A COMPARISON OF FACTORS ASSOCIATED WITH OCCIPUT POSTERIOR POSITIONING AND OUTCOMES FOR WOMEN DELIVERING INFANTS IN PERSISTENT OCCIPUT POSTERIOR VERSUS OCCIPUT ANTERIOR POSITION

by

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Abstract

Although most babies rotate to and are delivered in the occiput anterior (OA) position, approximately 5% of babies are delivered in the occiput posterior (OP) position. This fetal position is associated with many risks to mothers and babies such as long labours, postpartum hemorrhage, perineal trauma, caesarean sections, and psychological distress. Maternal hands and knees positioning is often encouraged during labour to help fetuses rotate from the OP to OA position.

The purpose of this retrospective chart review study was to compare mothers delivering infants in the OP and OA positions on exposure to hands and knees positioning and other factors associated with OP position, as well as to compare delivery outcomes between groups. Using a sample of women delivering at a mid-sized community hospital, this nested case-control study compared OP and OA delivery groups. One hundred and fifty women delivering term, singleton infants were selected based on OA or OP vaginal delivery positions and were matched according to maternal age, timing of rupture of membranes, and parity. Analytic approaches included Chi-Square, the Mann-Whitney *U*, student's *t*-test, and Fisher's exact test. A Bonferroni correction was calculated for these analyses to determine statistical significance, yielding a *p* value of <.005.

Women with OP deliveries were significantly more likely to have an instrumental delivery ($\chi^2(1) = 15.213$, $p = .000$). Second-stage labour was also significantly longer for women delivering OP positioned infants (Mdn = 00:45), compared with women delivering OA positioned infants (Mdn = 00:30), $U(1) = 2002.50$, $p = .003$. No significant differences were found between groups regarding maternal exposure to hands and knees positioning, epidural analgesia, induction of labour, obese body mass index, perineal lacerations, episiotomies,

postpartum hemorrhage, high infant birth weight (>4000g) and infant Apgar scores ≤7. Fisher's exact test revealed no significant differences in ethnicity between groups. Mean birth weights were also compared between groups, revealing non-significant results. Although only length of second stage labour and exposure to instrumental delivery revealed statistically significant results, this study provided insight into the morbidity associated with OP labour for a Canadian sample, implications for nursing practice, and direction for further research.

Preface

This thesis is an original, unpublished, independent work by Laura Lande. Ethical approval for this study involving a health records review was obtained via UBC Behavioural Research Ethics Board [certificate #H14-01831], and Fraser Health Authority (FHA) Research Ethics Board (for a minimal risk study) [certificate #2014-081]. Further approval was obtained from the FHA Privacy and Security offices.

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List of Abbreviations

AROM – Artificial rupture of membranes

BMI – Body mass index

CPD – Cephalopelvic disproportion

EA – Epidural anesthesia

FHA – Fraser Health Authority

FOIPPA – Freedom of Information and Protection of Privacy Act

HIE – Hypoxic ischemic encephalopathy

HK – Hands and knees

IOL – Induction of labour

OA – Occiput anterior

OP – Occiput posterior

PDR – Perinatal Data Registry

POP – Persistent occiput posterior

PPH – Postpartum hemorrhage

PSBC – Perinatal Services of British Columbia

PTSD – Post-traumatic stress disorder

SROM – Spontaneous rupture of membranes

VBAC – Vaginal birth after cesarean section

VE – Vaginal exam

Glossary

Apgar Scores: A standardized infant assessment scale based on an infant's heart rate, respiratory effort, muscle tone, reflex irritability and color. Infants are assessed at 1 minute and 5 minutes after birth (Pillitteri, 2010)

Aritifical Rupture of Membranes: Procedure in which a long, thin crochet-like instrument is inserted vaginally and used to tear the amniotic fluid filled membrane sac housing the fetus (Pillitteri, 2010).

Body Mass Index: A weight-for-height calculation that classifies adults as underweight, overweight, normal, or obese (World Health Organization, 2004)

Epidural Anesthesia: Pain relief method whereby medication is continuously administered into the epidural space of the spine, blocking spinal nerve roots (and thus sensation) (Pillitteri, 2010)

Episiotomy: "[A] surgical incision of the perineum that is made both to prevent tearing of the perineum and to release pressure on the fetal head with birth" (Pillitteri, 2010, p.389)

First stage of labour (active labour): "Regular, frequent uterine contractions accompanied by cervical changes (dilatation and effacement) from 3-4cm to full dilatation and effacement of the cervix" (Perinatal Services of British Columbia, 2011, p.37)

Hands and knees position: Position in which pregnant woman is "on her knees with thighs upright, torso horizontal, resting on hands or fists, with her head held in a comfortable position" (Andrews & Andrews, 2004, p.132)

Labour Dystocia: Cervical dilatation of less than 2cm in 4 hours (<0.5 cm/hr assessed over 4 hours) (Perinatal Services of British Columbia, 2011)

Labour Arrest: Arrest of dilatation of the cervix in the first stage or descent of the presenting part in the second stage (Balki, Ronayne, Davies, Fallah, Kingdom, Windrim, & Carvalho, 2006)

Leopold's Maneuvers: A systematic method of observation and abdominal palpation to determine fetal presentation and position (Pilliteri, 2010)

Occiput-posterior position: Any position in which the occiput of the fetal head lies along the posterior (back) portion of the pelvis (up to the transverse position)

Occiput-anterior position: Any position in which the occiput of the fetal head lies along the anterior (front) portion of the pelvis (up to the transverse position)

Parity: The number of pregnancies that have reached 20 weeks gestation (Lowdermilk, Perry, Cashion, & Alden, 2012)

Perineal Lacerations:

> *First degree perineal laceration:* A tear involving the vaginal mucous membrane and the skin of the perineum to the fourchette (Pillitteri, 2010)
>
> *Second degree perineal laceration:* A tear involving the vagina, perineal skin, fascia, levator ani muscle, and perineal body (Pillitteri, 2010)
>
> *Third degree perineal laceration:* A tear involving the entire perineum which extends to the external sphincter of the rectum (Pillitteri, 2010)
>
> *Fourth degree perineal laceration:* A tear involving the entire perineum, rectal sphincter, and some of the mucous membranes of the rectum (Pillitteri, 2010)
>
> *Persistent Occiput-Posterior: "*[F]ailure of spontaneous rotation to the anterior or transverse position prior to vaginal delivery" (Phillips & Freeman, 1974, p.172)

Prolonged second stage labour: Greater than 3 hours from the time of full dilation of the cervix to delivery (Cheng, Shaffer, & Caughey, 2006a)

Spontaneous rupture of membranes: A spontaneous breaking of the fetal membrane sac, evidenced by a sudden gush or slow trickle of amniotic fluid from the vagina (Pillitteri, 2010).

Vaginal exam: A digital examination of cervical dilatation and effacement, membrane status; and fetal descent (station), position, and well-being (through scalp stimulation) (Dixon, 2005)

Women in labour: A nulliparous woman who is 3 or more centimeters dilated, or a primiparous/multiparous woman who is 4 or more centimeters dilated (Lowdermilk et al., 2012)

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Chapter 1: Introduction

1.1 Background

While the majority of babies are born in the occiput-anterior (OA) position, anywhere from 10 – 35% of women experience labour with a fetus in the occiput-posterior (OP) position and approximately 5% of fetuses are born in the OP position (Fitzpatrick, McQuillan, & O'Herlihy, 2001; Gardberg, Leonova, & Laakkonen, 2011; Ponkey, Cohen, Heffner, & Lieberman, 2003; Sizer & Nirmal, 2000). Factors associated with OP positioning at birth include high infant birth weight (>4000g), obese BMI, epidural anesthesia, labour induction, hands and knees positioning in labour, primiparity, and maternal age ≥ 35 (Cheng et al., 2006a; Cheng et al., 2006b; Lieberman, Davidson, Lee-Parritz, & Shearer, 2005; Sizer & Nirmal, 2000; To & Li, 2000). Despite the fact that 80-90% of OP fetuses in labour rotate to OA for delivery, OP position can cause stress and increased risk for the mother and fetus (Fitzpatrick et al., 2001; Gardberg, Laakkonen, & Sälevaara, 1998). For example, this malposition has been associated with prolonged labour, postpartum hemorrhage (PPH), perineal trauma, caesarean section, and maternal psychological distress (Alcorn, O'Donovan, Patrick, Creedy, & Devilly, 2010; Cheng, Shaffer, & Caughey, 2006a; Fitzpatrick et al., 2001; Senécal, Xiong, & Fraser, 2005). Furthermore, when internal rotation does not occur naturally, interventions such as oxytocin augmentation, manual or forceps rotation and extraction, episiotomy, or digital rotation are often used (Reichman, Gdansky, Latinsky, Labi, & Samueloff, 2008). These are difficult to perform, and can lead to increased pain, genital tract lacerations, and incontinence in mothers; and facial lacerations, intracranial hemorrhage, subgaleal hematomas and nerve injuries in infants (Andrews & Andrews, 2004; Gei & Belfort, 1999; Meyer, Hohlfeld, Achtari, Russolo, & De Grandi, 2000; Meyer, Schreyer, De Grandi, & Hohlfeld, 1998; Reichman et al., 2008; Robertson,

Laros, & Zhao, 1990; Shaffer, Cheng, Vargas, & Caughey, 2011). OP delivery is more costly for the healthcare system financially from increased transfers to high acuity units (such as the NICU), longer lengths of stay, and greater use of interventions in OP labour and birth (such as induction/augmentation, analgesia, and cesarean section) (Palencia et al., 2006; Senécal, Xiong, & Fraser, 2005). The risks and morbidities associated with OP labour and birth and the risk of interventions currently used to manage OP labour suggest that, in the Canadian population, identifying the factors associated with persistent OP (POP) fetal positioning and outcomes associated with POP compared with OA positioning at birth would be desirable.

1.1.1 Comparison of OP Labour and Normal Labour

In normal labour, the fetal head enters the pelvic inlet in the transverse position. As it descends and meets pressure from the surrounding tissues, muscles and the cervix, flexion of the fetal head occurs. This resistance encourages internal rotation of the head (of 45 degrees) to the left-occiput or right-occiput anterior position. The occiput then rotates into direct OA position for the fetus to be born. When the fetus rotates in the opposite direction, towards the maternal spine, labour is often prolonged as the head must rotate 135 degrees to deliver in the OA position. Persistent OP (POP) position is "the failure of spontaneous rotation to the anterior or transverse position prior to vaginal delivery" (Phillips & Freeman, 1974, p.171). When a fetus is in the POP position, flexion of the head does not occur and the wider anteroposterior diameter of the head can cause a relative cephalopelvic disproportion (CPD) (Hart & Walker, 2007). CPD occurs when there is a discrepancy between the fetus' head size and the size of the maternal pelvis; this disproportion stops cervical dilation and descent of the presenting part (Pattinson, 2000). Additionally, in POP labour, pressure from contractions is exerted by the presenting part on the anterior portion of the cervix that sits between the fetal head and symphysis pubis; as a

result, an anterior cervical lip, cervical edema, and even cervical lacerations can occur (Hart & Walker, 2007). As more pressure is placed anteriorly, contractions are less effective because the fetal head does not act as a driving "dilating wedge" on the cervix (Biancuzzo, 1993).

1.1.2 The Mechanism of POP Positioning

There is debate in the scientific community regarding the mechanism of the POP position. Akmal, Tsoi, Howard, Osei, and Nicolaides (2004) and Souka, Haritos, Basayiannis, Noikokyri, and Antsaklis (2003) found that the majority of POP deliveries are due to persistence of the OP position from the onset of labour. At delivery, Akmal et al. (2004) found that 70%, 91% and 100% of OP positions were due to persistence of the position from 3-5cm, 6-9cm and 10cm of cervical dilation respectively. In contrast, Gardberg et al. (1998) found that 68% of OP deliveries developed from malrotation from an originally OA position. In their study, however, women were examined before labour was established—either before induction or at the onset of spontaneous labour, and many confounding factors were not taken into account.

