 Randomized clinical trial Group N = 162 Individual N = 160	31.7%	29.7%	0.71
Grady et al., 2004 Descriptive, pilot Group N = 124 Individual N1 = 144 Individual N2 = 233	13.7%	N1=14.6%, N2=15.9%	•
Jafari et al., 2010 Cluster randomized control trial Group = 320 Individual = 308	32.8%	40.9%	.031
Barr et al., 2011 Retrospective cohort Group = 195 Control = 184	17.53%	26.92%	.028

• = not reported

Satisfaction/Knowledge:

Patient satisfaction and pregnancy knowledge were assessed as outcomes in several trials (see table 6). Most found high satisfaction in women who participated in group prenatal care or, when compared to those receiving individual care, significantly greater satisfaction reported by women in group prenatal care (3) (36-38). One quasi-experimental study found that satisfaction among women who received group prenatal care was comparable to satisfaction among women in individual care, but women participating in group care had acquired significantly more pregnancy or birth knowledge

Latent Labor Hospital Admission: Outcomes and Prevention

(39). Higher pregnancy and birth knowledge scores were also found in Ickovics 2007

RCT (3). The reliability and validity of the satisfaction and knowledge assessment tools used were not reported.

Table 6: Group prenatal care vs. individual prenatal care, Satisfaction and knowledge

	Greater satisfaction with prenatal care in group	Greater knowledge of pregnancy and/or birth in group
Baldwin, 2006 Two-group pre-test, post-test Group N = 50 Individual N = 48	Satisfaction scores equal	Higher post-test knowledge scores for women in group, p = .03
Ickovics et al., 2007 Randomized Controlled Group = 623 Individual = 370	Higher satisfaction scores for women in group p = .001	Higher knowledge scores for women in group p = .001
Grady et al., 2004 Descriptive, pilot Group N = 124 Individual N1 = 144 Individual N2 = 233	Mean 9.2 satisfaction (1-10 scale) in group. Comparison not assessed	-
Klima et al., 2009 Descriptive, pilot Group N = 61 Individual N = 207	Higher satisfaction scores for women in group p = .05	-
Kennedy et al., 2011 Randomized clinical trial Group N = 162 Individual N = 160	Higher satisfaction scores for women in group p = .001	-

Summary of Outcomes

One systematic review and one systematic review with meta-analysis of the group prenatal care model surveyed and synthesized the literature on this subject (29, 30). Both concluded that women exposed to group prenatal care or CenteringPregnancy yielded

Latent Labor Hospital Admission: Outcomes and Prevention

significant reductions in preterm birth, significant improvement in breastfeeding initiation and duration, greater knowledge and satisfaction with prenatal care, and a non-significant reduction in cesarean rates and low birth weight infants (29, 30). Although CenteringPregnancy and group prenatal care were considered to hold promise, stronger research design and replication of results are required to draw firmer conclusions on the models' effectiveness (29-31).

Future Research Directions

External Validity:

The majority of experimental and quasi-experimental studies (Ickovics, 2003; Ickovics, 2007; Jafari, 2010; Barr, 2011; Picklesimer, 2012) include predominantly women of minority, low socio-economic or teen status, which limits generalizability. Given the costs and complexities in understanding and addressing U.S. health disparities, the findings for enhanced outcomes in these populations at higher risk for perinatal complications are compelling. Future research must seek to test the applicability of this model in other pregnant populations.

Model Fidelity:

Another area needing clarification in future research involves defining the intervention. Many studies published to date on this subject use the terms 'group prenatal care' and 'CenteringPregnancy' interchangeably, and do not specify what constitutes fidelity to the CenteringPregnancy model nor if their interventions maintain model fidelity. Clarity regarding specifics of each group prenatal model under investigation is

Latent Labor Hospital Admission: Outcomes and Prevention

essential for building knowledge of how this model may be improving prenatal outcomes. This information will also illuminate if adherence to the CenteringPregnancy criteria is essential to replicating improved outcomes or if adaptations of the model may also reach these goals.

Aspects of the Group Prenatal Care Model:

A proposed direct correlation between quantity of prenatal visits and effectiveness of prenatal care has been the central premise of some experts' analysis of prenatal care (32). This approach neither assesses the complexities of how pregnant women interact with the health care system nor the content or structure of a clinical encounter. It is possible that the positive outcomes associated with group prenatal care are related to variables that have not yet been defined or quantified. Because CenteringPregnancy discourages didactic interactions and emphasizes social, behavioral, and organizational changes, the assertion can also be made that no two groups are ever exactly the same. Perhaps this flexibility regarding information exchange, as yet unstudied, positively influences outcomes. It is also possible that the socializing and community building aspects of the group model or the increased patient/provider interaction time are the elements most significantly linked to better outcomes. Building upon the recent publication by Novick, et al., investigation of these questions is needed for identifying the most effective aspects of CenteringPregnancy or other group prenatal care models (42). Other elements that invite investigation are the effect of group care on women's self-efficacy for labor and mothering and on their fear of labor, perceptions of social support

Latent Labor Hospital Admission: Outcomes and Prevention

during and after pregnancy, postpartum depression, long-term breastfeeding, and postpartum birth control utilization.

Social Intervention:

One aspect of group prenatal care deserving of careful consideration is how this intervention changes the social context of care. Future research on the model may benefit from considering investigation of other social interventions. Researchers examining the ‘Latina paradox’ have suggested that one key contribution to Mexican immigrant women’s healthier pregnancies involves the informal prenatal care and support received through social networks that complement clinical care (33). Continuous doula support during labor has been consistently linked with improved outcomes and decreased interventions (34, 35). These examples highlight the social context of care and challenge us to consider not only the type of information or the frequency of clinical encounters a pregnant or laboring woman receives, but also the impact of how, when, in what context, and by whom this information is communicated.

Stress:

Research to date suggests that group prenatal care is associated with an improvement in a number of pregnancy outcomes; most important among these is preterm birth. This raises the question: how could the model of prenatal care influence the pathophysiology of preterm birth? One area that warrants investigation is whether group prenatal care modifies pregnant women’s stress responses. Stress has been associated with a number of suboptimal perinatal outcomes; a recent epidemiological

Latent Labor Hospital Admission: Outcomes and Prevention

study links maternal bereavement during pregnancy with higher rates of fetal death (40). Future research might evaluate the group prenatal care intervention from a bio behavioral framework and examine stress markers.

Implementing Group Prenatal Care

The nurse-midwives at Oregon Health & Science University (OHSU) chose to implement CenteringPregnancy in 2009. It became clear that certain aspects of the model were not an optimal fit for the midwifery clinic population, which includes predominantly well-educated, Caucasian, and privately insured patients. For this reason, we revised the curriculum, certain aspects of the CenteringPregnancy model, and handouts based on the experiences, issues, and questions of the women in our patient population while maintaining the majority of the '13 essential elements.' For example, we eliminated content regarding oral hygiene and STI transmission, increased focus on stress reduction and skill building for labor, and replaced game-based group interactions with a more didactic style for certain content areas. To clarify this departure from the CenteringPregnancy curriculum, we named this model OHSU Nurse-Midwifery Group Prenatal Care. Many of the previously noted benefits of group prenatal care have been realized, though a number of issues were identified which might be considered when implementing this model.

Lack of flexibility regarding the timing of prenatal groups has emerged as the primary barrier to accessing group care for our patients. We have experimented with offering group prenatal care visits at a variety of times and weekdays. Late afternoon group prenatal care visits have proven to be the most accessible for patients.. Provider

Latent Labor Hospital Admission: Outcomes and Prevention

preparation time is also different in the group care model. Given the rapid pace of interaction required to assess the basic prenatal information with each woman, most providers need dedicated time to prep charts thoroughly prior to starting group. One benefit, however, is that many of our providers have found charting post group to be easier and less time consuming than with individual care.

Another concern with this model involves the effort required to initiate, administer, and maintain group prenatal care within a clinical space and administrative structure designed for individual care. The first effort that must be made requires either receiving training through The Centering Healthcare Institute or investing the time to create the content and structure of a group prenatal care model if the CenteringPregnancy model is not selected for use. Financial consideration must be evaluated as gaining CenteringPregnancy site approval requires training facilitators (\$700), cost of notebooks (\$22 per woman), and payment for site approval (\$6000). Ongoing tasks include advertising, recruitment, stocking materials for group use and, unless there is a dedicated space for the group sessions, set up and break down of the room. Allocating resources for administrative responsibilities is recommended.

It has also become clear that timing of recruitment and timing of group sessions influences patient perceptions and has additional cost implications as well. Recruiting for group care so that women have no more than eight weeks of waiting prior to starting group care is advised as longer waits may lead to attrition. Continuing group sessions through the end of pregnancy resulted in naturally thinning numbers as women delivered, with fewer women engaged in conversation, less efficient use of provider time, and

Latent Labor Hospital Admission: Outcomes and Prevention

higher prenatal care delivery costs incurred. An informal financial audit within our practice projected that conducting groups with fewer than eight patients per session incurred lost revenue in comparison to revenue generated through devoting the same provider time to individual care. Providers and clinics code and bill for group prenatal care the same as one does for individual care appointments; because group prenatal care provides the same core care that a patient would receive in standard appointments, insurers reimburse with equivalent rates as they do for individual care.

To address these financial issues, our program begins groups between 20 and 22 weeks, includes seven two-hour sessions, and concludes groups by 34 to 38 weeks. Some groups have also scheduled their postpartum reunions at a patient's home, keeping the focus on socializing while freeing up clinic time. When groups are less than eight women, providers in our practice offer individual GYN or new OB appointments immediately before or after the group session to offset lost billing revenue.

Financial evaluation of traditional prenatal care and group prenatal care in a small, rural, critical access hospital was undertaken to understand the economic performance of group prenatal care (41). A cost analysis model was created based on hospital cost, revenue, and obstetric and gynecology volume estimates, applying the CenteringPregnancy format of ten, 2-hour sessions. The authors concluded that when there is adequate obstetric volume and patient interest, there are financial benefits from increased patient capacity and improved efficiency. Moving prenatal care to lower cost CNMs from higher cost physicians increased time efficiency of the group prenatal care model and the capacity for higher revenue gynecology services.

Latent Labor Hospital Admission: Outcomes and Prevention

Medicaid reimbursement at higher levels for CenteringPregnancy has begun in a handful of states and is under evaluation in others. This trend warrants attention as such modifications may begin to shift the financial burden of this model away from individual practices. It remains unclear if this trend will only include clinics with CenteringPregnancy site approval or will encompass other forms of group prenatal care.

Conclusion

Group prenatal care has frequently been perceived as a nurse-midwifery led model of care. Incorporation by physicians has been slower than in the midwifery community. Potential barriers may include provider reluctance to stray from the individual model in which they were trained. One organizational barrier is that most general obstetrician/gynecologists have integrated clinics with both pregnant and non-pregnant patients, and this mix of patients can serve to provide a balance of different kinds of care, interactions, and financial revenue.

Who is group prenatal care 'for'? Group prenatal care holds promise for low-risk women seeking more engagement, more information, and more social connection during pregnancy; for women at high risk for PTB or LBW infants or low breastfeeding rates; for women with risk of unnecessary cesarean delivery; for providers seeking methods to increase quality patient interaction time and work satisfaction. Nurse-midwives in the OHSU practice, in collaboration with maternal-fetal medicine providers, are currently developing a group prenatal care model designed to serve women diagnosed with gestational diabetes. The CHI model for CenteringParenting opens possibilities for transitioning group prenatal care into group well-infant care. The recent Strong Start

Latent Labor Hospital Admission: Outcomes and Prevention

Initiative to decrease preterm births, supported by the U.S. Department of Health and Human Services, is funding studies examining the outcomes of CenteringPregnancy and group prenatal care models across the country. Given national attention to these innovative models, increased data on CenteringPregnancy and group prenatal care can be anticipated.

Where can you get more information?-

www.centeringhealthcare.org

http://www.aafp.org/online/etc/medialib/aafp_org/documents/clinical/pub_health/aim/groupvisits.Par.0001.File.tmp/GroupVisitAIM.pdf

AAFP Policy on Shared Medical Appointments/Group Visits.

<http://www.aafp.org/online/en/home/policy/policies/s/sharedmedapptsgrpvisits.html>

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GroupVisits (Shared Medical Appointments): An AAFP

Resource for Designing Your Practice. <http://www.aafp.org/online/en/home/>

<http://innovations.cms.gov/initiatives/Strong-Start/index.htm>

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Chapter IV

The Influence of Group Versus Individual Prenatal Care on Phase of Labor at Hospital Admission

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This manuscript replaced essential elements of the traditional doctoral methods and results chapters. Ellen Tilden will be the primary author on this paper. She conducted analysis under the supervision of Dr. Lee, and Dr. Lee is the senior author of this paper. This paper will be submitted to the *Journal of Midwifery and Women's Health* which is an indexed and peer-reviewed journal with an impact factor of 1.039. The readership for this journal includes nurses caring for women during their reproductive years, nurse-midwives, family practice physicians, and obstetricians/gynecologists. This manuscript will be ready to submit at the time of dissertation defense.

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Latent Labor Hospital Admission: Outcomes and Prevention

Precis

Latent labor hospital admission is associated with increased cesarean delivery. Women who received group prenatal (vs. standard) care were admitted more frequently in active labor.

Abstract

Background: Group prenatal care, an alternate model of prenatal care delivery, has been associated with various improved perinatal outcomes in comparison to standard, individual prenatal care. One important obstetric process measure that has not been explored in this literature is the phase of labor at hospital admission (latent vs. active), which has been associated with cesarean delivery rates, among women who receive standard prenatal care vs. group prenatal care.

Methods: Utilizing retrospective chart review and data abstraction, a case control study was conducted comparing 150 women who selected group prenatal care with CNMs vs. 225 women who chose standard prenatal care with CNMs. Analysis performed included descriptive statistics to compare groups and multivariate regression to evaluate the contribution of key covariates influencing outcomes. To minimize bias, propensity scores were calculated and included in regression models.