Although there is controversy about the origins of POP position, there are multiple interventions suggested for assisting the fetus to rotate. One intervention that is commonly used in the clinical setting to rotate fetuses into the OA position is putting women in the hands and knees position (Hunter, Hofmeyr, & Kulier, 2007; Simkin, 2010). In this position, a woman is "on her knees with her thighs upright, torso horizontal, and resting on her hands or fists" (Andrews & Andrews, 2004, p.132). Many practitioners recommend this position to women experiencing OP labour as it is noninvasive, inexpensive, and convenient (Simkin, 2010). The hands and knees position is thought to rotate OP fetuses through the use of gravity (the heavy fetal back is most superior in the hands and knees position) and buoyancy (from amniotic fluid) (Andrews & Andrews, 2004). Although this position is commonly encouraged, and there is a

theoretical basis for its use, there is little known regarding its use in OP compared with OA deliveries. Investigation into proportions of women with OP and OA deliveries who used hands and knees positioning would therefore be beneficial. It would provide understanding of its use in Canadian women and a basis for study on its use for fetal rotation.

1.2 Problem Statement

The OP fetal position occurs in as many as 35% of women's labours and creates many challenges and potential complications for both the mother and infant (Fitzpatrick et al., 2001). These can include prolonged labour, more complex deliveries, and postnatal complications for mothers and infants (Cheng, Shaffer, & Caughey, 2006; Fitzpatrick et al., 2001; Simkin, 2010). These outcomes can have long-lasting negative psychological effects for women (Alcorn et al., 2010; Simkin, 2010). Thus, POP positioning at birth, and its associated complications, place greater short and long-term burdens on the healthcare system compared with the OA position.

The hands and knees position is often used during labour in the clinical setting to rotate the fetus from an OP to an OA position (Hunter, Hofmeyr, & Kulier, 2007; Simkin, 2010); however, scientific evidence is lacking to support the use of this intervention. Finding an intervention that reduces the POP position in labour and birth, is supported by evidence, creates minimal expense, is easy to carry out, and is well accepted by women may not only reduce healthcare system costs and promote women's positive birth experiences, but also improve health outcomes for women and their babies. It is thus important to compare women delivering babies in the OP versus OA position on whether or not they used hands and knees positioning. It is also important to compare Canadian women in both groups for the presence of other factors associated with POP position, e.g. large fetuses, obesity, induction of labour (IOL); and outcomes that have been more commonly associated with POP positioning at birth. An

understanding of factors that contribute to OP positioning, and morbidities associated with its persistence can provide a basis for developing interventions, such as hands and knees positioning, that may reduce its incidence.

1.3 Significance

POP delivery contributes to a host of problems for both mothers and infants. Pain, longer labours, surgery, episiotomy, PPH and longer hospital stays are some of the negative sequelae associated with POP positioning in labour and at birth (Fitzpatrick et al., 2001; Ponkey et al., 2003; Senécal et al., 2005; Simkin, 2010). Furthermore, third and fourth degree perineal lacerations occur more frequently in OP delivery compared with OA delivery (Cheng, Shaffer, & Caughey, 2006; Fitzpatrick, McQuillan, & O'Herlihy, 2001). Pain, infection, and recurring tears with subsequent deliveries are some of the complications associated with perineal tears (Buppasiri, Lumbiganon, Thinkhamrop, & Thinkhamrop, 2010). Anal sphincter disruption can also occur and is associated with fecal incontinence in women, significantly impacting their quality of life (Wheeler & Richter, 2007).

Infants born in the OP position are more likely to be admitted to the neonatal intensive care unit (NICU), have lower Apgar scores, aspirate meconium-stained amniotic fluid, acquire neonatal hypoxic-ischemic encephalopathy (HIE), and suffer birth trauma, such as Erb's and facial nerve palsies (Badawi et al., 1998; Cheng, Shaffer, & Caughey, 2006b; Ghi et al., 2010; Pearl, Roberts, Laros, & Hurd, 1993). Consequently, OP delivery is more costly for the healthcare system due to increased transfers to high acuity units (such as the NICU), longer lengths of stay, and greater use of interventions in OP labour and birth (such as induction/augmentation, analgesia, and cesarean section) (Palencia et al., 2006; Senécal, Xiong, & Fraser, 2005).

Achieving births absent of risky medical and surgical interventions holds many benefits for women. Birth offers women the opportunity to "grow and change in life-expanding ways", to gain a sense of mastery and competency, and to positively enrich their relationships with family and friends (Humenick, 2006, p.1). Conversely, when birth experiences are complex, for example because of medical interventions and potential morbidities associated with POP labour and birth, psychological distress and suffering can result—even leading to conditions such as depression, anxiety and PTSD (Alcorn et al., 2010). Traumatic birth has been shown to impede maternal-infant attachment, negatively affect women's relationships with partners and family members, and discourage women from undertaking further childbearing (Alcorn et al., 2010).

Exploration of factors associated with POP versus OA births, including use of hands and knees positioning is important to inform care for Canadian childbearing women. Furthermore, examining proportions of women experiencing negative outcomes from POP versus OA births provides a foundation for developing interventions to remedy the OP malposition.

1.4 Statement of Purpose

The purpose of this retrospective, chart review study was to compare women who delivered infants in the OP position with women who delivered infants in the OA position on factors associated with POP position, such as high infant birth weight (>4000g), maternal BMI $\geq$30.00 kg/m^2, and exposure to epidurals, labour induction, and hands and knees positioning in labour. Additionally, proportions of women delivering in the OP and OA positions were compared in relation to experiencing PPH, 3rd or 4th degree tears, episiotomies, instrumental deliveries, prolonged labour, and delivering infants experiencing low five minute Apgar scores ($\leq$7). Finally, we sought to explore differences in ethnicity between OA and OP groups in this study.

1.5 Null Hypotheses

1. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position were exposed to hands and knees positioning.
2. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position had their labours induced.
3. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position used epidural analgesia (EA).
4. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position were classified as having a BMI $\geq$ 30.00 kg/m^2.
5. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position had infants with birth weights of > 4000g.
6. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position experienced third or fourth degree perineal lacerations.
7. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered babies in the OP position and the OA position had episiotomies.

8. Equivalent proportions of women delivering babies in the OP position and the OA position (matched according to maternal age, membrane status and parity) had instrumental deliveries.
9. Equivalent proportions of women delivering babies in the OP position and the OA position (matched according to maternal age, membrane status and parity) had PPHs.
10. Women delivering babies in the OP and OA positions (matched according to maternal age, membrane status and parity) had equivalent lengths of labour.
11. Equivalent proportions of infants of mothers (matched according to maternal age, membrane status and parity) who were delivered in the OP and OA position received five minute Apgar scores ≤7.

Chapter 2: Literature Review

This chapter presents a critical review of the literature available on POP position. The physical forces at play in fetal rotation are described, providing a theoretical basis for the study, and rationale for the use of the hands and knees position to rotate fetuses. Next, methods of diagnosing fetal position are outlined, including issues with obtaining reliable results. Finally, a review of the factors associated with the development of POP position is discussed, along with the maternal and neonatal morbidities associated with POP position.

2.1 A Biophysiological Theory to Guide Rotation of Fetal Malposition

The theory guiding this study was developed by Andrews and Andrews (2004). Their theory outlines how the physical forces of gravity, buoyancy and friction interplay as the fetus rotates and descends through the pelvis and birth canal. According to the theory, the hands and knees position optimizes these forces – combining gravity (which pulls the fetus downward) and buoyancy from the amniotic fluid to drive rotation, while also reducing friction against the uterine wall/pelvis to facilitate proper fetal positioning in labour.

The force of gravity places a general, downward pull on the fetus through the pelvis and birth canal. Gravity will also cause the heavy fetal back and head to move inferiorly to the lighter fetal limbs. Buoyancy is the force opposing gravity and pulls the fetus upwards. Andrews and Andrews (2004) write: "A body immersed in [amniotic] fluid...is buoyed with a force equal to the weight of the displaced fluid" (p.132), causing a continuous opposing force to gravity and a medium in which a fetus will "float" and can rotate. Finally, frictional forces impede movement of the fetus. This can be friction from movement, such as when the fetal back slides along the uterus or through the pelvis, or from rest (static friction), such as when the fetus lies against the uterine wall. When fetal movement is resisted by frictional forces it will take

longer for the presenting part to descend through the pelvis, and be more difficult for the fetus to rotate through various positions of the birth process, e.g., from a transverse, to LOA and OA position.

According to Andrews and Andrews (2004) the center of gravity of the fetus in the amniotic-fluid filled uterus misaligns with the center of buoyancy because the fluid is a consistent density compared to the uneven distribution of fetal mass, e.g. heavy fetal back. The resulting misalignment causes the two forces to create a "couple". A "couple" occurs when two forces act in opposite directions around an axis of rotation (Andrews & Andrews, 2004). When gravity and buoyancy act together on the fetus, a drive to rotate is set in motion. In order to rotate a fetus, the force of this couple must be stronger than the frictional forces at play that resist movement. Frictional force could result from the fetal occiput resting against the pelvis, the fetal back lying along the uterus, or the fetal back rubbing against the uterus as it moves.

2.1.1 Physical Theory and Hands and Knees Positioning

The hands and knees position occurs when a woman "is on her knees with thighs upright, torso horizontal, resting on hands or fists, with her head held in a comfortable position" (Andrews & Andrews, 2004, p.133). Hands and knees positioning, combined with a slightly arched lower back, facilitates a completely oval uterus, with no impingements from the thighs or maternal bone structures that could cause obstruction of movement (Andrews & Andrews, 2004). The theory holds that, if the fetus is in the OP position, the heavy back will lie along the superior portion of the maternal uterus and the couple created between gravity and buoyancy will cause rotation. Further, the widened pelvis and oval uterus occurring in this position will reduce the effects of friction (from the fetus rubbing against maternal tissue/bone structures).

2.1.2 Other Factors Influencing Rotation

Physical relaxation and timing of positioning influence the physical forces at play in rotation. Relaxation of the uterine muscles is an important component of successful rotation of the fetus (Andrews & Andrews, 2004). Contracted muscles create less room for movement of the fetus. Further, the rigid walls of the uterus create more frictional force. Andrews and Andrews (2004) suggest the use of relaxation techniques in early labour when trying to foster fetal rotation. It is logical then, that hands and knees positioning would be most effective in early labour when the uterus is most relaxed. Although theoretically Andrews and Andrews recommend use of hands and knees positioning when the uterus is relatively relaxed, they indicate it is possible to use the position at any time during labour.

Given the importance of buoyancy to rotation in this theory, it seems that an adequate amount of amniotic fluid would be necessary to facilitate rotation. In essence, the theory relies on a woman's membranes being intact so that sufficient fluid is available to provide buoyancy, and reduce friction. This theory fails to address the impact of ruptured membranes, i.e., the breaking of the fluid filled amniotic sac, on the potential for fetal rotation.

The influences of pelvic shape, pelvic outlet capacity, birth weight, and placental location on fetal rotation are also not addressed in the theory. Android, anthropoid and platypoid pelvises are more prone to contributing to fetal OP position as the narrow bi-temporal diameter of the fetal head is accommodated easily into the relatively small fore pelvis (Floberg, Belfrage, & Ohlsén, 1987; Holmberg, Lilieqvist, Magnusson, & Segerbrand, 1977; Sizer & Nirmal, 2000). These pelvic shapes may cause physical barriers to fetal attempts to rotate. Anterior placental location is another factor thought to be more common in OP presentation (Gardberg & Tuppurainen, 1994) whichmay also pose a physical barrier to fetal rotation and descent. Finally,

research shows that babies born in the OP position are larger than those delivered in the OA position (Cheng et al., 2006b; Lieberman et al., 2005; To & Li, 2000); rotation may be hindered due to increased friction from more fetal mass. Although pelvic shape, placental location, and birth weight are not modifiable factors, and their exact effects on OP labour and delivery are not clearly delineated in the literature. These variables serve as limitations for the theory because they were not addressed by Andrews and Andrews (2004).