Results: Women within this sample who received group prenatal care were admitted to the hospital with significantly greater cervical dilation (mean (SD) 5.73 (2.49) cm vs. 5.08 (2.28) cm, $P < .005$) and were 73% more likely (OR, 1.73; 95% CI, 1.0-2.9, $P = 0.05$) to be in active labor (≥ 4 cm of cervical dilation) compared with women who received standard prenatal care, controlling for potential confounding variables and propensity for group vs. individual care selection.

Discussion: Group prenatal care may be an effective intervention for decreasing latent labor hospital admission among low-risk women. Further, regression analysis

Latent Labor Hospital Admission: Outcomes and Prevention

showed that neither group prenatal care participation nor higher rates of active labor hospital admission were associated with increased maternal or neonatal morbidity in this sample with relatively low rates of cesarean delivery (primary CS- 5.9%; total CS- 8.8%).

Latent Labor Hospital Admission: Outcomes and Prevention

Keywords: CenteringPregnancy, group prenatal care, prenatal care, latent labor, early labor, cesarean delivery, vaginal delivery, low-risk pregnant women, nurse-midwifery, maternity care

Introduction

Maternity care in the U.S. over the last thirty years has been characterized as a period of increased diagnosis of labor dystocia and arrest,(Zhang, Troendle, & Reddy, 2010) increased use of interventions and procedures, (Martin, Hamilton, & Osterman, 2013; Osterman & Martin, 2011) and a rise in maternal morbidity and mortality(Kassebaum, 2014). Concurrently, cesarean delivery (CD) in the U.S. has more than doubled since 1996 (Podulka, 2011). Though CD can be life-saving, this sharp increase in surgical delivery has not been accompanied by corresponding improvement in maternal or neonatal outcomes (Declercq, 2011) but has instead been accompanied by corresponding increases in maternal morbidity and mortality, (Kassebaum, 2014) worse maternal short (Menacker & Hamilton, 2010) and long term(Silver, 2012) health outcomes, as well as increased costs (Barrett, 2013; Menacker & Hamilton, 2010). There is a need to identify drivers of procedure overuse and levers to decrease these trends.

As a variable strongly associated with higher risk for CD, latent labor hospital admission is one such driver warranting examination. One care model, group prenatal care (GPC), is a novel form of antenatal care which may facilitate decreasing latent labor hospital admission, potentially via increasing labor knowledge (Low & Moffat, 2006) or confidence to cope with labor pain (N. K. Lowe, 1993). We set out to compare phase of labor at admission and mode of delivery outcomes among women who received GPC vs. standard prenatal care. Our intent was twofold; to examine association between prenatal care modality and: 1) rates of latent vs. active labor hospital admission, and 2) rates of vaginal vs. cesarean delivery.

Background

Latent labor hospital admission

Healthy women admitted in latent labor are particularly vulnerable to receiving medical intervention and procedures, without corresponding improvement in perinatal outcomes, when compared to those admitted during the active phase. Research has demonstrated higher utilization of oxytocin augmentation (Bailit et al., 2005; Holmes et al., 2001; McNiven et al., 1998; Rahnama et al., 2006), increased reliance on internal monitoring (Bailit et al., 2005), increased use of epidural anesthesia (Holmes et al., 2001; McNiven et al., 1998), and increased CD (Bailit et al., 2005; Boyle & Reddy, 2012; Davey et al., 2013; Gharoro & Enabudso, 2006; Hemminki & Simukka, 1986; Holmes et al., 2001; Klein et al., 2004; Lundgren et al., 2013; McNiven et al., 1998; Rahnama et al., 2006) among women admitted to the hospital in latent labor as historically defined (Friedman, 1978). Where an association between latent labor hospital admission and CD has not been found (Incerti et al., 2011; O'Driscoll et al., 1993) confounding variables, such as continuous labor support, may mitigate this relationship (Brown et al., 2009; Hodnett et al., 2013). State and national organizations support decreasing latent labor hospital admission as a vital target for reducing unnecessary CD in the U.S. (Spong et al., 2012; Zabari, 2014). Little is understood about how to reach this goal, but prior latent labor investigation suggests that antenatal educational interventions may be more feasible and effective for this purpose than intrapartum interventions (Spiby, Walsh, Green, Crompton, & G., 2014).

Latent Labor Hospital Admission: Outcomes and Prevention

To our knowledge, four experimental studies have explored interventions intended to decrease latent labor hospital admission (Hodnett et al., 2008; Janssen et al., 2006; Lumluk & Kovavisarach, 2011; Maimburg et al., 2010). Of the two trials examining intrapartum interventions, (Hodnett et al., 2008; Janssen et al., 2006) only one study demonstrated that women randomized to receive latent labor nursing care at home (vs. nursing triage by phone) decreased latent labor hospital admission (Janssen et al., 2006). Both trials examining antepartum interventions, including group-based education regarding correct self-diagnosis of latent labor (Lumluk & Kovavisarach, 2011) and group-based prenatal education sessions (Maimburg et al., 2010), demonstrated effectiveness in significantly decreasing latent labor hospital admission. No studies have examined the impact of prenatal care modality on phase of labor at hospital admission or examined antepartum interventions to decrease latent labor admission in a U.S. population. Our study seeks to address these gaps.

Group prenatal care vs. standard prenatal care

The current standard for prenatal care delivery involves individual appointments between one pregnant woman and one obstetric provider (Moos, 2006). GPC is an alternate model for prenatal care delivery; first piloted in 1993, 'CenteringPregnancy' was the first and is the currently dominant form of GPC (Schindler-Rising, 2004). CenteringPregnancy and similar GPC models have been associated with a range of improved perinatal outcomes; most consistently with decreased preterm birth, decreased low birth weight, improved knowledge and satisfaction, and improved breastfeeding outcomes (Ruiz-Mirazo, Lopez-Yarto, & McDonald, 2012; Sheeder, Weber Yorga, &

Latent Labor Hospital Admission: Outcomes and Prevention

Kabir-Greher, 2012). One RCT and one prospective cohort study found an association between GPC and decreased risk for CD (Barr et al., 2011; Jafari et al., 2010).

Purpose

The primary purpose of this study was to compare phase of labor at hospital admission and explore mode of delivery as a function of prenatal care model among a sample of medically low-risk women enrolled in one U.S. CNM practice. Because changes to maternity care practices seek non-inferior or improved morbidity outcomes, we also examined standard measures of morbidity for both mothers (e.g., estimated blood loss) and neonates (e.g., Apgar scores).

Methods

Sample, Setting, and Practitioners

Following approval by the Oregon Health & Science University Investigational Review Board, cases and controls were selected using a de-identified data set. The sample ($n = 375$) consisted of pregnant women who self-selected to receive care from the nurse-midwifery practice at a large, university hospital in the Pacific Northwest of the U.S. The practice was established in 1975 and currently includes 11 certified nurse-midwives (CNM) providing full-scope care. In this practice, CNMs standardly directly assess women in labor via phone or in triage. All antenatal care was provided at a large, outpatient clinical facility associated with and abutting the hospital where intrapartum care was provided.

Nurse-midwives in this practice care only for patients meeting criteria as low to moderate risk, defined by practice guidelines negotiated between CNM, OB, and MFM

Latent Labor Hospital Admission: Outcomes and Prevention

clinical leaders. For example, the CNM service cares for women with gestational diabetes who maintain good glycemic control via diet and exercise while those who require pharmaceutical support are transferred to obstetric or perinatal care. Due to these clinical guidelines, all subjects included in this study were low to moderate risk. To create better balance between samples, common comorbidities were noted and controlled for during analysis. Women were included in this study if they received care between 2009 and 2014, met the nurse-midwifery care risk-criteria, received a minimum of 6 prenatal appointments with the CNM practice (a minimum of 4 group prenatal care appointments was defined as adequate to meet criteria for inclusion as a case), intended vaginal delivery, and were admitted under the CNM service in spontaneous, term labor and received cervical examination at hospital admission.

Data Collection

Data were collected by merging information obtained via electronic medical record (EMR) data field download with information obtained via chart abstraction. Chart review was used to confirm data extracted from the EMR and also to gather variables that could not be obtained through EMR abstraction. Out of the sample of 532 nurse-midwifery patients who received GPC, 150 cases met inclusion criteria and were sequentially selected. Out of a sample of 2880 nurse-midwifery patients who received standard prenatal care in this same timeframe, we randomly selected 225 controls to achieve a case-to-control ratio of 1:1.5 to facilitate propensity score scoring and effectively test for differences in effectiveness. Power analysis was based on averaged results of two U.S. studies reporting frequency of latent labor hospital admission among

Latent Labor Hospital Admission: Outcomes and Prevention

low-risk women (44.5%) and the overall CNM CD rate in 2012 (15.2%) (Hodnett et al., 2008; Jackson et al., 2003). Given these background event rates, assuming an alpha of 0.05, a beta of 80%, and a sample size of 375, this study was powered to detect an odds ratio of 1.35 for latent labor presentation and an odds ratio of 1.55 for CD between groups. Because morbidity events are rare, this study was underpowered to reach final conclusions about model of prenatal care and morbidity.

Prenatal Care Model

The GPC model examined in this study bears many similarities to published descriptions of CenteringPregnancy but does not utilize CenteringPregnancy materials and has not undergone site assessment. Similarities include many of the essential elements of CenteringPregnancy (Table 1).

Latent Labor Hospital Admission: Outcomes and Prevention

Table 1

Essential Elements of CenteringPregnancy³⁵
Health assessment occurs within the group space
Women are involved in self-care activities
A facilitative leadership style is used
Each session has an overall plan
Attention is given to the core content; emphasis may vary
There is stability of group leadership
Group conduct honors the contribution of each member
The group is conducted in a circle
Group composition is stable, but not rigid
Group size is optimal to promote the process
Involvement of family support people is optional
Opportunity for socializing within the group is provided
There is ongoing evaluation of outcomes

Key distinctions between the GPC model in this study and CenteringPregnancy include fewer group prenatal sessions (7 vs. 10), differing curriculums and patient materials (Table 2), group discussions occur around a table and may not always form a circle, and no game-based interactions. It is uncertain if this model meets CenteringPregnancy standards for facilitative leadership style; however, the investigated GPC model strives to conduct care in a manner encouraging participant engagement and responsive to patient inquiry, initiative, and direction.

Latent Labor Hospital Admission: Outcomes and Prevention

Table 2

Prenatal Care, Timing and Topics			
<u>Group Prenatal Care Session</u>	<u>Individual Prenatal Care</u>	<u>Gestational age range</u>	<u>Group Prenatal Care Discussion Topics</u>
<i>This visit is individual care</i>	Initial individual visit (30-60 minutes)	8-15 weeks	<i>Discussion:</i> Developing fetus, genetic screening options, self-care and nutrition during pregnancy, pregnancy dating
1 (2 hours for each session)	Return individual visit (10-20 minutes for each return visit)	18-22 weeks	<i>Discussion:</i> Nutrition, exercise, weight gain
2	Return individual visit	26-30 weeks	<i>Discussion:</i> Fear, strength and coping skills
3	Return individual visit	28-32 weeks	<i>Discussion:</i> Pain vs. suffering in labor, coping with both
4	Return individual visit	30-34 weeks	<i>Discussion:</i> Latent labor, identifying latent v. active phase, and the processes of normal, physiologic labor
5	Return individual visit	32-36 weeks	<i>Discussion:</i> Active labor, birth, and delivery of the placenta
6	Return individual visit	34-38 weeks	<i>Discussion:</i> Newborn procedures and options, breastfeeding, contraception
7	Return individual visit	36-40 weeks	<i>Discussion:</i> Adjustment to parenthood, postpartum depression
<i>This visit is individual care</i>	Postpartum standard visit	2 weeks postpartum	Screening for postpartum depression. Breastfeeding and adjustment to mothering
<i>This visit is individual care</i>	Postpartum standard visit	6 weeks postpartum	Full physical, screening for postpartum depression, breastfeeding assessment, contraception selection
8 (optional; organized by group participants)		1-3 months postpartum	Social gathering outside of clinic

Analysis

Characteristics of women in the sample were calculated and initial descriptive statistics included measures of central tendency and comparison of raw outcomes based on treatment exposure (Table 3). Using Fisher's exact test for categorical variables and independent samples t-test for continuous variables, association between each

Latent Labor Hospital Admission: Outcomes and Prevention

independent variable and each dependent variable were assessed. Significance for all outcomes was defined as a P value equal to or less than 0.05. Multivariate and logistic regression analysis was performed to assess the strength and direction of the effect of the independent variables on the dependent variables. Based on guidance from clinical experts and a thorough review of the literature, covariates likely to modify relationships between key variables of interest were controlled in multivariate modeling. Propensity score analysis has been well-established as a technique to adjust for confounding in non-experimental studies (Shah, Laupacis, Hux, & Austin, 2005). To balance for participant's propensity to choose group or individual prenatal care, propensity scores were calculated and included in regression estimates. All analyses were performed utilizing Stata 13 (StataCorp LLC, College Station, TX).

Results

The women in the sample (n=375) were predominantly Caucasian, non-Hispanic, partnered or married, and educated. There were no significant demographics, antepartum health-related, or intrapartum events differences when comparing women who selected GPC and those who selected standard care (Table 3). A greater proportion of nulliparous women, however, were in the GPC model as compared to the standard care group (77.6% nulliparous women in GPC vs. 44.4% nulliparous women in standard care, $P<.001$).