2.2 Determining Fetal Position

Diagnosis of fetal position is traditionally ascertained by ultrasound, digital vaginal exams, Leopold's maneuvers, and visual observation in the clinical setting (Biancuzzo, 1993; Simkin, 2010). Clinically, diagnosis is valuable so that health care professionals can implement interventions that foster rotation and reduce the many risks associated with POP position. Furthermore, accurate diagnosis is necessary for the production of valid research. Examining varying techniques used to assess fetal position in the literature reveals inconsistencies in their accuracy. Various factors affect the reliability and validity of each technique, making proper diagnosis of OP position difficult.

2.2.1 Methods Used to Assess Position

Ultrasound is considered the gold standard for determining fetal position as it demonstrates the greatest reliability compared to any other indicators commonly used to diagnose OP position (Kreiser et al., 2001; Sherer, Miodovnik, Bradley, & Langer, 2002a; Simkin, 2010; Souka et al., 2003). Because it is neither feasible nor common practice on wards to routinely use ultrasound with women to determine fetal position, other methods are commonly used. These methods include digital vaginal exam, Leopold's maneuvers, locating fetal heart tones, observation of abdominal contours, and identifying maternal back pain in labour.

Digital vaginal exam (VE) is commonly used in the clinical setting to determine fetal position and help make decisions regarding care (Simkin, 2010). Many studies have examined the consistency of detecting fetal position between vaginal examination and the gold standard: ultrasound, and have shown similar results. In the literature, alignment between the two methods occurs in between 31% and 49% of women assessed, with most studies averaging around a 40% consistency rate (Akmal, Tsoi, Kametas, Howard, & Nicolaides, 2002; Nizard et al., 2009; Sherer et al., 2002a; Souka et al., 2003). These results show the lack of reliability of VE assessments because they are not accurate even half of the time. Consistency of VE assessments with ultrasound is considerably higher when women are fully dilated and access to the fetal presenting part is easier (Sherer, Miodovnik, Bradley, & Langer, 2002b).

During the second stage of labour, consistency of the VE with ultrasound increases. Dupuis et al. (2005) found agreement between vaginal examination and ultrasound to be as high as 80% during the second stage. Chou, Kreiser, Taslimi, Druzin, and El-Sayed (2004); Souka et al. (2003), and Sherer et al. (2002b) found consistency of VE with ultrasound at 72%, 66% and 39% of the time respectively during the second stage. While assessment of fetal position may be more reliable during the second stage, the concurrence is still relatively low considering the magnitude of decisions that can be made based on that information.

Some factors contribute to discrepancies between VEs and ultrasound. Dupuis et al. (2005) found that caput succedaneum (scalp edema) was a major predictive factor in lowering accuracy rates during the second stage of labour. Edema makes detecting suture and fontanel positioning difficult. Furthermore, OP and OT positions may generally be subject to much higher error rates than the OA position (Akmal, Kametas, Tsoi, Hargreaves, & Nicolaides, 2003; Dupuis et al., 2005).

Another method used to determine fetal position is Leopold's maneuvers, which have been used since the 1900's (McFarlin, Engstrom, Sampson, & Cattledge, 1985). Unfortunately, minimal research has been conducted to examine the validity of this technique. Two studies that look at the validity of the maneuvers show that Leopold's align with ultrasound 68-69% of the time (McFarlin et al., 1985; Sharma, 2009). Ridley (2007) found the consistency of Leopold's maneuvers with ultrasound to be less at 60.3%.

The location of fetal heart tones is also used to determine fetal position. It is thought that fetal heart tones can best be heard on the maternal flank when the fetus is in the OP position due to the position of its back (Biancuzzo, 1993). No studies, however, have validated this method and one obstetrical textbook even refutes the practice (Posner, Black, Jones, & Dy, 2013).

Many practitioners look for the "classic dip" in the maternal abdomen characteristic of OP position. This is due to the uneven contours of the limbs against the front of the uterus, compared to the smooth fetal back. Simkin (2010) writes that: "Observation of the abdominal contours is erratic, at best, and depends on the woman being lean, a normal amount of amniotic fluid, single fetus, fetal limbs being tucked out of the way, and other factors" (p.63). Simkin's observations suggest it is unlikely that observation of the abdominal wall is a consistent indicator of OP position.

Another sign commonly associated by care providers with OP position is maternal back pain (Biancuzzo, 1993; Hunter et al., 2007). One study looking at fetal OP malposition found that only 28% of women with a fetus in the OP position, diagnosed by ultrasound, experienced back pain compared to 29% of women with a fetus in the OA position (Lieberman et al., 2005). Although back pain occurs frequently in labour, no literature supported the claim that the OP position is the primary cause.

Ultrasound provides the most reliable assessment of fetal position; however, its use is generally impractical due to lack of equipment, training, and other feasibility factors. The use of VE could be beneficial if practitioners gained experience with the skill, received specialized training in the area, and combined its use with other methods of assessment of fetal position (Akmal et al., 2002; Ridley, 2007; Simkin, 2010). In light of the uncertainty associated with the methods presented to determine fetal position in labour — i.e., VE, Leopold's maneuvers, identifying location of fetal heart tones, observing abdominal contours, and identifying presence of back pain; fetal position at birth is the best confirmation of the presence of OP position in labour.

2.3 Factors Associated with POP Position

The literature presents many factors associated with the persistence of OP position. Evidence has been presented for ethnicity, artificial rupture of membranes (AROM), parity, epidural anesthesia (EA), birth weight, BMI, IOL, and maternal age as influences on fetal positioning.

2.3.1 Ethnicity

The incidence of OP position has been found to be higher among some ethnicities than others. Phillips and Freeman (1974) estimated the incidence of OP position to be approximately 3% in the Caucasian community. Conversely, research has shown rates to be as high as 30% amongst African and Chinese populations (Cheng et al., 2006a; Phillips & Freeman, 1974; To & Li, 2000). Briggs (1989) proposed that the higher incidence in African populations outside of North America could be attributed to malnutrition and resulting pelvic deformity (thus predisposing women to fetal malpositions). Although there is an apparent link in the literature between African and Chinese populations and POP positioning, the low prevalence of these

groups in the sample for the study, the low incidence of OP delivery, and the inconsistencies in how ethnicity is charted by healthcare providers, makes matching women on ethnicity unfeasible. The large South East Asian population in Surrey and Abbotsford offers an opportunity to report proportions of women experiencing POP for an ethnic group not previously studied.

2.3.2 Artificial Rupture of Membranes.

A number of studies have shown higher rates of POP position among women who had their membranes artificially ruptured compared to women whose membranes ruptured spontaneously (Cheng et al., 2006a; Sizer & Nirmal, 2000; To & Li, 2000). The literature is unclear about whether it is the AROM itself that promotes the OP position, or whether fetuses are already persistently posterior prior to AROM. AROM may become necessary when labour is impaired due to malposition. Given the theoretical implications of AROM on fetal position (less buoyancy from amniotic fluid and more friction), and the increase of POP position among women who received AROM observed in the literature, it would be important to match women on intact or ruptured membrane status in active labour when identifying the factors associated with POP fetal positioning and outcomes associated with POP compared with OA position.

2.3.3 Parity

The influence of parity on the incidence of POP position is well documented in the literature. Ponkey et al. (2003) conducted a retrospective study of American women and found that the incidence of POP position was twice as high in nulliparas compared with multiparas. Likewise, in Cheng et al.'s (2006a) study looking at the association between maternal characteristics and POP position, 10.3% of nulliparas had POP positioned fetuses, compared to 6.0% of multiparas. Other studies also have also supported the high incidence of OP

presentation among nulliparas compared to multiparas (Gardberg et al., 2011; Sizer & Nirmal, 2000; To & Li, 2000).

Parity also influences the incidence and severity of perineal lacerations in women with POP positioned fetuses; multiparity appears to be a protective factor against tearing. Researchers have suggested that multiparas experience significantly less perineal lacerations than primiparas (Ponkey et al., 2003; Salameh et al., 2011; Wheeler & Richter, 2007).

In addition to influencing the incidence of POP position and perineal lacerations, parity impacts length of labour. POP position has been reported to increase the length of the first and second stages of labour (Cheng et al., 2006a; Fitzpatrick et al., 2001; Lieberman et al., 2005; Senécal et al., 2005; To & Li, 2000), even when accounting for parity (Cheng et al., 2006a; Fitzpatrick et al., 2001). Based on the strong associations between parity and POP position, we have chosen to match our OA and OP groups on this variable.

2.3.4 Epidural Anesthesia

Many observational studies show significantly higher incidences of OP position at birth among women with epidural anesthesia (EA) compared to those without EA – especially if epidural placement occurred before engagement of the fetus (Klein et al., 2001; Le Ray et al., 2005; Lieberman et al., 2005; Robinson, Macones, Roth, & Morgan, 1996; Stremler, Halpern, Weston, Yee, & Hodnett, 2009). For example, Lieberman et al. (2005) found that, among American women with EA, 12.9% delivered a baby in the OP position compared to only 3.3% of women without EA. Furthermore, when they accounted for factors such as age, height, BMI, gestational age, and induction, women with EA were four times more likely to deliver a fetus in the OP position.

Lieberman and O'Donoghue (2002) conducted a systematic review looking at the association between fetal malposition and EA and found inconclusive evidence for the association. Many observational studies showed higher rates of OP (or OT) position amongst women with epidurals compared to those without (Kaminski, Stafl, & Aiman, 1987; Kanto, Erkkola, Mansikka, & Aärimaa, 1983; Khan, Khan, Rasul, & Chohan, 1993; Thorp et al., 1991). With observational studies, causation is difficult to ascertain as it is unknown whether women with fetal malpositions are more likely to request EA or whether the epidural itself promotes fetal malposition (Lieberman & O'Donoghue, 2002).

There are three randomized controlled trials that look at the association between EA and OP or OT position. One study showed a significant increase in fetal malposition amongst the 48 women in the EA group compared with the 45 women in the control group (Thorp et al., 1993); 18.8% of women in the epidural group had a malpositioned fetus, compared to only 4.4% in the control group. Unfortunately, the small sample size obtained in this study makes it difficult to ascertain a causal relationship. Two other RCTs conducted by Bofill et al. (1997) and Howell et al. (2001) have demonstrated much smaller differences in malposition rates between epidural and non-epidural groups, with the RR reported at 1.3 and 1.1 respectively. Furthermore, these studies had a high amount of crossover between treatment and control groups; 24-30% of the women in these studies did not receive their assigned treatment. Additional research is necessary to clarify the association between these variables. Due to the inconclusive evidence in the literature, it would be beneficial to explore differences in EA rates between women delivering POP as compared with OA positioned fetuses.

2.3.5 Birth Weight

An association between birth weight and POP position is also acknowledged in the literature. To and Li (2000) found that babies delivered in the OP position were significantly larger than babies delivered in the OA position, even after adjusting for gestational age. Sizer and Nirmal (2000) found similar results in their study showing that as birth weight increased, so did the incidence of the OP position at delivery. Other cohort studies comparing labour in the OP and OA positions also found higher birth weights among POP groups, especially when the birth weight exceeded 4000g (Cheng et al., 2006a; Cheng et al., 2006b; Lieberman et al., 2005). It is important to examine factors associated with POP position at birth, such as infant birth weight, given the support in the literature for a higher incidence of POP birth position among women with large fetuses.

2.3.6 Body Mass Index

BMI is a weight-for-height calculation that classifies adults as underweight, overweight, normal, or obese (World Health Organization, 2004). In Cheng et al.'s (2006a) retrospective cohort study of 31,392 term births, the researchers found that a BMI of $\geq$ 30.00 kg/m^2 was detected significantly more often in the OP group compared with the OA group ($p < .001$). Likewise, in a recent study looking at the effects of maternal positioning on anterior rotation of fetuses in labour, researchers also found a relationship between BMI and POP position (Desbriere et al., 2013); they found that a one unit increase in BMI was associated with a 6% decrease in rotation of fetuses from the OP position (diagnosed via ultrasound in labour) to the OA position (as determined at birth) (Desbriere et al., 2013). Therefore, it is important to compare women's BMI in matched groups of women with OP and OA fetal position at delivery to better understand factors associated with POP malposition.

2.3.7 Induction of Labour

A few studies have reported a relationship between induction of labour (IOL) and POP position at birth. Two retrospective cohort studies showed increased rates of IOL via oxytocin, AROM, or prostaglandin insertion among women who delivered OP positioned fetuses compared to those who delivered OA positioned fetuses, but their results were not statistically significant (Fitzpatrick et al., 2001; Ponkey et al., 2003). Other cohort studies have found a significant difference in the prevalence of POP position among women who were induced (Cheng et al., 2006b; Sizer & Nirmal, 2000). Due to the debate in the literature regarding the effects of IOL on POP position, comparing proportions of women in OP and OA delivery groups who experienced labour induction would provide some understanding of the association between IOL and fetal position at delivery.

2.3.8 Maternal Age

Finally, maternal age has been associated with OP position at birth in the literature. Ponkey et al. (2003) compared maternal characteristics for women who delivered OP fetuses and those who delivered OA fetuses and found that increased maternal age was associated with OP deliveries among the multiparous group, but not the nulliparous group. Similarly, To and Li (2000) found that women with OP or OT positioned fetuses were significantly older than those with OA positioned fetuses at birth. Another study showed that maternal age of greater than 35 years was associated with an increased risk of POP position at birth (Sizer & Nirmal, 2000). In light of the apparent links between maternal age and POP position, it is important to match women on this variable when comparing women delivering infants in the OA and OP positions to identify factors and morbidities associated with POP position.

2.3.9 Placental Insertion Site

Some literature has proposed that placental insertion site has an influence on fetal position. In Gardberg and Tuppurainen's (1994) study looking at whether anterior placental location increases the likelihood of OP presentation at term, they performed an ultrasound on 325 women with singleton pregnancies. They found that an anteriorly located placenta was seen more frequently in the OP group than in the OA group. They found similar results in their 1998 study looking at the development of POP position in labour (Gardberg & Tuppurainen). These studies were both conducted in pregnancy (>36 weeks) or early labour. No studies were found that explore the relationship between placental location and fetal position *during* labour. Because this study seeks to explore factors associated with POP position that occur during labour, and there is a lack of evidence supplied regarding the influence of placental insertion site on fetal position in labour, placental location will not be considered in this study.

2.4 Effects of Fetal Position on Birth Outcomes

In this section I summarize the maternal and fetal morbidity associated with POP position, including instrument use, perineal lacerations, episiotomy, prolonged labour, postpartum hemorrhage, and Apgar scores ≤ 7.

2.4.1 Instrument Use

Interventions used in the second stage of labour to achieve vaginal birth of the POP positioned fetus include vacuum and forceps extraction. Sizer and Nirmal (2000) found that 41.7% of women with POP positioned fetuses had an instrumental delivery, compared to only 13.7% of women with OA positioned fetuses. Similarly, To and Li (2000) found instrument use in OP deliveries to be much higher than in OA deliveries with a rate of 38.5% for women with OP positioned fetuses compared to only 18.7% with OA positioned fetuses. Other studies also

show increased instrument deliveries among POP positioned fetuses compared to OA positioned fetuses (Cheng et al., 2006a; Fitzpatrick et al., 2001; Gardberg et al., 1998; Senécal et al., 2005). The studies reported here involved populations across the United States, France, the United Kingdom and China; a Canadian study that incorporates an examination of the proportions of women with POP positioned fetuses experiencing instrumental deliveries would add to our understanding of the relationship between POP position and instrument use in a Canadian sample.

2.4.2 Perineal Trauma and Episiotomies

The incidence of 3rd and 4th degree perineal lacerations is considerably higher among women who deliver babies in the POP position compared to the OA position (Cheng et al., 2006a; Fitzpatrick et al., 2001; Pearl et al., 1993; Senécal et al., 2005). Fitzpatrick et al. (2001) stated that perineal lacerations not only occurred more commonly in OP deliveries, but that the risk of anal sphincter disruption increased as much as seven-fold. The severe perineal trauma associated with OP position at birth and the potential for interventions such as hands and knees positioning to decrease its occurrence provide incentive to compare perineal trauma among women delivering OA and OP positioned fetuses.

The use of episiotomy is higher among women with POP positioned fetuses compared to those with optimally positioned fetuses; this is due in part to the high rate of instrument use among women delivering POP positioned babies (Pearl et al., 1993; Senécal et al., 2005). The relatively large head diameter that occurs with POP positioning increases both the use of episiotomy and the risk of the episiotomy extending into a third or fourth degree perineal laceration (Bodner-Adler et al., 2001). Extension of median and mediolateral episiotomies into third and fourth degree perineal tears is a common complication of episiotomies (Jones, 2000).

Given the evidence, comparing proportions of women with OA and OP positioned infants at birth who had episiotomies would be important to provide evidence about risks for women in that group.

2.4.3 Prolonged Labour

The association between OP position and prolonged labour is well-documented in the literature (Cheng et al., 2006a; Fitzpatrick et al., 2001; Lieberman et al., 2005; Senécal et al., 2005; To & Li, 2000). Prolonged labour, in this case, is largely due to the deflexed head (and resulting larger head circumference that must pass through the pelvis) often accompanying the malposition (Simkin, 2010). Cheng et al. (2006a) found that 93.2% of women in the OA group had first stage labours lasting less than 18 hours, compared to only 6.8% of women in the OP group. Results remained statistically significant when data were stratified by parity. Women labouring with a fetus in the OP position are also at more than twice the risk of having a prolonged second stage of labour (greater than three hours) compared to women with fetuses in the OA position (Cheng et al., 2006a). In short, the OP position predisposes women to prolonged labour of over 18 hours in the first stage and between 2.5 and 5.5 hours in the second stage (Cheng et al., 2006; Senécal et al., 2005). Thus, it is important to compare Canadian women delivering infants in the OA position with women delivering infants in the OP position on lengths of first and second stages of labour.

2.4.4 Postpartum Hemorrhage

Postpartum hemorrhage is more prevalent among women with fetuses in the POP position. Senécal et al. (2005), in their retrospective cohort study on North American and Swiss women, found that blood loss of greater than 500mL was significantly more common among women delivering fetuses in POP position compared to their OA counterparts. Likewise, in

Cheng et al.'s (2006a) retrospective study of American women, 14.0% of women with OA positioned fetuses had a PPH, compared to 31.1% of women with POP positioned fetuses. Comparing the proportions of Canadian women delivering POP positioned fetuses and women delivering OA positioned fetuses with PPH would further our understanding of the risks of fetal position for PPH.

2.4.5 Apgar Scores

The POP position is also associated with neonatal morbidity. Apgar scores are assessed following birth to determine infants' adaptation to the extrauterine environment. Infants born in the OP position have demonstrated significantly lower five minute Apgar scores than those born in the OA position (To & Li, 2000). Five minute scores of ≤ 7 have been shown to be 1.5 times more likely in babies born in the OP position compared with the OA position (Cheng et al., 2006b). Sénecal et al. (2005) also reported an increase in 5 minute Apgar scores ≤7 in nulliparous POP deliveries compared with nulliparous OA deliveries. Because Apgar scores provide insight into fetal well-being at birth, comparison of proportions of infants who were delivered OA versus OP at birth, experiencing Apgar scores of ≤ 7 at 5 minutes is warranted.

2.5 Maternal Positioning in Labour

The benefits of maternal positioning in labour are well documented in the literature. Positioning to promote the effects of gravity in labour has been shown to reduce pain, decrease the length of labour, increase the quality of contractions, facilitate fetal descent, decrease dystocia in labour, improve maternal-fetal circulation, and decrease perineal tears and the use of episiotomies (Adachi, Shimada, & Usui, 2003; Caldeyro-Barcia, 1979; Gupta & Nikodem, 2000; Liu, 1989; Simpson & James, 2005; Zwelling, 2010). The hands and knees position has been commonly recommended to women in the clinical setting since the 1950's (Puddicombe, 1955).

Benefits of the hands and knees position found in the literature include: improving uterine blood flow, mobilizing the coccyx and expanding the pelvis, decreasing pain, using gravity to promote descent, and increasing the internal transverse diameter of the pelvis (Fenwick & Simkin, 1987; Hart & Walker, 2007; Stremler, 2006; Stremler et al., 2009).

In Stremler's (2006) study on hands and knees positioning in labour, women found the position comfortable and "acceptable". Most women stated they would use the position again and thought that the position helped them progress in their labours. Women who used the position in their study also reported significantly less back pain than those who did not. While persistent back pain is not a reliable indicator of OP fetal position (Lieberman et al., 2005; Melzack & Schaffelberg, 1987), it is possible that hands and knees positioning decreases persistent back pain regardless of fetal position.

Stremler's (2006) study is the only randomized controlled trial conducted to compare hands and knees positioning with usual care in labour, with an outcome of rotating fetuses from OP to OA position. The multi-centered RCT had women in the intervention group spend a minimum of 30 minutes out of the one hour study period in the hands and knees position during labour. Diagnosis of fetal position was reliably determined by ultrasound. Outcomes from comparing the intervention group with the usual care group indicated that women, in the hands and knees intervention group expressed higher satisfaction with their positioning in labour than women in the usual care group. Further, persistent back pain scores were significantly reduced following hands and knees positioning among women in the intervention group.

While 16% of fetuses changed to OA position in the intervention group compared to 11% in the control group, the difference in proportions was not statistically significant (RR 2.42, 95% CI: 0.88-6.62). It is possible that the study was not powered sufficiently to detect a significant

difference. The sample size was 147 subjects, but a sample size of 364 women would be necessary to sufficiently power the study to detect the 9.2% rotation rate (from OP to OA) observed in the intervention group (Stremler, 2006). Further studies are necessary to determine whether hands and knees positioning in labour is effective in rotating OP fetuses during labour.

Chapter 3: Methods

This section describes the details, structure and rationale for the retrospective, nested case-control pilot study conducted. The strengths and limitations of health record review methodology are discussed. Next, the study's null hypotheses and operational definitions are outlined. Ethical considerations are described, followed by a description of the sample, including selection procedure, and inclusion and exclusion criteria. Finally, the data abstraction tool, power analysis, and plan for analysis are discussed.

In this retrospective nested case-control study, hospital charts at a mid-size community hospital were reviewed to compare women delivering infants in the OP and OA position on exposure to factors associated with POP position, such as high infant birth weight, maternal obesity, epidural, labour induction, hands and knees positioning in labour, third or fourth degree perineal lacerations, episiotomies, prolonged labour, postpartum hemorrhage, and 5 minute Apgar scores ≤ 7. Because few studies exist examining the relationship between hands and knees positioning and POP fetal position (especially among Canadian women), it was pragmatic to conduct a pilot study comparing women's exposure to the variables from an existing data set before mounting a full-fledged prospective study. Furthermore, chart reviews are an efficient and cost-effective method to explore areas of new research (Gearing, Mian, Barber, & Ickowicz, 2006).