Latent Labor Hospital Admission: Outcomes and Prevention

Table 3

Demographics and Outcomes of Women Receiving Prenatal Care (n=375)				
	Total (n=375)	Group Prenatal Care (n= 150)	Individual Prenatal Care (n= 225)	<i>P</i> - value
<i>Demographic</i>				
Caucasian	371 (91.6)	138 (93. 2)	202 (90.5)	.37
Non-Hispanic	371 (95.6)	145 (97. 3)	210 (94.5)	.21
Married or Partnered	369 (94.8)	144 (96.0)	206 (94.0)	.41
Age at Delivery	374 (31.3)	150 (31.2)	224 (31.4)	.51
Years of Educations	257 (16.6)	111 (16.8)	146 (16.4)	.32
<i>Health-related</i>				
Nulliparous	375 (57.3)	115 (76.6)	100 (44.4)	< .001
Comorbidities ^a	375 (41.3)	64 (42.6)	91 (40.4)	.67
BMI in first trimester	290 (24.3)	121 (24.3)	169 (24.3)	.93
Total pregnancy weight gain (kg)	309 (13.7)	127 (13.9)	182 (13.6)	.59
Intending VBAC	375 (12.5)	15 (10.0)	32 (14.2)	.23
Gestational Age at delivery (weeks)	372 (39.7)	150 (39.7)	222 (39.6)	.36
Epidural	375 (31.7)	42 (28.0)	77 (34.2)	.22
Augmentation of labor	375 (25.6)	38 (23.0)	58 (25.7)	1.0
Infant birth weight (g)	371 (3560)	147 (3533)	224 (3578)	.28
<i>Outcomes</i>				
Cervix at admission (cm)	375 (5.3)	150 (5.7)	225 (5.1)	.01
Active labor at admission	374 (73.8)	150 (80.0)	225 (69.8)	.03
Vaginal Delivery	375 (91.2)	150 (90.0)	225 (92.0)	.58
Estimated Maternal Blood Loss (cc)	368 (428.7)	148 (418.5)	220 (435.6)	.59
Days Inpatient	376 (2.1)	147 (2.2)	220 (2.0)	.04
Neonatal Intensive Care Unit Admission	363 (.05)	13 (.09)	8 (.04)	.04
APGAR 1 minute	367 (7.8)	149 (7.9)	218 (7.9)	.92
APGAR 5 minutes	368 (8.8)	150 (8.8)	218 (8.9)	.20

^a Composite for these comorbidities: gestational diabetes, preeclampsia, hypertension, group beta strep vaginal/rectal or urine culture positive, genital herpes, history of cesarean delivery

Multivariate Analysis including propensity scores**Effectiveness.**

Women who received GPC had greater cervical dilation upon admission compared with women who received standard prenatal care (unadjusted mean (SD) = 5.73 (2.49) vs. 5.08 (2.28) cm, $P < .001$), even after controlling for covariates and propensity scores ($\beta = 0.77$ cm \pm 0.27 cm; $t = 2.85$; $P = .005$) (Table 4). Similarly, women receiving GPC were 73% more likely to be admitted to the hospital during active labor (cervical dilation ≥ 4 cm) than those who received standard care (OR = 1.73, 95% CI = 1.03-2.99, $P = .05$) (Table 5).

Table 4

Determinants of Cervical Dilation (cms) at Hospital Admission				
	β	SE	t	<i>P</i> -value
Comorbidities	-0.13	0.26	-0.51	.61
Premature rupture of membranes (PROM)	-1.12	0.73	-1.54	.12
Nulliparous	-1.46	0.79	-1.86	.06
Maternal age at delivery	-0.02	0.03	-0.66	.51
Gestational age at delivery	-0.32	0.12	-2.60	.01
Participation in group prenatal care	0.77	0.27	2.85	.005

$R^2 = 0.04$, $F(7, 351) = 3.01$, $P = 0.004$
Mean VIF = 3.57

Table 5

Determinants of Active Labor Hospital Admission	
	Adjusted Odds Ratio (95% CI), <i>P</i> -value
Comorbidities	1.02 (0.62-1.71), .92
Premature rupture of membranes (PROM)	0.24 (0.07-0.89), .03
Nulliparous	0.22 (0.05-0.91), .04
Maternal age at delivery	0.98 (0.92-1.04) .53
Gestational age at delivery	0.71 (0.55-0.91) .01
Participation in group prenatal care	1.73 (1.03-2.99), .05

Model $\chi^2 = 19.77$, $p < 0.010$; McFadden's $R^2 = 0.05$;
Correct classification rate = 75.21%; ROC AUC = 0.63

Safety.

We observed a 91.2% vaginal delivery rate, with a 5.9% (n=22) primary CD rate and an 8.8% (n=33) total CD rate, in this predominantly nulliparous sample. There were no significant differences in CD rates between women who received GPC (90% vaginal birth (n = 150)) and those who received standard prenatal care (92% vaginal birth (n = 225)) (Tables 5 and 6). Moreover, there were no significant differences between groups regarding maternal length of hospital stay ($\beta = 0.14 \pm 0.09$; $t = 1.53$; $P = 0.13$), maternal estimated blood loss, ($\beta = -28.67 \pm 34.88$; $t = -0.82$; $P = 0.41$), neonatal intensive care unit admission (OR = 2.42, 95% CI = 0.69-8.46, $P = 0.17$), Apgar scores at 1 minute ($\beta = -0.03 \pm 0.20$; $t = -0.14$; $P = 0.89$) or APGARS at 5 minutes ($\beta = -0.09 \pm 0.07$; $t = -1.29$; $P = 0.19$).

Table 6

Determinants of Cesarean Delivery	Adjusted Odds Ratio (95% CI), <i>P</i> -value
Comorbidities	1.81 (0.48-6.81), .38
Body Mass Index	0.99 (0.88-1.11), .82
Total Pregnancy Weight Gain	0.99 (0.88-1.11), .87
Vaginal Trial of Labor	0.04 (0.00-0.47), .01
Gestational Diabetes	0.46 (0.07-3.09), .42
Epidural	0.21 (0.06-0.76), .02
Birth Weight	0.99 (0.99-1.00), .73
Augmentation of Labor	0.30 (0.93-0.98), .05
Premature rupture of membranes (PROM)	0.31 (0.02-4.46), .39
Nulliparous	2.69 (0.03-277.85), .68
Maternal age at delivery	0.96 (0.83-1.11) .59
Gestational age at delivery	0.81 (0.46-1.43) .47
Participation in group prenatal care	1.26 (0.41-3.77), .70
Model $\chi^2 = 47.93$, $P < 0.001$; McFadden's $R^2 = 0.3$; Correct classification rate = 92%; ROC AUC = 0.87	

Discussion

We found that women who chose and received GPC provided by CNMs in a U.S. university practice were significantly more likely to be admitted to the hospital in active labor and nearly 1 cm further dilated at hospital admission than women who received standard prenatal care in the same practice. These findings held true despite the larger proportion of nulliparous women in the GPC sample.

GPC mechanism of action

Our findings raise questions regarding why women who received GPC in this sample were more frequently admitted in active labor.

Knowledge and Expectations.

One possible mechanism of action relates to the increased time for education and discussion inherent with GPC. It is possible that these elements of GPC enable pregnant women to garner greater knowledge regarding physiologic labor and that this elevated knowledge either facilitates more accurate identification of the optimal time to present at the hospital or understanding of how to manage latent labor at home. A survey of women presenting to the hospital in latent labor showed that 66% of this sample would have been more satisfied if their care had enhanced knowledge regarding increasing comfort with latent labor symptoms at home (Hosek, Faucher, Lankford, & Alexander, 2014). The GPC model may also help women develop more realistic labor expectations than standard prenatal care, better preparing them to remain at home until active labor. Childbirth satisfaction has also been significantly associated with women's perceptions that their birth experiences matched their expectations (Christiaens & Bracke, 2007). If GPC better prepares women to cope with labor at home, through increased knowledge or the development of more realistic expectations, it is possible that GPC may decrease latent labor hospital admission while also improving maternal satisfaction.

Childbirth Self-Efficacy.

Another mechanism of action which might explain our findings is that women who participate in GPC may develop a higher capacity to cope confidently (or higher childbirth self-efficacy) with latent labor symptoms, enabling them to confidently experience latent labor in a non-clinical setting. If these findings are replicated, future research would benefit from exploring childbirth self-efficacy as both a theoretical framework and a variable modifying timing of hospital admission (N. K. Lowe, 1993).

Clinical significance and Practice Implications

Our findings suggest that GPC may successfully decrease latent labor hospital admission among low-risk women and, therefore, decrease the interventions, procedures, and resource expenditures associated with latent labor hospital admission among this population. The unexpectedly low CD rate in our study prevented our capacity to draw conclusions regarding the effect of GPC on mode of delivery outcomes. In healthcare systems with greater latent labor healthcare expenditures, higher CD rates, or populations frequently requesting latent labor admission, our findings may be especially clinically meaningful.

Women's experiences and preferences.

Presenting to the hospital believing that one is in 'active labor' when one is in latent phase has been associated with negative consequences such as anxiety (Barnett, Hundley, Cheyne, & Kane, 2008) and disappointment (Low & Moffat, 2006).

Additionally, there is evidence that women admitted in latent labor perceive that they are

Latent Labor Hospital Admission: Outcomes and Prevention

'handing over responsibility' for their labor, potentially undermining confidence (Carlsson, Hallberg, & Odberg Pettersson, 2009). Accumulated evidence also suggests that excess anxiety may disrupt physiologic labor progress (Buckley, 2015). For these reasons an effective early labor care system must not only successfully delay hospital admission until active labor but must also provide women with the information and skills necessary to cope well with latent labor in a non-clinical setting (Marowitz, 2014). Our findings suggest women could benefit from prenatal care models with the potential to increase knowledge or confidence during latent labor. This differs from the risk-assessment focus characterizing standard prenatal care. Future exploration of GPC clinical significance may be optimally considered within health promotion frameworks which recommend closer scrutiny of factors supporting well-being (Antonovsky, 1996).

Contemporary phase of labor definitions.

Clinical significance of these findings must also be considered in light of mounting evidence recommending revised definition of active labor onset (Neal et al., 2014; Neal, Lowe, Ahijevych, et al., 2010; Neal, Lowe, Patrick, et al., 2010; Zhang, Landy, et al., 2010; Zhang et al., 2002). While the purpose of this study was shaped by a research base using traditional phase of labor definitions, findings remain relevant to the proposed contemporary definition of latent labor for two reasons: 1) results suggest that GPC is an intervention with greater efficacy than standard care for helping women present to the hospital closer to the contemporarily defined onset of active labor; and 2) while clinical guidelines based on contemporary phase of labor definitions are emerging, there has been no known exploration of how women may be appropriately prepared to

Latent Labor Hospital Admission: Outcomes and Prevention

present to the hospital in tandem with new clinical targets. Given evidence that many women seek hospital admission prior to more conservatively (< 4 cm) defined latent labor (Bailit et al., 2005; Holmes et al., 2001; Jackson et al., 2003; Neal et al., 2014; Rahnama et al., 2006), and challenges encountered with modifying early labor services (Spiby, Green, Richardson-Foster, & Hucknall, 2013), delaying admission until further along the labor trajectory may prove a difficult goal to reach. Our findings propose that GPC be explored as one safe, feasible, and cost-equivalent vehicle with potential to reach this goal while also seeking women's positive childbearing experiences and satisfaction.

Limitations

Several limitations of this study merit consideration. One important factor that we were unable to systematically assess was the presence of doulas during labor which may have confounded our findings (Hodnett et al., 2013). Because the investigated practice setting encourages doula involvement for all women and demographics showed no significant differences in years of education, impact of this potential bias is likely minimal. This study was also unable to control for childbirth education; women who chose GPC may have more frequently attended childbirth education classes, potentially increasing knowledge, skills, or confidence. Because the majority of women in this CNM practice complete childbirth education classes this potential confounder is also unlikely. Further, this study was neither able to systematically assess patient calls to the attending CNM during labor nor how frequently or for how long patients were triaged before hospital admission. These will be important variables to assess in future prospective studies.

Latent Labor Hospital Admission: Outcomes and Prevention

While it is a limitation that findings can only be extrapolated to women selecting and receiving CNM care, the choice to only include patients meeting these criteria is also a strength as many factors apart from the model of antepartum care were better controlled with this study design. And though providers were not blinded, it is likely that the triaging or admitting CNM was often unaware of prenatal care modality while engaging women during latent labor. As well, much of the care was provided in years preceding this study, further reducing the likelihood of provider bias with latent labor care practices.

Other important limitations relate to study design. Retrospective and observational studies are unable to generate treatment effect estimations equal to those generated by experimental design. As well, women self-selected to mode of prenatal care, thus creating the possibility of selection bias. It is conceivable that women who self-select to GPC could have capacities enabling them to labor longer at home than women who self-select to individual care. Concern regarding these limitations may be mitigated by the study's moderate sample size and the application of advanced statistical techniques for enhancing balance in non-randomized samples. It should also be noted that regression models explained relatively low variance, reflecting the burgeoning nature of this area of inquiry. Lastly, the low CD rates found in this sample make this study underpowered to draw conclusions about GPC and mode of delivery. Even with these limitations, this study analyzes a key health systems variable, latent labor admission, which is a target with strong potential for improving quality and reducing cost in U.S. maternity care and also adds to the GPC evidence base.

Directions for future research

Future research will strengthen understanding through utilizing samples which are more reflective of broader U.S. populations and settings, such as more racially and socially diverse samples and settings with higher primary and total cesarean rates. It will also be important for future research to explore maximizing GPC's opportunities to best reach the goal of increasing active labor hospital admission. The GPC model examined for this study recommended one hour of discussion regarding latent labor. Future study may seek to increase time devoted to this content or attempt shorter but repeated information exposure. Benefit may also arise from closer examination of other GPC aspects, such as social exchange. For example, pregnant women exposed to peers who successfully entered the hospital in active labor may find greater capacity to do the same. Prospective trials may also elucidate if the relationship between various models of prenatal care and perinatal outcomes are modified by factors such as women's fear of labor (Adams, Eberhard-Gran, & Eskild, 2012) and birth-anxiety (Sieber, Germann, Barbir, & Ehlert, 2006), or women's childbirth self-efficacy (N. K. Lowe, 1993) and sense of preparedness and resilience (Churchill & Davis, 2010).