3.1 Retrospective, Health Record Review Methodology

Retrospective research "requires the analysis of data that were originally collected for reasons other than research" (Gearing et al., 2006, p.127). A chart review is a retrospective method of research involving the collection of data from hospital records. A chart review was a useful approach for this study given the extensive nature of hospital records available in the

perinatal field and the intent to compare women experiencing OA and OP deliveries on a variety of variables. There are provincial mandates for recording many of the variables of interest, specifically, fetal position at birth, patient demographics, ROM, birth weight, maternal position in labour, perineal lacerations, episiotomy, mode of delivery, BMI, postpartum hemorrhage, epidural use, and Apgar scores (Appendix A-D). Given the rare incidence of POP position (approximately 5% of deliveries), the retrospective chart review also had the advantage of drawing out many cases of POP births at once (Fitzpatrick et al., 2001; Gardberg et al., 2011; Ponkey et al., 2003; Sizer & Nirmal, 2000). Considerable time and effort would have been necessary to achieve the desired sample size by gathering sample subjects prospectively.

This study compared the proportions of women exposed to various factors influencing POP position in equivalent numbers of women in POP and OA delivery groups, matched on the variables of parity (nulliparous versus primiparous/multiparous), maternal age (>35 years, or ≤ 35 years), and condition of membranes (intact versus ruptured before active labour). Comparison of groups required identification of proportions of women exposed to the hands and knees position, infant weight > 4000g, BMI ≥ 30.00 kg/m^2, epidural, and labour induction. Data were also collected to describe proportions of women experiencing postpartum hemorrhage, third and fourth degree tears, episiotomy, instrumental delivery, prolonged labour, and delivery of infants with Apgar scores ≤ 7, in POP and OA delivery groups. Finally, a comparison of maternal ethnicity in POP and OA delivery groups was undertaken.

3.1.1 Study Limitations

Retrospective studies are limited by a variety of factors. Firstly, they depend on the availability of charts. Furthermore, when charts are available, the quality of the charting can be questionable — e.g., missing information, use of non-standardized acronyms, jargon, and

illegible script (Gearing et al., 2006). Researchers performing chart reviews must rely on the record keeping of others to provide their variables of interest, thereby, decreasing the reliability of the data (Gearing et al., 2006).

As opposed to prospective studies, retrospective studies are a poor choice to determine cause and effect of variables (Gearing et al., 2006). Without blinding and randomization it is difficult to control bias and confounding variables ((LoBiondo-Wood, Haber, Cameron, & Singh, 2004). The retrospective nature of this study limited the statistical tests and analyses that could be performed on the POP and OA delivery groups, i.e., we were unable to determine whether interventions in labour were able to rotate fetuses because we could not reliably determine fetus' original positions in labour prior to intervention.

Another limitation of retrospective studies in which matched control groups are formed is that they are prone to selection bias as they require that both the cases and controls are representative of the same "target population" (Geneletti, Richardson, & Best, 2009). Although there was only one data abstractor, selection and reviewer bias were minimized by using the same inclusion/exclusion criteria on all charts and by systematically screening charts (one by one from the last day of each month until all matches to OP deliveries were found for each month). Due to ethical constraints, data abstraction tools were not able to be audited by committee members for completeness and accuracy. The sole data abstractor reviewed each record prior to completion because the form would not be able to be linked back to the patient again. Finally, in retrospective reviews there is the potential for historical sampling bias whereby conditions that could influence the variables change over time.

3.2 Null Hypotheses

1. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position were exposed to hands and knees positioning.
2. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position had their labours induced.
3. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position used epidural analgesia (EA).
4. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position were classified as having a BMI $\geq$ 30.00 kg/m^2.
5. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position had infants with birth weights of > 4000g.
6. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position experienced third or fourth degree perineal lacerations.
7. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position had episiotomies.

8. Equivalent proportions of women delivering infants in the OP position and the OA position (matched according to maternal age, membrane status and parity) had instrumental deliveries.
9. Equivalent proportions of women delivering infants in the OP position and the OA position (matched according to maternal age, membrane status and parity) had PPHs.
10. Women delivering infants in the OP and OA positions (matched according to maternal age, membrane status and parity) had equivalent lengths of labour.
11. Equivalent proportions of infants of mothers (matched according to maternal age, membrane status and parity) who were delivered in the OP and OA position received five minute Apgar scores ≤7.

3.3 Operational Definitions

In this section, the operational definitions of the variables to be measured are provided. The method of measurement of both hands and knees position as well as fetal position at delivery is described. Other exploratory and matching variables are also defined including: perineal lacerations, episiotomy, instrumental delivery, length of labour, epidural anesthesia, labour induction, BMI, Apgar scores, birth weight, maternal age, ethnicity, ROM, and parity.

3.3.1 Fetal Position at Delivery

OP and OA deliveries were defined by their respective checkmark boxes on the *Labour and Birth Summary Record* (Appendix A). In an OP delivery the occiput of an OP positioned fetus will lie along the posterior portion of the maternal pelvis when the head is delivered. In contrast, the occiput of an OA positioned fetus will lay along the symphysis pubis as the head is delivered.

3.3.2 Hands and Knees Position

On the Fraser Health Authority's *Labour Partogram* (Appendix B), maternal position in labour is documented every thirty minutes in the first stage. The presence of hands and knees position was ascertained through one or more thirty-minute interval "boxes" having "HK" written in them. When "HK" is charted, there is an assumption that a patient was placed in hands and knees position in a way very similar to this description of hands and knees positioning reported in the literature: "On her knees with thighs upright, torso horizontal, resting on hands or fists, with her head held in a comfortable position" (Andrews & Andrews, 2004, p.132).

3.3.3 Labour Induction

Labour induction was defined as any use of cervical ripening agents (i.e., a 10mg dinoprostin strip or 1mg dinoprostin gel – the only two agents used at this site) and/or oxytocin intravenous infusion. This is documented under number two of the *Labour and Birth Summary Record* (Appendix A) with a "tick" in the "Induced"; "Oxytocin", and/or "Prostaglandin" boxes.

3.3.4 Epidural Anesthesia

Epidural anesthesia is a pain relief method whereby medication is continuously administered into the epidural space of the spine, blocking spinal nerve roots (and thus sensation) (Pillitteri, 2010). In this study it was determined by the presence of a mark in the" Epidural" tick box of the "Labour" section under the "Analgesia/Anaesthesia" heading of the *Labour and Birth Summary Record* (Appendix A).

3.3.5 Birth Weight

The infants' birth weights were collected, in grams, from the *Labour and Birth Summary Record* (Appendix A) under the "Weight" heading.

3.3.6 Body Mass Index

The BMI was developed by the World Health Organization (WHO) to classify individuals as underweight, normal weight, overweight, or obese (WHO, 2004) (Table 3.1). BMI is a ratio of weight (kg) to height (m^2). The BMI value was collected from the *Perinatal Triage and Assessment Record* (Appendix C), or the *British Columbia Antenatal Record Part 1* (Appendix D), and classified as Obese ($\geq$ 30.00 kg/m^2) or not obese (< 30.00 kg/m^2).

Table 3.1 Classification of BMI

Body Mass Index (kg/m^2)	**Classification**
<18.50	Underweight
18.50 – 24.99	Normal weight
25.00 – 29.99	Overweight
≥30.00	Obese

3.3.7 Rupture of Membranes

The OA and POP groups were matched according to membrane status (ruptured or intact) in early labour. The time of ruptured membranes and commencement of active labour (first stage) is documented on the first page of the *Labour and Birth Summary Record* (Appendix A) under "Time Summary". Early rupture was defined by having the time of ROM (AROM or SROM) occur prior to the time of "1st Stage" labour.

3.3.8 Ethnicity

Ethnic origin was collected from the *British Columbia Antenatal Record Part 1* (Appendix D), number one.

3.3.9 Parity

Women were matched according to parity – either nulliparous or primiparous/multiparous, as outlined on the *British Columbia Antenatal Record Part 1* (Appendix D) in the Obstetrical History. Nulliparous women had a "0" under the "Term" and "Preterm" headings. Primiparous/multiparous women had 1 or more term or preterm deliveries noted.

3.3.10 Maternal Age

Maternal age was collected from the *British Columbia Antenatal Record Part* 1 (Appendix D) under the "Age at EDD" section. Women in each group (OA or POP) were matched according to whether they were >, or ≤ 35 years old.

3.3.11 Perineal Lacerations

Perineal lacerations were categorized according to which tick box was marked on the *Labour and Birth Summary Record* (Appendix A): intact, first, second, third, or fourth degree laceration.

3.3.12 Episiotomy

An episiotomy is "[A] surgical incision of the perineum that is made both to prevent tearing of the perineum and to release pressure on the fetal head with birth" (Pillitteri, 2010, p.389). Episiotomy was defined by the marking of the "episiotomy" and either the "midline" or "mediolateral" tick boxes on the *Labour and Birth Summary Record* (Appendix A).

3.3.13 Instrumental Delivery

Instrumental delivery included both vacuum and forceps delivery. On the *Labour and Birth Summary Record* (Appendix A), instrument aldelivery had either the "vacuum" tick box or one of the forceps tick boxes ("outlet", "low", "mid", or "rotation") marked.

3.3.14 Length of Labour

Length of labour was recorded in hours and minutes for both first and second stages of labour as is determined under the "Time Summary" of the *Labour and Birth Summary Record* (Appendix A).

3.3.15 Apgar Score

The Apgar score is a standardized infant assessment scale based on an infant's heart rate, respiratory effort, muscle tone, reflex irritability and colour (Pillitteri, 2010). Infants are assessed at 1 minute and 5 minutes after birth (Pillitteri, 2010). The scores were determined from the *Newborn Record Part 1*, number two: "Apgar Score".

3.3.16 Postpartum Hemorrhage

PPH was defined as >500ml estimated blood loss as marked on the *Labour and Birth Summary Record* (either "500-1000ml" or " >1000ml" were ticked) (Appendix A).

3.4 Ethical Considerations

Ethical approval for this study was obtained from the University of British Columbia's ethics board and the Fraser Health Authority's (FHA) ethics board prior to accessing patient charts. The last date of patient data (07/14) occurred prior to the first date of data collection (11/14). Access to charts required approval from various departments at FHA. Ethical approval involved gaining permission from both the Health Records and Business and Analytics Departments at FHA. Next, access from the Privacy and Security Offices was gained through a *Data Access and Agreement Form* which involved ensuring that proper data encryption and hardware/software security measures were met based on the Freedom of Information and Privacy Act (FOIPPA) and standards set by FHA specifically. The FHA Privacy Office required record of the computers and USB devices used for data collection and storage as well as information

regarding the transfer of data between people/devices. Following approval from the Privacy Office, access was granted to patient records from the Security Office at FHA (to ensure that standards from both ethical and privacy standpoints were maintained). Finally, once permission was granted from the ethics, privacy and security offices, a request was made from FHA's Health and Business Analytics to draw out records (and variables of interest) as were approved by ethical and access agreements.

Patient charts were viewed on site at the mid-sized community hospital, in the Electronic Medical Records (EMR) database. Each record was assigned a numeric value (subject number), and no personal identifiers (i.e., date of birth, initials, name, personal health number, social insurance number, hospital number, address/phone numbers) were collected. Data abstraction forms were stored in a locked file cabinet in a locked office on the Maternity unit. The list of hospital records and coded data available from FHA's Business and Analytics department were stored on an encrypted USB device provided by the FHA Privacy Office, and stored in a separate locked office on the Maternity unit at the hospital. Staff members, with access to these rooms, were aware of the confidential information stored and how to maintain this confidentiality – i.e., ensuring a locked office and file cabinet. Committee members did not have access to patient charts, but did have access to the SPSS document containing de-identified data only. In addition to the researcher's personal laptop and the USB device, only Dr. Hall's computer was granted permission to store and handle data.