Conclusion

This study adds to the growing GPC literature. We shed light on a new aspect of GPC, finding that participation in this model of prenatal care was associated with higher rates of active labor hospital admission and higher cervical dilation at admission. In conjunction with prior evidence suggesting that antepartum (vs. intrapartum) interventions may be more feasible and are more successful in preventing latent labor

Latent Labor Hospital Admission: Outcomes and Prevention

hospital admission, our findings recommend further examination of GPC as one intervention with promise for safely decreasing maternity interventions and procedures while enhancing women's childbearing experiences and satisfaction.

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Latent Labor Hospital Admission: Outcomes and Prevention

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Chapter V

Childbirth Self-Efficacy to Conceptualize Group Prenatal Care

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This manuscript replaced aspects of the traditional conceptual/theoretical framework of the traditional dissertation. Ellen Tilden is the primary author on this paper and completed literature review and synthesis under the direction of Dr. Emeis who is the senior author on this paper. This paper will be submitted to the *Journal of Obstetric, Gynecologic, and Neonatal Nursing (JOGGN)*. The readership of this journal includes nurses caring for women during their reproductive years, nurse-midwives, family practice physicians, and obstetricians/gynecologists and has an impact factor of 1.195. This manuscript will be nearing submission at the time of dissertation defense.

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Abstract

Objective: To utilize knowledge from an integrative review of the quantitative childbirth self-efficacy literature to assess childbirth self-efficacy as a potential theoretical framework for conceptualizing how group prenatal care is associated with improved perinatal outcomes.

Data sources: MEDLINE (1946) and CINAHL data bases were searched using the keywords ‘self-efficacy,’ and ‘childbirth,’ or ‘birth,’ or ‘pregnancy/pregnan*,’ or ‘labor,’ or ‘labour,’ or ‘perinatal,’ or ‘postpartum.’ All years available up to 3/2015 were included in this search. 615 abstracts and 89 full-text articles were reviewed yielding 23 articles for this integrative review.

Study selection: All articles which met the following criteria were included: 1) the study utilized a tool explicitly created to measure childbirth self-efficacy, 2) the outcome variables fell within the perinatal period, 3) English publications, 4) in peer-reviewed journals, and 5) the study was intended for outcomes research, not translation and psychometric testing. Because this review was designed to evaluate all English language literature which measures childbirth self-efficacy and the perinatal period encompasses multiple phenomenon, this literature includes studies with a narrower range of independent variables (e.g., childbirth self-efficacy scores) and a wider range of dependent variables (e.g., labor pain scores, intention to attempt vaginal birth, parenting self-efficacy)

Data extraction: Data extracted from each article included first author, year of publication, country in which study was conducted, study design, sample size,

Latent Labor Hospital Admission: Outcomes and Prevention

recruitment, attrition, parity, race, married or partnered, level of education, level of annual income, intervention, outcomes.

Conclusions: Childbirth self-efficacy is a theoretical framework which may be relevant for deepening understanding of the group prenatal care model. Recommended areas for future research include evaluation of childbirth self-efficacy scores among women receiving group prenatal care and correlation between childbirth self-efficacy scores and perinatal outcomes, particularly phase of labor at hospital admission, mode of delivery, maternal satisfaction, and breastfeeding. Childbirth self-efficacy may be a core, but is likely not the singular, theoretical framework for conceptualizing group prenatal care.

Introduction

Prenatal care

The purpose of prenatal care is education, risk assessment, and support during pregnancy with the goal of optimizing maternal and neonatal outcomes (Rosen, Merkatz, & Hill, 1991). Prenatal care may also be a time of untapped potential as this is frequently the most interaction healthy women in the U.S. have with the medical system, creating an opportunity to improve both a woman's and her child's health. The current dominant prenatal care model in the U.S. standardly involves relatively brief exchange between one provider and one patient and has not been shown to consistently improve perinatal outcomes (Moos, 2006). As well, it is unclear if this dominant, individual prenatal care system enables realization of Institute of Medicine goals; these goals include a free flow of information or the patient as a source of control (Richardson, 2001).

Group Prenatal Care

One alternative prenatal care model is group prenatal care (GPC). GPC restructures several aspects of the standard prenatal care model including significantly increased time and interaction between pregnant women and providers, encouragement for social exchange between pregnant women, and stimulation of more patient engagement in prenatal self-care and labor preparation (Schindler-Rising, 2004). As well, while GPC shifts many aspects of care delivery, visits are currently billed and reimbursed the same as standard prenatal care, important when assessing cost-effectiveness and feasibility (Mooney, Russell, Prairie, Savage, & Weeks, 2008).

Latent Labor Hospital Admission: Outcomes and Prevention

The first known GPC model is CenteringPregnancy, which remains the dominant U.S. GPC model at this time (Schindler-Rising, 2004). When compared with standard prenatal care, GPC and CenteringPregnancy have been associated with a number of improved outcomes. Importantly, GPC has been associated with decreased preterm birth, decreased low birth weight, improved breast-feeding, and higher patient satisfaction. (Manant & Dodgson, 2011; Ruiz-Mirazo et al., 2012). Two studies have shown significantly decreased rates of cesarean delivery associated with GPC (Barr et al., 2011; Jafari et al., 2010). For all of these reasons, the group care model may more successfully embody the high-quality/high-value vision for optimal U.S. maternity care identified by Childbirth Connection (Carter, Corry, Delbanco, Foster, & Friedland, 2010) and may also be poised to better realize the Triple Aim (Berwick et al., 2008).

Review of the GPC literature reveals that investigation of this intervention moved relatively rapidly from initial descriptive and pilot studies to experimental and quasi-experimental study design. This line of research has predominantly addressed the first order question ‘is GPC an effective intervention?’ Perhaps particularly stimulated through association with dramatically improved preterm birth outcomes in adequately powered studies utilizing experimental and quasi-experimental design (Barr et al., 2011; Ickovics et al., 2007; Picklesimer, Billings, & Hale, 2012), the GPC literature essentially jumped from exploratory efforts to causal effects estimation.

Group Prenatal Care: How Does It Work?

Clearly this line of research is essential to understanding how GPC is an efficacious intervention and thus an intervention worthy of closer scrutiny and continued outcomes research. Importantly, however, the consistency of evidence showing that GPC is associated with improved outcomes asks the second order question 'how does GPC improve outcomes'? This second order question may be approached with the goal of identifying theoretical constructs which can successfully support investigation regarding how GPC may be affecting perinatal outcomes. Well applied theory can offer conceptualization of how an intervention may be functioning and, in this way, help investigators develop the most pertinent research questions and hypotheses (Smith & Liehr, 2008; Walker & Avant, 2005).

Developing knowledge regarding GPC theoretical constructs is important for several reasons. For example, increasing understanding of this intervention may identify which elements of the GPC model are most strongly associated with better outcomes. This would enable model evolution so that greater emphasis is placed on the most beneficial GPC elements. Also essential, GPC is a model which has predominantly been offered to medically low-risk women (Ruiz-Mirazo et al., 2012). If identification of optimal theoretical framework is achieved, this knowledge may enable offering high-risk pregnant women the most effective elements of GPC within a prenatal care structure of increased medical surveillance.

Purpose

Uncertainty regarding theoretical constructs has been noted as an important gap in the GPC literature (Sheeder et al., 2012). The intent of this manuscript is to explore childbirth self-efficacy as a potential theoretical framework for GPC. This paper provides two distinct but overlapping focuses. First, it offers an integrative review of the literature regarding the impact of childbirth self-efficacy on perinatal outcomes. The applicability of integrative review results will be considered for informing future GPC research. Secondly, these results will be an entry point to examine the strengths and weaknesses of using the childbirth self-efficacy theoretical framework to understand the relationship between the GPC model and perinatal outcomes.

Childbirth Self-Efficacy

Self-efficacy is a concept widely utilized in framing and predicting health behavior (Lenz, 2002) and with preliminary promise for explaining perinatal fear (Bandura, 2004) and anxiety (Khorsandi, 2008). Originally proposed by Bandura (1977), self-efficacy is defined as both the belief that one can successfully accomplish a task (efficacy expectancies) and one's estimation that if the task is accomplished it will lead to specific outcomes (outcome expectancies). Self-efficacy is proposed to be domain specific, which is defined as pertaining to a particular area, and to emerge from four sources: a) performance accomplishments, b) vicarious experience, c) verbal persuasion, and d) emotional arousal (Bandura 1977).

Based on seminal research applying self-efficacy theory to understanding perinatal phenomenon and outcomes (N. Lowe, 1993; Manning & Wright, 1983),

Latent Labor Hospital Admission: Outcomes and Prevention

childbirth self-efficacy has been defined as confidence in one's ability to cope during labor (N. K. Lowe, 1993). Childbirth self-efficacy is a psychosocial variable which has been important for improving understanding regarding how antenatal interventions improve several perinatal outcomes (Ip, Tang, & Goggins, 2009; Vasegh Rahimparvar, Hamzehkhani, Geranmayeh, & Rahimi, 2012). Additionally, this theory is important to explore because it is a framework which has a potential conceptual fit in relation to the GPC model. Specifically, GPC is a model which seeks to improve individual perinatal outcomes and focuses on a period of preparation (pregnancy); this meshes well with self-efficacy's emphasis on the process of an individual drawing from the four sources of self-efficacy to modify their efficacy and outcome expectancies in preparation for enacting a task.

It is plausible that women who utilize GPC may end pregnancy with increased childbirth self-efficacy. Two GPC studies explored the childbirth self-efficacy framework; however, incomplete reporting of findings (Ford et al., 2001) and concerns for sample cross-contamination (Kennedy et al., 2011) challenge interpretation of results.

Important differences between GPC and individual prenatal care are logical to explore when seeking to understand how GPC may be modifying outcomes. Three of the most prominent differences between these two models of care will be considered in relation to childbirth self-efficacy. First, increased time engaged with perinatal content and discussion may lead to increased patient knowledge. There is evidence associating GPC and increased prenatal knowledge in two studies (Baldwin, 2006; Ickovics et al.,

Latent Labor Hospital Admission: Outcomes and Prevention

2007). Enhanced knowledge regarding events of pregnancy or birth may facilitate women's confidence in her capacity to cope when approaching labor.

Second, facilitative style and high participant involvement may be an important element of GPC. Early work seeking to conceptualize the effects of GPC examined the association between two forms of fidelity (process vs. content) to the CenteringPregnancy model, finding that groups in which participants ($n = 519$) were more involved and leaders more frequently utilized facilitative style (process fidelity) were at significantly lower risk for preterm birth ($p = 0.001$) than groups in which participants were less involved and leaders did not emphasize facilitative style (Novick et al., 2013). Groups in which recommended CenteringPregnancy content was reviewed (content fidelity) did not show the same reduction in preterm birth rates. Women participating in GPC with leaders who more frequently solicit their direction and engagement may experience increased confidence and childbirth self-efficacy from these exchanges. It is also possible that these two GPC elements catalyze each other, so that increased time and increased knowledge work synergistically with facilitative style and high patient involvement to increase maternal confidence to cope.

It is also plausible that social aspects of the GPC model account for its effects. Perhaps pregnant women who share prenatal care develop an enhanced perception of social support or perhaps women in groups who deliver prior to their peers and, subsequently, share about their experiences serve as peer mentors, guiding others in their group through example. It is possible that these kinds of peer support enhance pregnant women's confidence to cope with childbirth. In one pilot study, 80% ($n=28$) of the

Latent Labor Hospital Admission: Outcomes and Prevention

women who received GPC remained in contact at 6 months postpartum and visited with each other on average 2.4 times monthly while 25% (n=10) of the women who had a sham intervention (parenting classes) remained in contact at 6 months postpartum and visited with each other on average 1.6 times per month (Wedin, Molin, & Crang Svalenius, 2010). This study suggests that social components of GPC may be important for understanding this model. Of note, social support has also been found to function synergistically with self-efficacy, leading to significantly improved outcomes when both social support and self-efficacy measures are elevated (Fernandez, Warner, Knoll, Montenegro, & Schwarzer, 2015; Warner et al., 2011).

While more difficult to envision how higher confidence to cope with labor may be leading to noted association between GPC and decreased preterm birth or low birth weight, there is a more plausible link between childbirth self-efficacy and other outcomes associated with GPC. These include: decreased cesarean delivery, decreased latent labor hospital admission, increased maternal satisfaction, and improved breastfeeding outcomes (Ruiz-Mirazo et al., 2012). For all of these reasons, an integrative review of the childbirth self-efficacy literature was conducted.

Integrative Review of Perinatal Outcomes Studies Measuring Childbirth Self-Efficacy

Methods

Integrative review search.

MEDLINE (1946) and CINAHL data bases were searched using the keywords 'self-efficacy,' and 'childbirth,' or 'birth,' or 'pregnancy/pregnan*,' or 'labor,' or 'labour,' or 'perinatal,' or 'postpartum' yielding 608 articles. Seven additional publications were identified through three review articles. Abstracts were reviewed for all 615 articles and, of these, 85 full-text articles were reviewed yielding 19 articles. All articles which met the following criteria were included: 1) the study utilized a tool explicitly intended to measure childbirth self-efficacy, 2) the outcome variables fell within the perinatal period, 3) English publications, 4) in peer-reviewed journals, and 5) the study was intended for outcomes research, not translation and psychometric testing. It should be noted that because this review was designed to evaluate all English language literature which measures childbirth self-efficacy and the perinatal period encompasses multiple phenomenon, this literature includes studies with a narrower range of independent variables (e.g., childbirth self-efficacy scores) and a wider range of dependent variables (e.g., labor pain scores, intention to attempt vaginal birth, parenting self-efficacy). After identification of all measures utilized to quantify childbirth self-efficacy within the original 19 articles, Scopus and Google Scholar data bases were searched for publications referencing the identified childbirth self-efficacy measures,

Latent Labor Hospital Admission: Outcomes and Prevention

yielding one additional article. A review of citations of these 20 publications identified three further articles for a total of 23 articles meeting inclusion criteria for this review.

Integrative Review of the Literature

Theory, capacities, measurement.

Several important patterns emerged from this integrative review. One involved the overall consistency with which childbirth self-efficacy theory is defined and referenced (with the majority citing Bandura or one of two scientists whose work is framed by Bandura: Lederman and Lowe). Also important within this pattern is how childbirth self-efficacy has been measured. More than half of the studies utilized the Childbirth Self-Efficacy Inventory (CBSEI) (N. Lowe, 1993).

The CBSEI is a 62 item, 10-point Likert scale with four subscales: two for efficacy expectations and two for outcome expectations. The Cronbach's alpha for subscales range from .86-.95. Content validity was assessed through a content analysis of interviews with 48 postpartum women regarding coping during labor, yielding 56 items rated by four PhD trained content experts and two clinical experts, then honed to 33 items. Eliminating conceptual redundancies reduced the items to 20. Construct validity was evaluated through comparison of CBSEI scores with scores for Generalized Self-Efficacy, Internal and Other Locus of Control, and Helplessness. All hypothesized convergent and divergent relationships were consistent in the expected directions except Other Locus of Control. Multiple replication studies in a variety of populations have

Latent Labor Hospital Admission: Outcomes and Prevention

confirmed reliability and validity of this instrument, e.g. (Cunqueiro, 2009; Gao, Ip, & Sun, 2011; Sinclair & O'Boyle, 1999).

Of the articles which do not utilize the CBSEI, seven studies utilize investigator developed childbirth self-efficacy measurement tools, defined as tools developed for a study. Of these, two report childbirth self-efficacy measures with acceptable Cronbach's alphas (.70-.93) (K. E. Larsen et al., 2001; R. Larsen, Plog, M., 2012) while the remaining studies either do not report Cronbach's alpha (Manning & Wright, 1983; Stockman, 2001; Svensson, Barclay, & Cooke, 2009), or report low Cronbach's alpha (.59) (Slade, Escott, Spiby, Henderson, & Fraser, 2000). Two studies utilize tools which researchers claim can measure childbirth self-efficacy but which were designed to measure other phenomenon, including locus of control (Hui Choi, 2012) and mastery (Christiaens & Bracke, 2007). These overall broad agreements regarding theory, measurement, and definition simplified comparison of childbirth self-efficacy literature on questions of sample, outcome, and study design.

Sample.

Another pattern revealed through this synthesis is sample homogeneity, including participants who were predominantly married or partnered, well-educated, with proportionally high income, nulliparous and either recruited from childbirth education classes or able to persist in antenatal interventions (Table 1). Domestic samples were largely among Caucasian women and several international samples report high proportions of Caucasians or participants of European origin. Sample homogeneity limits generalizability.

Latent Labor Hospital Admission: Outcomes and Prevention

Table 1: Sample

First Author, year of publication, country	N	% Recruited	% Attrition	% Nullip	Race / Ethnicity	Married or partnered	Annual Income	Education
Schwartz 2015 Australia	1410	61%	One time survey	43%	74% Australian born	93%	•	50% post year 12
Byrne 2014 Australia	12	•	67%	100%	•	89%	•	78% undergraduate or higher degree
Larsen 2012 US	115	•	78%	96%	•	79%	80% >= \$40,000	53% college or higher degree
Hui Choi 2012 Hong Kong	550	82%	10%	37%	•	86%	52% >= HK \$20,000	71% secondary school education
Goutoudier 2012 France	98	99%	22%	50%	•	•	•	61% college or higher degree
Rhamipavar 2012 Iran	150	100%	3%	100%	•	•	25% 'adequate income'	61% diploma or higher degree
Gau 2011 Taiwan	87	86%	50%	63%	•	•	•	80% college or higher degree
Kennedy US 2011	322	88%	4%	53%	59% Caucasian ; 19% African American	59%	•	16% college or higher degree
Sun 2011 Taiwan	88	•	8%	100%	•	•	•	30% college or higher degree
Svensson 2009 Australia	170	•	32%	100%	81% Born AUS, NZ, or UK	•	92% >= 40,000	84% diploma or higher degree
Ip 2009 Hong Kong	133	53%	31%	100%	•	93%	40% >= \$2564 in US dollars	83% secondary form 3-7 or higher degree
Berentson-Shaw, 2009 New Zealand	230	•	11%	100%	82% European	•	'higher mean income'	'higher mean education'
Williams, 2008 UK	100	59.3%	•	48%	•	89%	•	74% at A-level standard or higher degree
Christiaens, 2007 Belgium + the Netherlands	560	Hospitals 19-68% Midwifery 38-100%	7.5%	Belgian 48%, Dutch 52%	•	Belgian 98% Dutch 99%	•	Belgian 77%, Dutch 41% 'completed higher education'
Beebe 2007 US	35	•	13%	100%	89% Caucasian	100%	66% > \$50,000	51% college or higher degree
Seiber	61	•	16%	100%	•	96.7%	•	41% university

Latent Labor Hospital Admission: Outcomes and Prevention

2006 Switzerland								or advance technical college
Soet 2003 US	103	•	8.0%	92% nullipa rous	67% Caucasian 28% African American	91%	63% >/= \$50,000	70% college or higher degree
Larsen 2001 US	37	•	43.1%	100%	•	•	•	•
Stockman 2001 US	43	95%	81%	21%	100%	95%	76% >/= \$40,000	58% college or higher degree
Slade 2000 US	121	87%	•	100%	•	•	•	•
Lowe 2000 US	280	79%	*	100%	92%	90%	50% >\$40,000	61% college
Dilks 1997 US	74	33%	*	40.5%	83.8%	'the majority'	58.6% > \$50,000	mean education = 16.4 years (SD 3.4 years)
Manning 1983 US	52	•	26.9%	100%	•	•	•	•

• = inadequate information; * = cross-sectional study design

In addition, several sample characteristics may influence childbirth self-efficacy scores and, therefore, act as confounders in these studies. For example, racism can be conceptualized as a force which acts to undermine an individual's confidence; therefore, the experience of racism could influence women's childbirth self-efficacy scores. Of the 13 studies conducted in North America or Europe, only one recruited a higher number of non-Caucasian participants (Soet et al., 2003). Similarly, women within committed relationships, with more education, and with access to greater resources may draw confidence to cope from these supports, potentially leading to overall higher self-efficacy and potentially confounding the relationship between study interventions and levels of childbirth self-efficacy.

Latent Labor Hospital Admission: Outcomes and Prevention

An examination of samples also revealed that participants were predominantly recruited from childbirth education classes and prenatal clinics, with only three studies drawing samples from the broader community (Berentson-Shaw, Scott, & Jose, 2009; Byrne, Hauck, Fisher, Bayes, & Schutze, 2014; Dilks & Beal, 1997). As well, most women in childbirth self-efficacy interventional studies were required to complete time intensive antenatal interventions to remain in the final sample for analysis (Table 2). Two related sampling concerns included recruitment and retention. Lack of information about numbers recruited or evidence of low recruitment characterized much of the literature, with only 12 of 23 studies demonstrating and clearly reporting high recruitment (Table 1). As well, elevated attrition rates in several investigations (50-81%) suggested that study requirements often were untenable. Women willing to participate in childbirth education classes, seeking prenatal care, consenting to research, and who persist in childbirth self-efficacy studies and interventions may have differing abilities to cultivate childbirth self-efficacy than women who do not persist in these activities. These sampling concerns must be considered when evaluating the generalizability of this childbirth self-efficacy literature.

It is also important to note that, with the exception of four studies (Berentson-Shaw et al., 2009; Byrne et al., 2014; Dilks & Beal, 1997; Vasegh Rahimparvar et al., 2012), literature quantifying childbirth self-efficacy either did not report or define perinatal risk status of participants or indicated that high perinatal risk women were excluded from the study. Therefore, the evidence to date regarding childbirth self-efficacy fails to discern if the overall impact of childbirth self-efficacy based interventions in raising childbirth self-efficacy scores or the overall positive associations

Latent Labor Hospital Admission: Outcomes and Prevention

between higher childbirth self-efficacy scores and improved perinatal outcomes are findings specific to women with lower perinatal risk status or can be extended to women with higher perinatal risk status. For these reasons, only preliminary ideas can be formed regarding the influence of perinatal risk-status on childbirth self-efficacy.

Outcomes of childbirth self-efficacy studies.

While there are wide variations in outcomes examined, the majority of research on childbirth self-efficacy found either that childbirth self-efficacy could be modified or that increased childbirth self-efficacy was associated with improved perinatal outcomes. The two areas with the most consistently positive associations were between: 1) the increase of antepartum and intrapartum childbirth self-efficacy scores after prenatal efficacy enhancing interventions, 2) higher childbirth self-efficacy and decreased childbirth pain and suffering (defined as emotional or cognitive distress) during labor. More preliminary findings linked higher childbirth self-efficacy and improved postpartum outcomes in three studies (Table 2).

Latent Labor Hospital Admission: Outcomes and Prevention

Table 2: Outcomes

First author	Design / Intervention	AP outcomes	IP outcomes	PP outcomes
Schwartz	Secondary analysis; cross-sectional, descriptive	CBSEI self- efficacy scores higher among multiparous women		
Byrne	Single arm pilot; Repeated measures/ Mindfulness-Based Childbirth Education	1 (intervention increased antenatal measures of childbirth self- efficacy)		
Larsen (2012)	Quasi experimental/ Childbirth education	1		
Hui Choi	Cross-sectional, descriptive	2 (increased psychosocial adaptation to pregnancy)		
Goutoudier	Prospective longitudinal			4 (CBSEI measured 2-3 days pp)
Rhamipavar	RCT / Childbirth educational software	1		
Gau	RCT / Antepartum birth ball antepartum exercise classes; Intrapartum encouragement to use birth ball	1	1 2 (lower active labor pain scores)	
Kennedy	RCT / CenteringPregnancy group prenatal care	3		
Sun	Quasi-experimental / Prenatal yoga	2 (decreased end of pregnancy discomforts)	1 (increased CSE active first and second stage labor)	
Svensson	RCT / Childbirth education	1		2 (increased parenting self- efficacy and knowledge)
Ip	RCT/ Childbirth education		2 (lower active labor pain scores) And lower active labor suffering scores) 4 (did not predict pain of transition)	
Berentson- Shaw	Longitudinal descriptive		2 (lower active labor suffering scores and higher satisfaction with birth scores)	

Latent Labor Hospital Admission: Outcomes and Prevention

Williams	Longitudinal descriptive	4 (self-efficacy did not predict women's intentions to use pain medication)		
Christiaens	Longitudinal descriptive		2 (higher satisfaction with self, midwife, and physician related aspects of birth)	
Beebe	Longitudinal descriptive	2 (decreased anxiety)	4 (self-efficacy scores did not predict early labor pain scores)	
Seiber	Longitudinal descriptive			2 (predicted stronger identification with motherhood role)
Soet	Longitudinal descriptive			2 (decreased symptoms post-traumatic stress disorder)
Larsen (2001)	Longitudinal descriptive		2 (lower active labor pain scores And lower active labor suffering scores) 4 (did not predict transition pain)	
Stockman	Longitudinal descriptive		2 (lower latent and active labor suffering scores; lower latent and active labor pain scores) 4 (no association with length of labor or rates of anesthesia use)	
Slade	Longitudinal descriptive	2 (greater intention to avoid labor pain medication)		
Lowe	Descriptive cross-sectional	2 (decreased fear of labor)		
Dilks	Descriptive cross-sectional	2 (greater VBAC intention)		
Manning	Longitudinal descriptive		2 (greater capacity to cope with active labor and lower active labor suffering scores)	

1 = evidence that intervention significantly increased childbirth self-efficacy scores

Latent Labor Hospital Admission: Outcomes and Prevention

2 = evidence that increased prenatal childbirth self-efficacy scores significantly associated with improved outcomes

3 = no evidence that intervention increased childbirth self-efficacy scores

4 = no evidence that increased prenatal childbirth self-efficacy scores associated with improved outcomes

The majority of descriptive studies associated higher childbirth self-efficacy with enhanced perinatal outcomes. As well, the better designed quasi-experimental and experimental studies successfully increased childbirth self-efficacy scores or found that increased scores led to better perinatal outcomes. For these reasons, evidence within this body of literature identified childbirth self-efficacy as potentially important for understanding how optimal perinatal outcomes are achieved.

The dominant childbirth self-efficacy definition and measurement tool assumes utilization during pregnancy only (personal communication, N. Lowe). However, our review revealed that researchers using the CBSEI adapted this tool for measurement during the intrapartum and postpartum periods (Table 2). This unconventional timing of CBSEI administration is problematic in studies such as Goutaudier et al. (2012), which used the CBSEI to measure childbirth self-efficacy among women who were 2-3 days postpartum and then correlated these scores with symptoms of post-traumatic stress disorder at 6 weeks postpartum. Two compelling investigations showed that higher childbirth self-efficacy scores during pregnancy were linked with improved parenting outcomes postpartum (Sieber et al., 2006; Svensson, Barclay, & Cooke, 2009). Recalling that self-efficacy theory's proposed effects are domain specific, these findings might be interpreted as an indication that self-efficacy theory is a poor conceptual fit for these investigations. We propose instead that these findings indicate that the perinatal period

Latent Labor Hospital Admission: Outcomes and Prevention

might be conceptualized as one phenomenon encompassing the three overlapping and intertwined events of pregnancy, birth, and the early postpartum period.