3.5 Sample and Data Collection Procedure

A convenience sample was obtained by requesting (from Health and Business Analytics) the hospital records of all women who delivered an OA or OP positioned, term, singleton baby between January 1, 2011 and July 15, 2014 at the mid-sized community hospital. The Health

and Business Analytics department is responsible for coding the data of interest into the BC Perinatal Data Registry (BCPDR), and as such was able to provide the researcher with the hospital numbers of patients who met inclusion and exclusion criteria. Health records from 2011 onward were chosen because the *British Columbia Labour Partogram* (Appendix B) was revised at this time to include a standardized assessment of maternal positioning in labour. Data collection occurred at the hospital and was recorded on a hardcopy Data Abstraction Tool (DAT) (Appendix E). Data collected included: maternal age, position at delivery (OA or OP), use of induction, use of epidural, assisted delivery, degree of perineal laceration, estimated blood loss, time of ROM, spontaneous or artificial ROM, length of first and second stage labour, one and five minute Apgar scores, presence/absence of hands and knees positioning, number of thirty minute hands and knees positioning intervals, ethnicity, and parity.

Due to the small number of OP deliveries compared to OA deliveries in the study period, OP deliveries were selected first. The researcher began scanning records starting from the most recent month (July 2014). The last OP delivery of the month was reviewed for eligibility criteria, and if appropriate it was selected for the study; if the delivery did not meet eligibility criteria, then the second last OP delivery was reviewed, and so forth, until an OP delivery for that month was selected. An OP delivery was selected for each month of the review (43 months). The remaining seven OP deliveries were selected by starting from where the researcher concluded in July, 2014, and continuing until 7 more records were obtained from preceding months, ending in January, 2014. Although there were 188 OP deliveries present in the study period, our power analysis revealed that only 75 cases were necessary. As a result, this method of sampling over time seemed like an appropriate systematic method to sample the population of interest.

The hospital numbers of women with OA positioning for term, singleton deliveries were also requested from the Health and Business Analytics Department so that each OP delivery subject could be matched with an OA delivery (according to age, parity and ROM). For every OP delivery, an OA match was sought from the same delivery month. Records were scanned, starting with the most recent delivery of that month and moving towards the first delivery of the month. OA records were selected when they met inclusion and exclusion criteria; matched the maternal age, parity, and timing of ROM variables; and occurred in the same month as the OP delivery selected. Matches were not difficult to obtain due to the large difference in OP and OA delivery rates. After OA records were manually reviewed and a match found, collection of the remaining data of interest (as listed in the previous paragraph) were documented on the DAT (Appendix E).

Charts were excluded if any of these factors were present: twin pregnancy, cesarean delivery, vaginal birth after cesarean section, preterm delivery, or oligohydramnios. Originally, it was planned to collect charts from a larger tertiary care hospital in addition to the mid-sized community hospital; however, the required sample size was achieved using charts from the mid-sized community hospital only. Thus, it was unnecessary to include subjects from the large, tertiary hospital. When data were cleaned, any chart found to have greater than 20% missing data was excluded.

3.6 Power Analysis

An a priori power analysis was conducted using the program G*Power to determine the sample size for this study (Faul, Erdfelder, Buchner & Lang, 2009). The sample size was calculated based on plans for a chi-square analysis comparing OA/OP birth and the presence/absence of hands and knees positioning in labour. A moderate effect size (RR 2.4, 95%

CI: 0.88-6.62) was chosen based on the only existing trial on hands and knees positioning in labour (Stremler, 2006). A Bonferroni correction was calculated for the alpha level based on the ten planned chi-square analyses and one Mann-Whitney *U*, yielding an alpha level of .005. A sample size of 144 was necessary to detect a significant difference between variables for a two-tailed analysis given an effect size of 0.3, an alpha of .005, a power of .8, and degree of freedom of 1. A review of 150 records was undertaken, slightly exceeding the recommended sample size, to ensure an adequate sample size after accounting for missing data.

3.7 Measures

The data collected and their units of measure are outlined in Table 3.2.

Table 3.2 Unit of Measure for Variables Collected

Variable Collected	**Unit of Measure**
Outcome Variable	
Position at Delivery	OA or OP
Labour Characteristics	
Induction of Labour	Yes or No
Epidural Anesthesia	Yes or No
Birth weight	> 4000 or ≤ 4000 (g)
Body Mass Index	≥ 30.00 or < 30.00 (kg/m^2)
Matching Variables	
Maternal Age	> or ≤ 35 (years)
Membrane Status	Ruptured before or after "First Stage Labour"
Parity	Nulliparous or Primiparous/Multiparous

Table 3.2 Unit of Measure for Variables Collected

Variable Collected	Unit of Measure
Descriptive Variables	
Ethnicity	Open-ended response
Perineal Laceration	Intact, First, Second, Third, Fourth
Episiotomy	Yes or No
Instrumental delivery	Yes or No
Length of Labour	Hours and minutes
Postpartum Hemorrhage	< 500 or ≥ 500 (ml)
Apgar Score	0 – 10 (interval scale)

3.8 Analysis

A codebook was created to assign names, labels, and numeric codes for variables and missing data. Data were entered into IBM's Statistical Package for the Social Sciences (SPSS) data analysis program. The data were then cleaned and prepared for data analysis by checking for duplicate entries, accounting for missing values, ensuring that all of the columns had the same type of data in them, and looking at frequency tables, histograms or scatterplots to assess whether the data "made sense" (e.g. outliers, skewness, and kurtosis). The Kolmogorov-Smirnov test was used to assess for normality of data, determined by $p > .05$. The chi-square test was used to compare hands and knees positioning (presence or absence), and other categorical variables, i.e., IOL, EA, BMI, birth weight, instrument deliveries, PPH, perineal lacerations, and episiotomies, between OP and OA delivery groups. Results of the chi-square analyses for

instrument delivery, severe perineal lacerations, and episiotomy were also stratified by parity because of the known influence of parity on these variables. Infants' birth weights were further explored using the student's *t*-test. Fisher's exact test was used to compare proportions of infants experiencing Apgar scores ≤ 7 and proportions of women by ethnicity in OA and OP delivery groups. Differences in lengths of labour between OA and OP delivery groups were compared using the Mann-Whitney *U* because data were not normally distributed. Based on the Bonferroni calculation, a *p* value of <.005 was used to determine statistical significance.

3.9 Conclusion

A retrospective, chart review study was undertaken to explore the factors and morbidities associated with POP position at delivery. Ethical approval for this review was obtained from the University of British Columbia's and FHA's ethics boards. Further approval was granted from FHA's Health Records, Business and Analytics, Security, and Privacy departments prior to accessing charts. One-hundred and fifty health records of women delivering term, singleton infants were selected from a mid-sized community hospital. The 75 OP and OA deliveries were matched according to maternal age, timing of rupture of membranes, and parity. Groups were compared on exposure to hands and knees positioning, labour induction, EA, BMI's classified as obese, and large fetuses (> 4000g) in labour. Furthermore, an exploration of maternal and fetal morbidity associated with POP position – including severe perineal lacerations, episiotomies, prolonged labour, instrument delivery, postpartum hemorrhage, and infant Apgar scores ≤ 7 – was undertaken to clarify the risks associated with POP position in a Canadian context.

Chapter 4: Results

This chapter describes the study sample and the results from testing the study hypotheses. Prior to analysis, the data were cleaned by checking for duplicate entries, accounting for missing values, and ensuring that all of the columns had the same type of data in them. Boxplots were used to visualize outliers, skewness and/or kurtosis of continuous variables. The Kolmogorov-Smirnov test was used to test the normality of data, determined by $p > .05$.

4.1 Sample Characteristics

Patient demographics, including parity, age (> or ≤ 35 years), ethnicity, and timing of ROM (before or during active labour) were collected. The majority of patients were ≤ 35 years old (92%), multiparous (the delivery reviewed was their second or more preterm/term delivery) (58.7%), and had their membranes ruptured in active labour (58.7%). Women whose reviewed deliveries were their first viable deliveries were termed "primiparas" and women whose reviewed deliveries were their second or subsequent deliveries were termed "multiparas" for the purpose of describing the results. The majority of the sample were Caucasian for both OA (61.2%) and OP (46.8%) groups. This high proportion was followed by proportions of women with South Asian/East Indian ethnicity at 20.4% and 34% for OA and OP groups respectively. No significant association was found between ethnicity and fetal position at delivery using Fisher's exact test, $p = 0.139$. Subjects were matched according to age, parity, and timing of ROM, so no differences between groups were expected for these variables. Table 4.1 outlines demographic variables for OA and OP groups.

Table 4.1 Characteristics of Study Participants for OA and OP Groups

Demographic Variables	**All** ***N* = 150**	**Occiput posterior** ***n* = 75**	**Occiput anterior** ***n* = 75**	***p***
Age, *n* (%)				
≤35 years	140 (92)	70 (92)	70 (92)	
>35 years	10 (8)	5 (8)	5 (8)	
Parity, *n* (%)				
Primiparous[a]	62 (41.3)	31 (41.3)	31 (41.3)	
Multiparous	88 (58.7)	44 (58.7)	44 (58.7)	
ROM timing, *n* (%)				
Early ROM	62 (41.3)	31 (41.3)	31 (41.3)	
ROM in active labour	88 (58.7)	44 (58.7)	44 (58.7)	
	All ***N* = 96**	***n* = 49**	***n* = 47**	
Ethnicity n (%)				.139[b]
Caucasian	52 (54.2)	30 (61.2)	22 (46.8)	
South Asian/East Indian	26 (27.1)	10 (20.4)	16 (34.0)	
Aboriginal	4 (4.2)	4 (8.2)	0 (0)	
Dutch	4 (4.2)	1 (2.0)	3 (6.4)	
African American	1 (1.0)	0 (0.0)	1 (2.1)	
Philipino	2 (2.1)	0 (0.0)	2 (4.3)	
European	2 (2.1)	1 (2.0)	1 (2.1)	
Chinese	3 (3.1)	2 (4.1)	1 (2.1)	
South African	2 (2.1)	1 (2.0)	1 (2.1)	

[a] Primiparous at the time of matching; that is, the delivery reviewed was the woman's first delivery.
[b] Fisher's Exact test

4.2 Hands and Knees Positioning

Data regarding the presence of hands and knees positioning in labour, as noted by the presence of "HK" written in any of the 30-minute interval boxes during first stage labour, were collected (Appendix B). Forty-three out of 137 women used hands and knees positioning in labour (data were missing for the remaining 13 women in labour). For the 43 women who used hands and knees positioning, 39 out of 124 total intervals, were spent in the hands and knees position. Hands and knees episodes ranged from as little as 1 out of 24 intervals to as much as 2 out of 3 intervals. The maximum amount of intervals spent in hands and knees positioning was 7 (out of 29 intervals).

When analyzing the use of hands and knees positioning between OA and OP groups, the presence of hands and knees position in one or more 30-minute interval box did not differ significantly between OP and OA delivery groups ($\chi^2(1) = .372$, df = 1, $p = .542$, $\phi = .052$). Results are summarized in Table 4.2. Data were missing for six women in the OA group and 7 women in the OP group.

Table 4.2 Hands and Knees Positions for OA and OP Groups

Presence of Hands and Knees, *n* (%)	**All *n* = 137**	**Occiput posterior *n* = 68**	**Occiput anterior *n* = 69**	**Chi-Square**	**df**	**Asymp.Sig (2-sided)**
Presence	43 (31.4)	23 (33.8)	20 (29.0)	.372	1	.542
Absence (Usual positions)	94 (68.6)	45 (66.2)	49 (71.0)			

OP and OA groups were also compared on the number of 30 minute intervals spent in HK by each woman. These data were not normally distributed, so the Mann-Whitney *U* was used to test for a significant difference between OA and OP groups. The Mann-Whitney *U* test

did not demonstrate a significant difference between the number of 30 minute intervals spent in hands and knees positioning between women delivering infants in the OP position (Mdn = .00) and the OA position (Mdn = .00), $U = 2{,}492.00$, $p = .443$.