Discussion

Strengths of Childbirth Self-Efficacy for Understanding Group Prenatal Care

Several strengths merit consideration related to utilizing the childbirth self-efficacy theoretical framework for understanding how GPC impacts perinatal outcomes. Most fundamentally, self-efficacy theory is focused on the period of cognitive preparation prior to an event and GPC is a model which strives to improve the process of pregnancy and to prepare for birth and parenting. As well, self-efficacy behavioral modification is framed in relation to the individual and GPC is ultimately focused on modifying individual behavior to improve individual outcomes.

It is also important to note that childbirth self-efficacy theory focuses on behavior change which is specific to the domain but is not focused on micro-level tasks. Events of labor can be unpredictable and varied. What is required to accomplish a shorter, uncomplicated birth may be quite different from what is required for a long birth with multiple interventions. Childbirth self-efficacy seeks to stimulate behavior change through building confidence, not through mastering specific tasks. In this way it is a framework better suited to preparing for an event with more unknowns, such as labor or early parenting.

Latent Labor Hospital Admission: Outcomes and Prevention

Additionally, multiple aspects of the GPC model mesh neatly with Bandura's theory regarding the sources which build self-efficacy. For example, Bandura emphasized vicarious experience which is central to what GPC offers, e.g., women in the group sharing their birth stories. Verbal persuasion is another theorized source of self-efficacy; the language within CenteringPregnancy materials offers positive messages about birth, mothering, and breastfeeding. Bandura also theorized that emotional arousal plays an important role in self-efficacy. The GPC model may facilitate lower emotional arousal indirectly, through factors such as eliminating waiting for prenatal care or creating a sense of community, and directly, through factors such as teaching stress reduction techniques.

The fourth theorized source of self-efficacy, performance accomplishment, is a more challenging conceptual fit for the GPC model as women can't experience labor before they are in labor; however, it is interesting to consider if GPC may set the stage for latent labor to be a period of performance accomplishment which could either increase or decrease one's self-efficacy for active labor. There is support for this idea in Bandura's seminal work on self-efficacy: 'those who persist in subjectively threatening activities that are in fact relatively safe will gain corrective experiences which reinforce their sense of efficacy, thereby eventually eliminating their defensive behavior' (1977).

Lastly, 3 of the 4 theorized sources of self-efficacy do not relate to direct experience. For this reason childbirth self-efficacy theory provides a framework which could help to conceptualize how GPC may increase confidence to cope among women who have not experienced birth. Given high nulliparous participation in GPC studies

Latent Labor Hospital Admission: Outcomes and Prevention

(Ruiz-Mirazo et al., 2012), childbirth self-efficacy may be a good conceptual fit for better understanding how this prenatal care model is facilitating improved outcomes among nulliparous women.

Integrative review of the childbirth self-efficacy perinatal outcomes literature also identifies a number of important factors for consideration when seeking to explore if childbirth self-efficacy theory is an adequate framework for understanding why improved perinatal outcomes are associated with GPC. Given the consistency of findings that higher childbirth self-efficacy decreases childbirth pain and suffering during labor, childbirth self-efficacy may be what contributes to GPC improved satisfaction with care, lower cesarean rates, or with higher rates of active labor hospital admission. Also important, this integrative review of the childbirth self-efficacy literature shows repeated findings that higher childbirth self-efficacy is associated with decreases in negative psychosocial factors, such as less anxiety (Beebe, Lee, Carrieri-Kohlman, & Humphreys, 2007) and lower fear of labor (Lowe, 2000). It is possible that GPC's effect relies on the interplay of these kinds of factors related to maternal perception and experience. Future GPC investigation could build from this childbirth self-efficacy evidence to explore if GPC leads both to increased childbirth self-efficacy and to decreased fear and anxiety while anticipating labor or decreased pain and suffering during labor.

Another noted strength is the high proportion of childbirth self-efficacy research which has focused on antenatal education, both with descriptive and experimental designs. Though distinct, GPC bears similarity to antenatal education through the discussion and knowledge development components of the model. The consistency of

Latent Labor Hospital Admission: Outcomes and Prevention

childbirth self-efficacy studies showing that antenatal educational interventions shaped to increase childbirth self-efficacy are frequently successful provides relevant information for those seeking to examine the potential of childbirth self-efficacy for understanding outcomes associated with GPC.

The interesting findings that higher childbirth self-efficacy scores are linked to improved postpartum outcomes suggest that antenatal interventions should be explored for their effects beyond pregnancy and birth. These findings open the possibility that childbirth self-efficacy may be a relevant theoretical framework for understanding how GPC is leading to improved breastfeeding and also recommend that future GPC investigation explore more broadly how this model of prenatal care might be preparing women, and potentially families, for the challenges, opportunities, and transitions of parenting during infancy.

Weaknesses of Childbirth Self-Efficacy for Understanding Group Prenatal Care

Weaknesses are also evident with regards to utilizing the childbirth self-efficacy theoretical framework for conceptualizing the influence of GPC on perinatal outcomes. Childbirth self-efficacy's focus on the individual and individual behavior would not support hypothesis building regarding other potential influences on women's behavior. For example, this theory would not support investigation regarding partner, family, or doula interactions. As well, childbirth self-efficacy is not a framework which could account for systems influences, such as hospital structures or policies, nor for broader social or cultural influences, such as poverty or racism.

Latent Labor Hospital Admission: Outcomes and Prevention

Another limitation is that childbirth self-efficacy may not be the appropriate theory to understand the social aspects of the GPC model. Childbirth self-efficacy does include social exchange as a part of building what is required for behavior change (vicarious experience, verbal persuasion) but the theory is narrowly focused on the individual's cognitive development. There may be more about social support in GPC that is influencing outcomes. One GPC study found that 6 months after birth, 80% of the women who had GPC (vs. 25% of the control group) were socializing with other women they had met during group care and also that the group care women met with other women from their group 33% more frequently than did those in the control group (Wedin et al., 2010). The childbirth self-efficacy conceptual framework would be challenged to support hypothesis development for the GPC model related to these findings.

Childbirth self-efficacy theory provides a framework for understanding how one develops confidence but not as clearly for how one develops expectations about accomplishing a task. This presents another weakness. Many feel there is a paucity of accurate information about normal labor in U.S. culture which may frustrate pregnant women's efforts to build realistic labor expectations. Several aspects of the GPC model, such as longer time allocated for discussion, may enhance the development of realistic expectations for labor. Childbirth self-efficacy theory may not be the ideal conceptual lens through which to understand expectation development.

It is also difficult to envision a direct connection between childbirth self-efficacy and certain outcomes positively associated with the GPC model, such as lower preterm birth (PTB) rates and higher birth weight. One tenuous link is the role of maternal stress,

Latent Labor Hospital Admission: Outcomes and Prevention

one of several factors associated with risk for PTB. It seems implausible that low childbirth self-efficacy scores might elevate stress levels to a degree which could stimulate premature labor. While challenging to imagine this, association has been found between grief and stillbirth (Laszlo et al., 2013) and fear and cesarean delivery (Ryding, Wijma, Wijma, & Rydhstrom, 1998), suggesting complex links between maternal psychosocial variables and certain perinatal outcomes. So while childbirth self-efficacy may not clearly frame how GPC is associated with decreased PTB, our understanding of how maternal experience affects perinatal outcomes is preliminary and incomplete at this time.

The relative homogeneity of samples evident in this integrative review presents both concern and opportunity with regard to proposing childbirth self-efficacy as a theoretical framework for GPC. Many of the samples included in the GPC literature include women with more racial, ethnic, and socioeconomic diversity than samples included in the childbirth self-efficacy literature. Because GPC has been associated with improved perinatal outcomes among women with higher risk for poor outcomes (e.g., lower socioeconomic status, teenagers, African American women), it is important to utilize theoretical structures with higher potential to clarify how GPC may be leading to these better outcomes. As a theory focused on the individual, childbirth self-efficacy may not be able to examine social inequities or race. This same concern also presents a scientific gap. If GPC investigation involving more diverse samples is able to show that childbirth self-efficacy is importantly linked to perinatal outcomes, this will be an important scientific contribution to the childbirth self-efficacy literature and expand generalizability in this area of science.

Conclusion

Based upon the growing evidence linking GPC with improved perinatal outcomes, this work seeks to catalyze scientific engagement with the question: ‘how does GPC improve perinatal outcomes’? This manuscript examined childbirth self-efficacy as a potential theoretical framework for understanding how GPC may be leading to improved perinatal outcomes. This was accomplished through an integrative review of the literature regarding the impact of childbirth self-efficacy on perinatal outcomes which built knowledge useful for examining the strengths and weaknesses of using the childbirth self-efficacy theoretical framework to conceptualize the GPC model.

Childbirth self-efficacy is not clearly a poor or an excellent theoretical framework for understanding GPC. Because literature synthesis and examination of a fit between childbirth self-efficacy as a theoretical framework for understanding GPC reveals both strengths and weaknesses, it is possible that childbirth self-efficacy may be a core, but not singular, psychosocial component or conceptual model.

One mid-range theory which may offer greater strength incorporates self-efficacy as one of four factors theorized as important for understanding perinatal outcomes research. The Perinatal Maternal Health Promotion Model proposes that achieving perinatal well-being can best be facilitated through helping women develop or strengthen 4 things: 1) the ability to mobilize social support, 2) self-efficacy, 3) positive coping strategies, and 4) realistic expectations (Fahey & Shenassa, 2013). Future GPC research will benefit from ongoing exploration of childbirth self-efficacy and other theoretical

Latent Labor Hospital Admission: Outcomes and Prevention

frameworks with promise for enlightening the intermediary and causal factors of the innovative group prenatal care model.

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Chapter VI

Latent Labor Hospital Admission: Outcomes and Prevention

Discussion, Summary, and Implications

Introduction

Latent labor hospital admission is an important and understudied phenomenon. This dissertation sought to build knowledge regarding outcomes and prevention of this phenomenon. Results of this body of work revealed that latent labor hospital admission of low-risk women is a costly healthcare practice which increases morbidity and mortality in this population (Chapter 2). Based on literature synthesis showing that group prenatal care (GPC) is associated with enhanced perinatal outcomes (Chapter 3) and prior literature indicating that antenatal (vs. intrapartum) group based interventions were associated with decreasing latent labor hospital admission, we hypothesized that GPC might also be associated with decreased latent labor hospital admission. This association was found in a sample of 375 low-risk women receiving prenatal care with a University-based CNM practice (Chapter 4). While this portion of the dissertation study adds to the body of perinatal outcomes research indicating the efficacy of GPC, reasons for this are unclear. In an effort to begin addressing this gap in the science, dissertation study found that childbirth self-efficacy may provide a partial explanation of how GPC influences outcomes but does not adequately frame all aspects of the GPC model (Chapter 5).

This final dissertation chapter presents a discussion and summary of these findings. In the first section, integration of dissertation study results, implications of results, and examination of how dissertation findings relate to previous research will be described. Because findings suggest clinical importance from both a healthcare systems perspective and an individual woman's perspective, both perspectives will be described. The second section, related to summary and implications, integrates study findings to

Latent Labor Hospital Admission: Outcomes and Prevention

summarize salient themes identified in the discussion section, considers implications of the research for nursing, weighs strengths and weaknesses of the study, and suggests future research. To minimize redundancy, it should be noted that the study and its findings only apply to a low-risk, U.S., female population during pregnancy, labor, birth, and the early postpartum period.

Discussion

Literature review, identifying latent labor hospital admission as linked to higher intervention and procedure rates without evidence of corresponding outcomes improvement, frames the relevance of the overarching hypothesis of this doctoral research. The overarching hypothesis of this study was that women who receive GPC may increase their knowledge of and skills for coping with latent labor, via enhanced childbirth self-efficacy, which leads to increased confidence when experiencing latent labor at home. It was proposed that this increased confidence results in decreased requests for hospital admission during latent labor and, subsequently, lower cesarean delivery (CD) rates without negatively impacting neonatal outcomes. This dissertation study produced foundational knowledge necessary to begin addressing this overarching hypothesis.

This dissertation created four distinct manuscripts focused primarily on two concerns: the issue of latent labor hospital admission and how it might be impacted by GPC. Findings of the study help further define the problem of latent labor hospital admission. Subsequently, the investigators conducted a comprehensive literature synthesis and employed both descriptive and comparative effectiveness methods to build

Latent Labor Hospital Admission: Outcomes and Prevention

knowledge regarding one model of prenatal care, GPC, as an intervention with potential for decreasing latent labor hospital admission. Lastly, this dissertation examined the theoretical framework known as childbirth self-efficacy and its suitability as a theoretical framework for understanding how GPC influences perinatal outcomes.

The foundation of this dissertation lies with cost-effectiveness analysis (Chapter 2). This portion of the dissertation provided estimates of the costs and outcomes related to being admitted to the hospital during latent vs. active labor. While prior literature has identified repeated association between healthy women's latent labor hospital admission and higher rates of both interventions (e.g. epidurals) and procedures (e.g. CD), results of this study within the dissertation contribute the first known cost-effectiveness analysis on this subject. Findings that reducing latent labor hospital admission in this population is an effective strategy for both decreasing costs and improving outcomes are impactful. It is telling that the Washington State Hospital Association's recent approach to reducing cesarean deliveries included delaying admission to the hospital among its recommended labor management practice ("Safe Deliveries Roadmap," 2014). This dissertation study also produced a review and synthesis of the most relevant perinatal outcomes literature regarding one prenatal care intervention, GPC (Chapter 3). Review of GPC clarified that this model of care has been successful in improving varied perinatal outcomes. This portion of the dissertation highlighted important information regarding the state of the science of GPC, examined the history and intent of prenatal care, described pragmatic concerns related to model implementation, and detailed several possible directions for future GPC research. Based on this review and synthesis of the GPC literature, it was

Latent Labor Hospital Admission: Outcomes and Prevention

hypothesized that GPC may also be effective in reducing latent labor hospital admission among a low-risk, U.S. population

Shaped by both cost-effectiveness results and synthesized GPC knowledge, the dissertation subsequently explored whether the GPC model might be an effective intervention for addressing the core problem of latent labor hospital admission (Chapter 4). Results from this portion of the study found an association between participation in GPC (vs. standard care) and decreased risk for latent labor hospital admission. In a retrospective case control study, the investigator observed that among 375 low-risk, predominantly Caucasian, married, and well-educated pregnant women choosing nurse-midwifery care, women who chose group care ($n = 150$) and women who chose individual care ($n = 225$) experienced significantly different outcomes. Women who received GPC were admitted to the hospital with significantly more advanced cervical dilation (5.73 cm vs. 5.08 cm, $p=0.01$) than women who received standard care ($\beta = 0.77$ cm \pm 0.27 cm; $t = 2.85$; $p < 0.01$). Regression analysis additionally indicated that women who received GPC were 73% more likely (OR = 1.73, 95% CI = 1.03-2.99, $p = 0.05$) to be admitted to the hospital during active labor as defined by cervical dilation equal to or greater than 4 centimeters of dilation. The inclusion of propensity scores in regression modeling increased balance in this observational study, further enhancing confidence in results.