4.3 Induction of Labour

A chi-square analysis indicated that women in OA and OP delivery groups had similar rates of induction, $\chi^2(1) = .141$, $p = .707$, $\phi = .031$.

Table 4.3 Spontaneous or Induced Labour for OA and OP Groups

Induction of Labour, n (%)	All N=150	Occiput posterior N=75	Occiput anterior N=75	Chi-Square	df	Asymp.Sig (2-sided)
Spontaneous labour	112 (74.7)	57 (76.0)	55 (73.3)	.141	1	.707
Induced labour	38 (25.3)	18 (24.0)	20 (26.7)			

4.4 Epidural Analgesia

Exposure to epidural analgesia in labour did not differ significantly between OP and OA delivery groups, $\chi^2(1) = 3.019$, $p = .082$, $\phi = .142$.

Table 4.4 Presence or Absence of Epidural for OA and OP Groups

Epidural Analgesia, n (%)	All *N*= 150	Occiput posterior *n* = 75	Occiput anterior *n* = 75	Chi-Square	df	Asymp.Sig (2-sided)
Epidural	35 (23.3)	22 (29.3)	13 (17.3)	3.019	1	.082
No epidural	115 (76.7)	53 (70.7)	62 (82.7)			

4.5 Body Mass Index

The proportions of women classified as obese (≥30.00 units) were not statistically significantly different between women delivering infants in the OA and OP positions, $\chi^2(1) = 1.048$, $p = .384$, $\phi = .114$. Data regarding BMI were missing for 69 of the 150 records reviewed.

Table 4.5 Obese Body Mass Index for OA and OP Groups

Body Mass Index, n (%)	**All *N*= 81**	**Occiput posterior *n* = 39**	**Occiput anterior *n* = 42**	**Chi-Square**	**df**	**Asymp.Sig (2-sided)**
< 30.00 kg/m^2	67 (82.7)	34 (87.2)	33 (78.6)	1.048	1	.384
≥ 30.00 kg/m^2	14 (17.3)	5 (12.8)	9 (21.4)			

4.6 Birth Weight

Birth weight data were plotted on a histogram and a box plot to visualize normality of data. Normality of data was further explored using the Kolmogorov-Smirnov test to look at birth weights of infants in both OA and OP delivery groups. Birth weights of OP positioned infants, $D(68) = .105$, $p = .058$, and OA positioned infants, $D(69) = .059$, $p = .200$ both showed non-significant results indicating normality of data for both groups. Further analysis revealed that the mean birth weights of OA delivered infants (M = 3368.94g, SD = 437.44g), and OP delivered infantss (M = 3447.69g, SD = 474.22g) did not differ significantly, $t(135) = -1.011$, $p = .314$. Data for birth weight were missing for 6 infants in the OP group and 7 infants in the OA group.

Table 4.6 Mean Birth Weight for OA and OP Groups

Birth Weight	**All *N* = 137**	**Occiput posterior *n* = 69**	**Occiput anterior *n* = 68**	***P***
Birth weight, mean in grams (SD)	3408.03 (456.10)	3447.69 (474.22)	3368.94 (437.44)	.314

Data were also compared using chi-square analysis based on a comparison of birth weight ≤ 4000g or > 4000g between OA and OP delivery groups, and revealed non-significant results ($\chi^2(1) = .724$, $p = .395$) (Table 4.7). The effect size was $\phi = .073$.

Table 4.7 Birth weight for OA and OP Groups

Birth weight, n (%)	All N= 137	Occiput posterior *n* = 68	Occiput anterior *n* = 69	Chi-Square	df	Asymp.Sig (2-sided)
≤ 4000g	122 (89.1)	59 (86.8)	63 (91.3)	.724	1	.395
> 4000g	15 (10.9)	9 (13.2)	6 (8.7)			

4.7 Instrumental Delivery

Instrumental deliveries occurred significantly more often among OP deliveries than OA deliveries, $\chi^2(1) = 15.213$, $p = .000$, $\phi = .318$, OR = 5.464 (Table 4.8).

Table 4.8 Instrumental Delivery for OA and OP Groups

Type of delivery, *n* (%)	All *N*= 150	Occiput posterior *n* = 75	Occiput anterior *n* = 75	Chi-Square	Df	Asymp.Sig (2-sided)
Spontaneous delivery	116 (77.3)	48 (64.0)	68 (90.7)	15.213	1	.000
Instrumental delivery	34 (22.7)	27 (36.0)	7 (9.3)			

When data were stratified by parity, results remained statistically significant for primiparas, $p = .001$; but not for multiparas, $p = .020$ (Table 4.9).

Table 4.9 Instrumental Delivery for OA and OP Groups Stratified by Parity

Type of delivery, *n* (%)	All *N*= 150		Occiput posterior *n* = 75		Occiput anterior *n* = 75	
Primiparous (P), Multiparous (M)	**P (n = 62)**	**M (n = 88)**	**P (n=31)**	**M (n=44)**	**P (n=31)**	**M (n=44)**
Spontaneous delivery	42 (67.7)	74 (84.1)	15 (48.4)	33 (75.0)	27 (87.1)	41 (93.2)
Instrumental delivery	20 (32.3)	14 (15.9)	16 (51.6)	11 (25.0)	4 (12.9)	3 (6.8)
	$p = .001^a$	$p = .020^a$				

[a] Fisher's exact test

4.8 Postpartum Hemorrhage

The proportions of women in OA and OP delivery groups who experienced PPH did not differ significantly, $\chi^2(1) = .543$, $p = .461$, $\phi = .061$ (Table 4.10). Data regarding PPH were missing for 2 records reviewed.

Table 4.10 Postpartum Hemorrhage for OA and OP Groups

Postpartum Hemorrhage[a], n (%)	All N= 148	Occiput posterior N=74	Occiput anterior N=74	Chi-Square	Df	Asymp.Sig (2-sided)
No PPH	129 (87.2)	63 (85.1)	66 (89.2)	.543	1	.461
PPH	19 (12.8)	11 (14.9)	8 (10.8)			

[a] ≥ 500ml blood loss

4.9 Severe Perineal Laceration

Although the degree of laceration was collected for each woman, groups were compared based on the presence or absence of severe perineal lacerations (presence of third or fourth degree laceration compared with intact/first/second degree laceration). Women in the OP delivery group had over double the incidence of severe perineal lacerations (14.3%) compared with women in the OA delivery group (6.8%); however, the results were not statistically

significant, $\chi^2(1) = 2.105$, $p = .147$, $\phi = .111$. Non-significant differences also occurred when the groups were stratified by parity: primiparas, $\chi^2(1) = .508$, $p = .476$; multiparas, $\chi^2(1) = 3.263$, $p = .071$. Data regarding perineal lacerations were missing for 7 women.

Table 4.11 Severe Perineal Lacerations for OA and OP Groups

Perineal Lacerations, *n* (%)	**All *n* = 143**	**Occiput posterior *n* = 70**	**Occiput anterior *n* = 73**	**Chi-Square**	**df**	**Asymp. Sig (2-sided)**
Intact/first/second degree	128 (89.5)	60 (85.7)	68 (93.2)	2.105	1	.147
Third/fourth degree	15 (10.5)	10 (14.3)	5 (6.8)			

4.10 Episiotomy

Likewise, although the incidence of episiotomy was double in the OP group (16%) compared with the OA delivery group (8.0%), results were not statistically significant, $\chi^2(1) = 2.273$, $p = .132$, $\phi = .123$ (Table 4.12). Results were also not statistically significant when data were stratified by parity: primiparas $p = .224$, multiparas $p = .306$.

Table 4.12 Episiotomy for OA and OP Groups

Episiotomy, n (%)	**All *N*= 150**	**Occiput posterior *n* = 75**	**Occiput anterior *n* = 75**	**Chi-Square**	**df**	**Asymp. Sig (2-sided)**
Yes	18 (12.0)	12 (16.0)	6 (8.0)	2.273	1	.132
No	132 (88.0)	63 (84.0)	69 (92.0)			

4.11 Length of Labour

The lengths of the first and second stages of labour were collected. For the first stage of labour, mean length of labour for women in the OP group was 5 hours and 53 minutes compared with 4 hours and 38 minutes for women in the OA group. In second stage, mean length of labour

was 1 hour and 22 minutes for the OP group and 50 minutes for the OA group. To determine the appropriateness of comparing group means and the most suitable statistical analysis, data were plotted on histograms and box plots to visualize distributions. Further testing of normal distribution was explored using the K-S test. In the first stage of labour, results of the K-S test showed significant results for both the OP group, $D(68) = .137$, $p = .003$, and the OA group, $D(68) = .153$, $p = .000$, indicating that data were not normally distributed. Similar results were found in the second stage of labour for the OP group, $D(68) = .209$, $p = .000$, and the OA group, $D(68) = .222$, $p = .000$.

As a result, the Mann-Whitney *U* test was run because it does not rely on a normal distribution of data. Table 4.13 summarizes the results of this test. In first stage of labour, no significant difference was observed between OP (Mdn = 5:00) and OA (Mdn = 3:54) groups, $U(1) = 6.45$, $p = .011$, $r = .21$. However, time spent in second stage labour was significantly longer for women delivering OP positioned infants (Mdn = 00:45), compared with women delivering OA positioned infants (Mdn = 00:30), $U(1) = 2002.50$, $p = .003$, $r = .24$.

Table 4.13 Length of First and Second Stage Labour for OA and OP Groups

Length of Labour	**All** ***n* = 149**	**Occiput posterior** ***n* = 75**	**Occiput anterior** ***n* = 74**	***p***
First stage, median in hours and minutes (IQR)	4:25 (2:40-7:14)	05:00 (3:00-7:40)	3:54 (2:16-5:54)	.011
Second stage, median in hours and minutes (IQR)	00:39 (00:14-01:46)	00:45 (00:20-02:19)	00:30 (0:06-1:04)	.003

4.12 Apgar Scores

Five minute Apgar scores were collected for infantss delivered in the OA and OP positions. Fisher's exact test was used to analyze data due to the low frequency of five-minute

scores ≤ 7. Scores ≤ 7 were found only in the OP group; however, results did not reach statistical significance $\chi^2(1) = .058$, $p = .058$, $\phi = .210$. One minute Apgar scores were also not significantly different between groups, $\chi^2(1) = .917$, $p = .338$, $\phi = .211$. Apgar scores were missing for one OP delivery.

Table 4.14 Apgar Scores for OA and OP Groups

Five Minute Apgar Scores, n (%)	**All N= 149**	**Occiput posterior N=74**	**Occiput anterior N=75**	**Fisher's Exact**	**df**	**Asymp.Sig (2-sided)**
≤7	4 (2.7)	4 (5.4)	0 (0)		1	.058
>7	145 (97.3)	70 (94.6)	75 (100.0)			
One Minute Apgar Scores, n (%)				**Chi-Square**		
≤7	22 (14.8)	13 (17.6)	9 (12.0)	.917	1	.338
> 7	127 (85.2)	61 (82.4)	66 (88.0)			

4.13 Summary

OP and OA delivery groups were compared on the presence of hands and knees positioning in labour, IOL, EA, maternal BMIs classified as obese, large fetuses (> 4000g), postpartum hemorrhage, severe perineal lacerations, episiotomy, infant Apgar scores ≤7, and ethnicity. Instrument delivery was the only variable shown to occur in significantly higher proportions of women delivering infants in the OP position. When results were stratified by parity, results remained significant only for primiparas. Length of labour was also compared in the first and second stages of labour; women in the OP group had significantly longer second stage labours compared with women in the OA group.