Given the findings that GPC, previously associated with a variety of improved perinatal outcomes, was also associated with decreasing rates of latent labor hospital admission, several new areas of inquiry were revealed. Put simply, one important

Latent Labor Hospital Admission: Outcomes and Prevention

question is ‘why do women who participate in GPC enter the hospital in more advanced labor’? Dissertation results provide preliminary exploration of this question (Chapter 5). Findings from this integrative review revealed both strengths and weaknesses regarding the conceptual fit between GPC and the childbirth self-efficacy framework.

Methodological importance.

The methodological importance of this dissertation is primarily in the application of multiple methodological techniques to address dissertation questions. This was the first known study to use health outcomes and economic modeling and methods to estimate costs and outcomes regarding the maternity care decision of admitting low-risk women in latent vs. active labor. Since cost-effectiveness analysis is not a common approach in nursing or midwifery science results of this portion of the dissertation (Chapter 2) reflect how this method can reveal or highlight maternity care consequences for healthy women in the U.S.

This was also the first known GPC study to employ propensity score methods to observational data for refining treatment effects estimates (Chapter 4). This analytic method should be useful to future GPC investigators for several reasons. For example, because many nurse-midwifery practices currently offer GPC, there may be existing data repositories of women who received GPC vs. standard prenatal care. Additionally, investigators considering prospective GPC trials may encounter resistance to randomization of subjects. Under either circumstance, advanced statistical analytic techniques, such as propensity score matching, likely produce more balanced treatment effects estimates than standard regression modeling. Utilization of these methodologic

Latent Labor Hospital Admission: Outcomes and Prevention

techniques could increase the quality and relevance of future nurse-midwifery and GPC science.

Theoretical importance.

Findings of the study suggest several key theoretical implications. The findings reported in Chapter 2, emphasizing the consequences of latent labor hospital admission, and the findings reported in Chapter 4, identifying an association between GPC and a significant decrease in latent labor hospital admission, provide further evidence regarding the relevance of GPC investigation. Because the findings indicate the efficacy of GPC in achieving improved perinatal outcomes, deeper understanding of this intervention is required. Mid-range theory is noted for its capacity to broaden understanding of healthcare interventions and, therefore, to support meaningful research questions (Smith & Liehr, 2008; Walker & Avant, 2005). Findings of this dissertation study (Chapter 5) support conclusions drawn by other GPC researchers (Sheeder et al., 2012) suggesting that GPC investigation will be strengthened through identification of appropriate theoretical underpinnings.

Case control study dissertation findings (Chapter 4) that women who participated in GPC were significantly less likely to be admitted to the hospital in latent labor raises the possibility that women who participated in GPC developed a higher capacity to cope confidently (or higher childbirth self-efficacy) with latent labor symptoms, enabling them to confidently experience the beginning of labor out of a clinical setting.. If further study indicates that GPC increases women's capacity to cope with labor, future research may benefit from exploring childbirth self-efficacy as an important theoretical framework for

Latent Labor Hospital Admission: Outcomes and Prevention

understanding how GPC may modify timing of hospital admission (Bandura, 1977; N. Lowe, 1993). Dissertation findings regarding theoretical underpinnings of GPC (Chapter 5) also suggest that childbirth self-efficacy theory may not adequately explain all aspects of how GPC functions; therefore, wider exploration of alternate theories is warranted.

Clinical importance to healthcare systems.

U.S. healthcare is increasingly shaped by efforts to increase quality of care while reducing cost (Berwick et al., 2008). Results of this dissertation contribute to these efforts in several ways. First, cost effectiveness analysis of this dissertation (Chapter 2) quantified the common care practice of admitting healthy U.S. laboring women to the hospital during latent labor. Estimating costs and outcomes highlights resource utilization questions of this healthcare practice. Dissertation work within Chapter 3 also reviewed prior literature associating GPC with improved quality of perinatal outcomes. Additionally, this dissertation included a cohort study (Chapter 4) showing that GPC participation may safely decrease latent labor admission. As this portion of the dissertation is the first known study to identify an association between an antepartum intervention and lower rates of latent labor admission in a U.S. population, it has important health systems implications.

It was also interesting to note findings that women in GPC utilized, on average, fewer epidurals and required less augmentation of labor than those in standard care. While these between group findings were not statistically significantly different, they showed an interesting trend in decreased resource utilization. Given that GPC does not modify billing for prenatal care and resource expenditure can be structured so that GPC is

Latent Labor Hospital Admission: Outcomes and Prevention

cost-equivalent to standard prenatal care (Mooney et al., 2008), this finding adds to previous GPC research that suggests the GPC model may be a more effective strategy than standard prenatal care in reaching national goals of better quality at lower cost.

Prior latent labor hospital admission research has utilized traditional definitions of the phases of labor (Friedman, 1978), and therefore these definitions were also used in this dissertation. Recent science challenges these phase of labor definitions (Neal et al., 2014; Neal, Lowe, Ahijevych, et al., 2010; Neal, Lowe, Patrick, et al., 2010; Zhang, Landy, et al., 2010; Zhang et al., 2002). And though there remains debate regarding which set of definitions are most accurate (Cohen & Friedman, 2015), emerging practice targets and guidelines are adopting the contemporary phase of labor definitions (Spong et al., 2012).

In the midst of this debate, dissertation findings remain relevant for two reasons. First, results suggest that GPC is an intervention with greater efficacy than standard care for helping women present to the hospital closer to the contemporarily-defined onset of active labor. Secondly, while clinical guidelines based on new definitions are emerging, there has been little exploration of how women may be appropriately prepared to present to the hospital in tandem with new clinical targets. Given evidence that many women seek hospital admission prior to the traditionally defined latent labor (< 4 cm) (Bailit et al., 2005; Holmes et al., 2001; Jackson et al., 2003; Neal et al., 2014; Rahnama et al., 2006), and challenges encountered with modifying early labor services (Spiby et al., 2013), delaying admission until even further along the labor trajectory may prove a difficult goal to reach. The findings of this dissertation study suggest that GPC be

Latent Labor Hospital Admission: Outcomes and Prevention

explored as one vehicle with potential to be part of an early labor care system which can reach these emerging healthcare systems goals while also facilitating laboring women's positive childbearing experiences and satisfaction.

Clinical importance to laboring women.

Clinical importance may also be considered from the laboring woman's perspective. The experience of presenting to the hospital believing that one is in active labor when one is in latent phase has been associated with negative consequences. There is evidence that women who incorrectly believed they were in active labor and were sent home from the hospital experienced anxiety (Barnett et al., 2008) and disappointment (Low & Moffat, 2006). Evidence also suggests that excess anxiety may disrupt physiologic labor progress (Buckley, 2015). As well, research found that women admitted in latent phase perceive that they are 'handing over responsibility' for their labor, potentially undermining confidence (Carlsson et al., 2009). A study of women's preferences for latent labor management (n=730) determined that women dislike the experience of being denied admission to the hospital (Scotland et al., 2011) Thus, an effective and sustainable early labor care system which meets both healthcare systems needs and women's needs must not only successfully delay hospital admission until active labor but must also provide women with the information and skills necessary to avoid early presentation to the hospital (Marowitz, 2014). If future studies determine with more confidence that GPC participation decreases latent labor hospital presentation, this intervention may be one important component of an ideal prenatal and latent labor care system with a goal of reducing interventions, particularly cesarean delivery.

Latent Labor Hospital Admission: Outcomes and Prevention

Several elements of the GPC model may lead to the clinically important goal of improving women's experiences and increasing satisfaction. Recent GPC investigation found that nulliparous women randomized to a group prenatal educational program (GPC n=529 vs. standard care n=526) reported statistically lower worry on the Cambridge Worry Scale related to going to the hospital ($p = 0.001$), internal examinations ($p=0.024$), and giving birth ($p=0.004$) (Maimburg, Vaeth, Hvidman, Durr, & Olsen, 2013). It is possible that factors of maternal perception and experience, such as worry, anxiety, and disappointment, may importantly shape maternal satisfaction.

The review article in this dissertation study (Chapter 3) also synthesized literature findings that the GPC model provides increased time for education and discussion over standard prenatal care. It is possible that these elements of the GPC model enable pregnant women to garner greater knowledge regarding normal physiologic labor and that this elevated knowledge either facilitates more accurate identification of the optimal time to present at the hospital or capacity to and normalization of managing latent labor at home. A survey of women presenting to the hospital in latent labor showed that 66% would have been more satisfied if their care had provided knowledge regarding how to increase comfort with latent labor symptoms at home (Hosek et al., 2014). If GPC enhances prenatal knowledge accumulation, this may also lead to increased maternal satisfaction.

Childbirth satisfaction has also been significantly associated with women's perceptions that their birth experiences matched their expectations (Christiaens & Bracke, 2007). Dissertation study regarding theoretical underpinning of GPC (Chapter 5) also

Latent Labor Hospital Admission: Outcomes and Prevention

proposed that the GPC model may be more amenable to effectively developing realistic labor expectations than standard prenatal care. If women who desire less labor intervention enter labor with more realistic expectations about latent labor, they may be better prepared to remain at home until active labor. It is also possible that these elements of the GPC model catalyze other positive outcomes. For example, if women who received GPC and desire less labor intervention develop increased knowledge and more realistic labor expectations find that their early labor symptoms match their labor expectations, this may help lead to increased capacity to cope more confidently at home and enter the hospital more frequently in active labor while also leading to higher satisfaction with the childbirth experience.

The core intent of prenatal care is to reduce poor maternal and fetal/neonatal outcomes. Our current dominant system of prenatal care is oriented toward risk assessment and risk reduction as the primary approach to reaching this goal. Given the plausibility that GPC functions through increasing factors such as increasing women's knowledge or skills, with risk assessment included but not emphasized, this may suggest the need to rethink which elements of prenatal care deserve emphasis. For this reason, future exploration of GPC clinical significance may benefit from consideration within a health promotion framework, such as Antonovsky's Salutogenic Model, which recommends closer scrutiny of factors supporting well-being as an alternate approach to improving healthcare outcomes (Antonovsky, 1996).

Relationship Between Dissertation Findings and Prior Work

Latent Labor Hospital Admission: Outcomes and Prevention

Dissertation findings are relevant to three bodies of knowledge: group prenatal care, latent labor hospital admission, and childbirth self-efficacy. A summary of the relationship between findings and prior work will be considered in each area.

Of the three areas of prior work, findings relate most directly to the literature regarding GPC. Findings regarding the cost-effectiveness of active labor hospital admission in a low-risk U.S. population (Chapter 2) relate to the GPC literature predominantly because most GPC research includes U.S. samples of low-risk women. Thus cost-effectiveness findings from this dissertation might be used to frame the relevance of future GPC care research seeking to examine phase of labor at hospital admission.

Synthesis of the GPC literature most relevant to associations between the GPC model and enhanced perinatal outcomes (Chapter 3) offers information about this innovative form of care relevant to a clinical audience, both through synthesizing the most clinically relevant findings in the GPC literature and through offering pragmatic suggestions when seeking to implement the group care model. And while the *Obstetrical and Gynecological Survey* boasts a diverse readership, it likely attracts a higher proportion of physician providers than many nurse-midwifery journals where the preponderance of GPC literature has been published. For this reason, this portion of the dissertation (Chapter 3) offers effective communication about the GPC model to an audience with potentially less exposure to this innovation. This dissertation section also offers consideration regarding a number of phenomena with potential to strengthen future

Latent Labor Hospital Admission: Outcomes and Prevention

GPC research, including consideration of the social context of prenatal care and the need for future research to offer detail regarding GPC models studied.

As the first study to examine the impact of prenatal care modality on phase of labor at hospital admission and also the first study to examine antepartum interventions to decrease latent labor admission in a U.S. population, Chapter 4 within the dissertation Chapter 4 addressed two scientific gaps relevant to prior GPC literature. This study adds to the body of GPC literature through identifying a new association between this model of care and enhanced perinatal outcomes. Further, it added information which may shed light on prior association between GPC and decreased CD outcomes.

Dissertation findings regarding childbirth self-efficacy (Chapter 5) also relate to the GPC literature via evaluating the possibility that the childbirth self-efficacy framework may help to conceptualize how GPC is improving outcomes. Further, dissertation findings seek to begin addressing the identified need for theory to enhance GPC investigation (Sheeder et al., 2012). Results determining that childbirth self-efficacy cannot adequately explain all aspects of the GPC model could shape future GPC research seeking theoretical grounding. Thus, future research might propose alternate theories to better explain those aspects of GPC which do not fit well within the childbirth self-efficacy framework. As well, this work identifies the opportunity for theory development to better understand how GPC influences outcomes.

Considering prior work which concerns latent labor hospital admission, dissertation findings related to cost-effectiveness analysis (Chapter 2) provided methodologically strong estimates of the costs and consequences of latent labor

Latent Labor Hospital Admission: Outcomes and Prevention

admission in a contemporary U.S. population. Findings from this dissertation (Chapter 4) also relate to the latent labor hospital admission literature through identifying GPC as a prenatal intervention associated with decreasing latent labor hospital admission. Findings from this dissertation lend weight to the results of the two prior studies which found that antenatal group interventions were associated with decreased latent labor hospital admission (Lumluk & Kovavisarach, 2011; Maimburg et al., 2010). Taken together, these three studies suggest that future research aiming to decrease latent labor hospital admission might be more effective when focused on antenatal, not intrapartum, intervention.

This dissertation also identified knowledge about childbirth self-efficacy (Chapter 5). Integrative review results identified gaps in the childbirth self-efficacy literature that provide opportunities to shape future childbirth self-efficacy investigation. Additionally, consideration of the strengths and weaknesses of a conceptual match between the childbirth self-efficacy framework and the GPC model might inform future investigators seeking to understand if GPC modifies childbirth self-efficacy or exploring theoretical frameworks which may complement childbirth self-efficacy for understanding GPC.

Summary and Implications

This dissertation demonstrated that the outcomes and cost consequences of admitting medically low-risk U.S. women to the hospital during latent labor are substantial, described the GPC model and known associations, and supported the hypothesis that GPC participation is associated with lower rates of latent labor hospital admission and non-inferior neonatal outcomes. The study also produced an integrative review of the

Latent Labor Hospital Admission: Outcomes and Prevention

childbirth self-efficacy literature relevant to perinatal outcomes research and proposed strengths and weaknesses of the theoretical fit between childbirth self-efficacy and GPC.

These study findings are relevant for several reasons. The results make important contributions to the latent labor hospital admission literature, the GPC literature, and the childbirth self-efficacy literature. The most significant contributions are the first known cost-effectiveness analysis of latent labor hospital admission in a low-risk U.S. population, the first known examination regarding the association between GPC and phase of labor at hospital admission, and the first known examination of an antepartum intervention to decrease latent labor admission in a low-risk U.S. population. Other important contributions include a review of the most clinically relevant GPC literature framed for an audience less familiar with GPC and also an examination of a potentially relevant GPC theoretical framework.

Methodological importance is evident in the applications of novel analytic techniques to dissertation questions. Specifically, this dissertation utilized economic health outcomes research methods to estimate the relevance of a common latent labor healthcare practice in a low-risk population. This dissertation study is also the first known GPC quasi-experimental study to incorporate propensity score analysis into treatment effect estimates. Theoretical importance is evident in dissertation findings that childbirth self-efficacy is likely a relevant component of, but not all-encompassing, theoretical framework for understanding GPC.

These dissertation findings demonstrated clinical importance both from a healthcare systems perspective and from a laboring woman's perspective. The relevance

Latent Labor Hospital Admission: Outcomes and Prevention

to healthcare systems importance is found in dissertation results which quantify the consequences of the common U.S. healthcare practice of admitting low-risk women to the hospital during latent labor. Further, healthcare systems importance is evident in dissertation findings that GPC may be an effective vehicle to decrease latent labor hospital admission and thus decrease associated resource expenditure, interventions, and procedures. Lastly, dissertation results showing higher cervical dilation and greater active labor at hospital admission among women who received GPC may be particularly important as healthcare systems seek to successfully modify early labor care systems so that they are in line with emerging contemporary phase of labor definitions.

Clinical importance of dissertation findings from a laboring woman's perspective build upon existing literature examining women's experiences, preferences, and satisfaction with latent labor processes and care. One study within this dissertation(Chapter 4) finding that women who chose GPC care were successfully admitted to the hospital further dilated and more frequently in active labor supports the hypothesis that GPC may facilitate development of factors such as increased knowledge, more realistic expectations, or elevated confidence enabling those women to successfully remain home longer. Women who find the capacity to stay home longer in the early portions of labor may avoid the negative consequences of anxiety, disappointment, worry, or disrupted physiologic labor progress potentially incurred when women present to the hospital believing they are in active labor but actually in latent labor. Also important, these negative consequences are associated with decreased maternal satisfaction. On this aspect, dissertation findings are relevant to both laboring women seeking a satisfying birth experience and to healthcare systems seeking to increase patient

Latent Labor Hospital Admission: Outcomes and Prevention

satisfaction outcomes as maternal satisfaction is important to women and also a key maternity quality indicator.

Implications for nursing and other disciplines.

Nursing is devoted to preventative care and health promotion as important for engendering wellness in a population (National Institute of Nursing Research, 2011). This dissertation study examines a relevant healthcare concern among healthy pregnant women and one prenatal intervention, GPC, which is well aligned with a health promotion approach.

Nurse-midwives specialize in care of well-women during their reproductive years. The American College of Nurse-Midwives Mission Statement and Code of Ethics emphasize the core values of evidence-based care, woman-centered care, and shared decision making (American College of Nurse-Midwives, 2008, 2012). GPC is a nurse-developed innovation which includes several elements congruent with both the broader nursing mission of health promotion and disease prevention and the broader philosophy of the nurse-midwifery approach to maternity care. Additionally, this nurse-developed model of care has a well-established and growing evidence base.

Dissertation findings are relevant within both nursing and nurse-midwifery frameworks for several reasons. Findings are concerned with a healthy pregnant and birthing population and quantify outcomes related to the likely over-utilization of intervention within this population. Dissertation findings also identify an intervention which emphasizes health promotion, likely via elements such as knowledge development

Latent Labor Hospital Admission: Outcomes and Prevention

and social support, suggesting that this intervention is associated with clinically meaningful perinatal outcomes from both systems-level concerns and also maternal concerns.

Further, this dissertation explores the fit between childbirth self-efficacy and GPC. Childbirth self-efficacy has been an area of nursing science which has made important contributions to understanding perinatal processes and seeking better outcomes. This dissertation study contributes to nursing science and expands focus on what strengthens pregnancy and birth knowledge, confidence, or resilience, moving away from pathology focused biomedical research. This work, therefore, will contribute to complementary nursing research which seeks to build knowledge regarding how best to strengthen healthy women's capacities during pregnancy as one approach to optimizing perinatal outcomes.

Strengths and weaknesses.

Strengths of this dissertation include contribution to the science regarding latent labor, an understudied phase of labor. Strengths also can be found in the varied but complementary examinations of GPC and latent labor hospital admission which offer the first known cost effectiveness analysis of latent vs. active labor hospital admission (Chapter 2), the first known study examining association between GPC vs standard prenatal care and phase of labor at hospital admission, and the first known study to examine an antenatal intervention aimed at decreasing latent labor hospital admission within a low-risk, U.S. pregnant and birthing population (Chapter 4).

Latent Labor Hospital Admission: Outcomes and Prevention

Further study strengths include findings which support dissertation hypotheses. Significant association between GPC participation and more advanced labor at hospital admission, without corresponding morbidity concerns, suggests this model of prenatal care may successfully and safely decrease latent labor hospital admission for low-risk women. These findings encourage replication of this study, study of this question in more diverse and larger samples, and if findings are consistent over time, experimental research design. Exploration of GPC model fit with childbirth self-efficacy theory (Chapter 5) suggests several elements of good fit between this theoretical framework and the intervention but also reveal areas of incongruence, indicating that consideration or development of alternate theoretical frameworks is warranted.

Weaknesses of this dissertation study include limitations inherent with all cost effectiveness modeling, specifically reliance on previously published findings to determine outcome probabilities. Further weakness is evident in the use of observational data. Because women in the dissertation cohort study were not randomized to intervention arm and care providers were not blinded to women's form of prenatal care, study findings are less confident regarding the proposed association between model of care and outcomes. Another cohort study weakness involved the lower than expected cesarean delivery rate which limited our ability to explore the hypothesized relationship between mode of prenatal care and mode of delivery. Lastly, the dissertation cohort study was unable to control for doula involvement or childbirth preparation classes, both factors which may have influenced outcomes.

Suggestions for future research.

Latent Labor Hospital Admission: Outcomes and Prevention

As increased publication regarding latent labor and associated outcomes/costs become available, it may be beneficial to repeat cost effectiveness analysis utilizing this new information. Specific recommendations include cost-effectiveness analysis and observational research which focuses on the nulliparous labor trajectory and outcomes. Recent research showing that latent labor hospital admission increases intervention and procedure risk for low-risk nulliparous women more sharply than it does for low-risk multiparous women indicates the need to further refine cost-effectiveness estimates and estimated GPC treatment effect by parity (Lundgren et al., 2013). It is also recommended that cost-effectiveness analysis be utilized to better understand costs and outcomes of latent labor care practices in differing birth settings, such as birth centers. Future research in these areas will benefit from study design which thoughtfully defines low-risk pregnancy and which include larger samples.

Centering Pregnancy and GPC are models which have many differences when compared to standard care. For example, research is just beginning to emerge regarding the provider's behavior in this model. To our knowledge, only one GPC study was explicitly designed so that the nurse-midwife providing GPC care was the same to provide individual care thus decreasing the possibility that provider care style, not prenatal care modality, is causing treatment effect (Wedin et al., 2010). Future GPC research will benefit from teasing out model of prenatal care vs. prenatal care provider.

GPC research is also needed to begin exploring the social and peer interaction aspects of this form of care. One direction for GPC research which may be especially fruitful would be an examination of family or partner dynamics regarding group care and

Latent Labor Hospital Admission: Outcomes and Prevention

latent labor. There is evidence that family anxiety may be importantly related to the timing of hospital admission during labor (Green, Spiby, Hucknall, & Foster, 2011; Nolan & Smith, 2010; Spiby et al., 2014). GPC leaders in our study noted anecdotally that the majority of women receiving GPC were accompanied by their partners. It is possible that partner exposure to the GPC model influences how he or she responds during latent labor which may influence the laboring woman's sense of ease or shape decision-making regarding when to present at the hospital. It will also be important to explore association between other social elements of GPC. For example, future investigators might explore association between GPC vs. standard care participant perception of social support and perinatal outcomes or quantity of time devoted to social interaction between participants and perinatal outcomes. Additionally, confounding by group assignment is an important consideration and may not be adequately controlled with statistical techniques, thus future, randomized trials will be beneficial to examine the impact of GPC.

Of the four areas of investigation within this dissertation study, conceptualization of GPC theoretical underpinnings may be the most underexplored (Chapter 5). This clarifies the importance of preliminary work seeking to explain how GPC improves outcomes and which theoretical frameworks are the most relevant for explaining this link (Novick et al., 2013; Sheeder et al., 2012; Wedin et al., 2010). Future research must build upon these studies.

The relatively low primary and total CD rates found in the cohort study of this dissertation (Chapter 4) were unexpected and are findings of interest. The ideal rate of

Latent Labor Hospital Admission: Outcomes and Prevention

CD is challenging to determine, but the World Health Organization suggests striving for a 10-15% CD rate while the 2020 Healthy People goals aim for reductions from current levels to 23.9% (U.S. Department of Health and Human Services Healthy People 2020, 2005; World Health Organization, 1985). Given that the CD rates of this sample were not associated with evidence of increased maternal or neonatal morbidity, it is conceivable that laboring women with characteristics similar to the sample population and delivering under similar setting and practice conditions may be able to safely attain CD rates which are lower than proposed benchmarks. Contributing knowledge about safe target ranges for vaginal and cesarean delivery rates among the majority of medically low-risk U.S. women is a valuable direction for future research.

The surprisingly low CD rate of the entire sample examined in Chapter 4 also opens questions about which factors beyond GPC or latent labor hospital admission may lead to safe lower CD rates. Domestic clinical practices and hospital systems with evidence of unusually low CD rates corresponding with low rates of maternal and infant morbidity and mortality may warrant systems evaluation to reach the goal of safely reducing the primary CD in the U.S. (Spong et al., 2012). Larger samples will be needed to adequately assess this possibility.

It is interesting to consider potential catalyst points between provider team characteristics and both quantitative and qualitative hospital systems factors. For example, in this sample prenatal and intrapartum care was provided by a group of clinically experienced CNMs whose practice has relative longevity in a university hospital setting. It is possible that the interplay between degree of provider clinical

Latent Labor Hospital Admission: Outcomes and Prevention

confidence or experience and the integration of a CNM team into a university clinical setting engenders institutional or labor and delivery unit cultural factors leading to systems acceptance of greater patience with labor progress in low-risk women. Cultural factors may also be relevant with regards to inter-professional relationships. It is conceivable that greater collegiality between CNM and nurse teams and/or between CNM and OB or MFM teams is associated with safe lower rates of intrapartum interventions and procedures. Similarly, questions of interprofessional trust, CNM autonomy and recognition as licensed independent providers, or effective communication between teams may be important areas for future research seeking to understand ideal systems for achieving intervention-appropriate, high quality, and safe birth outcomes among healthy women in the U.S.

Conclusions

This body of work estimated substantial outcomes and cost consequences of admitting medically low-risk U.S. women to the hospital during latent labor, described the GPC model and known associations, demonstrated significant association between GPC participation and lower rates of latent labor hospital admission with non-inferior maternal and neonatal outcomes, and observed relatively low primary and secondary CD rates among a sample of low-risk women choosing CNM care. Additionally this dissertation successfully integrated the literature regarding childbirth self-efficacy's influence on perinatal outcomes and offered preliminary work in seeking a theoretical framework for understanding how GPC might affect perinatal outcomes. Framed by the high morbidity and cost consequences of the current U.S. intervention and procedure

Latent Labor Hospital Admission: Outcomes and Prevention

rates among medically low-risk women, there is clear need for evidence that identifies models of care and specific interventions which are successful in safely addressing these concerns. Findings from this dissertation contribute to the body of literature identifying risk-appropriate care for healthy pregnant and laboring women in the U.S.

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