Chapter 5: Discussion

This chapter presents a discussion of the study results in the context of the literature and the theoretical framework used for the study. Implications for nursing practice and recommendations for research are also outlined.

5.1 Review of Purpose of Study

POP labour and delivery has been associated with morbidity for mothers and babies including prolonged labour, postpartum hemorrhage (PPH), perineal trauma, caesarean section, and psychological distress (Alcorn, O'Donovan, Patrick, Creedy, & Devilly, 2010; Cheng, Shaffer, & Caughey, 2006a; Fitzpatrick et al., 2001; Senécal, Xiong, & Fraser, 2005). Therefore, this study compared women who delivered infants in the OP position with women who delivered infants in the OA position on a number of these variables including, exposure to labour induction, EA, BMI $\geq$ 30.00kg/m^2, high infant birth weight (> 4000g), and hands and knees positioning in labour. Additionally, proportions of women delivering in the OP and OA positions experiencing PPH, 3rd or 4th degree tears, episiotomies, instrument deliveries, long labour, and infants experiencing five minute Apgar scores $\leq$7 were compared. An understanding of factors that contribute to OP positioning, and morbidities associated with its persistence, can provide a basis for developing interventions such as hands and knees positioning, that may reduce its incidence.

5.2 Overview of Findings

The presence of instrumental delivery was one of two variables that reached statistical significance in the study's comparison of OP and OA deliveries. In the OP group, 36.0% of women experienced instrument delivery compared with only 9.3% of women in the OA group,

$\chi^2(1) = 15.213$, $p = .000$, $\phi = .318$, OR = 5.464. When stratified by parity, results remained significant for nulliparas only, $p = .001$.

The length of second stage labour was the second variable to achieve statistical significance. Women in the OP group had significantly longer second stage labours than their OA counterparts ($p = .003$). Contrary to reports in the literature, for all other variables, including hands and knees positioning, labour induction, epidural analgesia, obese BMI ($\geq$ 30.00kg/m^2), high infant birth weight (>4000g), severe perineal lacerations, episiotomies, PPH, and five minute Apgar scores $\leq$7, there were no statistically significant differences between OP and OA groups. A review of these findings in relation to the theoretical framework and literature may prompt discussion, point to areas for further research, and provide implications for nursing practice.

5.3 Findings in Relationship to the Literature and Theoretical Framework

The following section presents a discussion of the results of the study using each hypothesis. Results are discussed in relationship to the available literature and the theoretical framework used to guide this study.

5.3.1 Hands and Knees Positioning

1. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position were exposed to hands and knees positioning.

According to Andrews and Andrews (2004) Theory to Guide Rotation of Fetal Malposition, hands and knees positioning would facilitate fetal rotation from the OP to OA position. The authors argue that, if the fetus is in the OP position, the heavy back will lie along the superior portion of the maternal uterus and the couple created between gravity and buoyancy

will cause rotation. In addition, the hands and knees position opens the pelvis creating the widest diameter possible, and reduces the effects of friction (from the fetus rubbing against maternal tissue/bone structures).

This retrospective study was unable to consider the influence of hands and knees positioning on fetal rotation because of the unreliability of methods used to diagnose fetal position in labour (particularly VE which is available on FHA health records) (Akmal et al., 2002; Nizard et al., 2009; Sherer et al., 2002a; Souka et al., 2003). Because the original positions of fetuses in labour were not discernible, it was not possible to ascertain whether hands and knees positioning is effective in rotating fetuses to optimal positions. Despite this, this study provided insight into the proportions of women in OP and OA groups using hands and knees positioning in labour and fetus' positions at delivery. Results showed that use of hands and knees positioning did not differ significantly between OP and OA delivery groups ($p = .542$). In the OP group, 33.8% of women used this position compared with 29.0% of women in the OA group.

Care providers hold persisting beliefs that OP position causes increased back pain in labour. However, literature suggests that back pain is not a reliable indicator of fetal position in labour. Lieberman, et al. (2005) found that only 28% of women with fetuses in the OP position, diagnosed by ultrasound, experienced back pain compared to 29% of women with fetuses in the OA position. In this study, there was a relatively high proportion of women using hands and knees position in labour – approximately 1 in 3 (in both groups). This may suggest that women find this position comfortable and helpful in labour, regardless of fetal position at delivery. In other words, because the lack of reliability for determining fetal position in labour, women with back pain in labour (whether the fetus be OP or OA positioned) may be encouraged to use hands

and knees positioning in labour and find comfort in it. Stremler's (2006) RCT showed that women had high satisfaction with hands and knees positioning in labour. In her study, women stated that they found the position comfortable, would use it again in labour, and thought it helped their labour progress. Further, back pain scores were significantly lower among women who used hands and knees positioning in labour, regardless of fetal position.

Although the effects of hands and knees positioning on fetal rotation are unclear and need further exploration, this study shows high use of hands and knees positioning in labour, potentially suggesting women's and nurses' satisfaction with the position. It may be expected that care providers would use hands and knees positioning more often in labours where OP positioning is suspected; however, because of the unreliability of diagnosing fetal position in labour, the use of hands and knees positioning may actually be similar in OA and OP labours. Clarification about potential benefits of hands and knees positioning, such as reducing back pain or improving psychological coping with labour, would be beneficial. Additionally, further RCTs with large sample sizes and reliable methods of diagnosis would be necessary to determine a cause and effect relationship between hands and knees positioning and rotating OP positioned fetuses to OA positions.

5.3.2 Labour Induction

2. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position had their labours induced.

Results of this study revealed that women in OA and OP delivery groups had similar rates of labour induction, $p = .707$. There are multiple retrospective studies in the literature looking at prevalence of IOL and POP position at birth. Similarly to this study, two retrospective

cohort studies did not show a significant difference between rates of induction between OA and OP delivery groups (Fitzpatrick et al., 2001; Ponkey et al., 2003). In contrast, other cohort studies have found a significant difference in the prevalence of POP position among women who were induced (Cheng et al., 2006b; Sizer & Nirmal, 2000).

The influence of one particular method of labour induction, the rupturing of membranes, on fetal position at birth has been studied specifically. Literature has shown higher rates of AROM among POP deliveries (Cheng et al., 2006a; Sizer & Nirmal, 2000; To & Li, 2000); however, it is unclear about whether it is the AROM itself that promotes the OP position, or whether fetuses are already persistently posterior prior to AROM (which becomes necessary when labour does not progress due to malposition). In light of Andrews and Andrews' (2004) theory, AROM would reduce the buoyancy provided by amniotic fluid and increase friction from the uterine wall, impeding rotation. So, although the literature shows higher rates of AROM among POP deliveries, and AROM would (theoretically) inhibit rotation to optimal positions in labour, the lack of clarity on whether AROM causes OP position or OP position warrants AROM prompted us to match women on this variable. Further exploration into the effects of various methods of induction, e.g., cervical ripening agents, oxytocin infusion, vaginal foley catheter insertion, or AROM, with a larger sample size, on fetal positioning at delivery would illuminate factors contributing to OP positioning in labour and birth.

5.3.3 Epidural Analgesia

3. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position used epidural analgesia (EA).

The rate of epidural for women in the OP group was 29.9% compared with 17.3% among the OA group. Although there were higher proportions of women who used epidural analgesia among the OP group compared with the OA group, results did not reach statistical significance (p = .082). The finding aligns with other observational studies conducted showing higher incidence of OP position at birth among women with epidural analgesia compared to those without (Klein et al., 2001: Le Ray et al., 2005; Lieberman et al., 2005; Robinson et al., 1996; Stremler et al., 2009). Unfortunately, observational studies are unable to determine whether women with fetal malpositions are more likely to request EA or whether the epidural itself promotes fetal malposition (Lieberman & O'Donoghue, 2002). The RCTs conducted looking at these variables (Bofill et al., 1997; Howell et al., 2001; Thorp et al., 1991) have varying results. Thorp et al. (1991) found significantly more malpositioned fetuses in the epidural group, while studies conducted by Bofill et al. (1997) and Howell et al. (2001) did not show a significant difference in fetal malposition between intervention and control groups. The studies showing significant results did not have adequate sample sizes and had a high amount of crossover between the treatment and control groups. Thus, although difficult to perform, further RCTs with large sample sizes and minimal crossover would be necessary to clarify cause and effect in exposure to epidural analgesia and POP.

The low epidural rate in this study (only 35 women or 23.3%), made it difficult to determine whether there was a relationship between epidural use and fetal positioning at delivery. In 2013/2014 the epidural rate in the Fraser East region of BC (where this hospital is located) was only 20.3% and was the third lowest rate in BC (Canadian Institute for Health Information, 2015). A larger sample size would likely be necessary to examine this variable adequately. Studying this variable at centres with higher epidural rates (such as Vancouver

where there is a 49.7% epidural rate) would be worthwhile. Research studies that examine various types of epidurals would also be useful due to the potential effects of gravity on fetal rotation (Andrews & Andrews, 2004). Andrews and Andrews' (2004) theory would hold that when women are limited to lying on their backs/sides the fetal back would then also rotate towards the maternal spine due to the effects of gravity. At this institution, where the study took place, a solution of 0.1% or 0.08% Bupivicaine with 50mcg Fentanyl is typically administered as a continuous infusion for analgesia in labour. The block is such that women are limited to bed, and are primarily assisted to lay on their left and right sides throughout the remainder of labour. This type of epidural used, compared to a walking epidural (which uses a low-dose solution and allows women to move well or walk), may theoretically have different effects on fetal positioning in labour, and thus warrants further study.

5.3.4 BMI

4. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position were classified as having a BMI $\geq$30.00 kg/m^2.

In this study, high maternal BMI was not statistically different between OA and OP delivery groups (p = .384). This finding is inconsistent with results in the literature showing a higher incidence of POP position among women with BMI's of $\geq$30 kg/m^2 (Cheng et al., 2006a). A potential factor influencing these results is the amount of missing data for this variable; out of the 150 health records reviewed in this study, only 81 contained information regarding a patient's BMI. The mean BMI of patients in this study was 24.96 – "normal" – but only .04 off from "overweight" status. The relatively high BMI, in general, for women in this study, coupled with the fact that nearly half of all women's BMIs were not recorded, may suggest that

practitioners are more likely to record the BMIs of patients who appeared obese. Consequently, given the limitations of the data, it is possible that these results do not reflect the actual relationship between these variables. It is also possible that results from this study are not consistent with the literature because of differences in study locations. Cheng et al.'s (2006) study was conducted in China; differences in cultural and medical systems between countries may account for different results in the studies.

5.3.5 Birth Weight

5. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position had infants with birth weights of >4000g.

There was no difference between OA and OP delivery groups regarding proportions of high birth weight infants (p = .395). Furthermore, mean birth weights were nearly identical between OA delivered infants (M = 3368.94, SD = 437.44), and OP delivered infants (M = 3447.69, SD = 474.22). These findings are inconsistent with literature that demonstrated increased POP position when infants are >4000g (Cheng et al., 2006a; Cheng et al., 2006b; Lieberman et al., 2005; To & Li, 2000). A significant difference in neonatal weights may have been difficult to detect because of the low incidence of high birth weight infants in this study in general. Only 9 infants (13.2%) in the OP group had large birth weights and 6 infants in the OA group (8.7%). The retrospective studies cited above may have more power to detect results because of their large sample sizes. Differences may also be attributed to differences in prenatal care in China and the United States of America, compared with Canada. It may be possible that Canadian prenatal care results in fewer LGA babies.

Our results also deviate from what might be expected given Andrews and Andrews (2004) theory on fetal rotation. In their theory, friction, one of the three forces at play in fetal rotation, inhibits rotation of the fetus. This can be friction from movement, such as when the fetal back slides along the uterus or through the pelvis, or from rest (static friction), such as when the fetus lies against the uterine wall (Andrews & Andrews, 2004). A large fetus would produce more friction, limiting rotation and increasing persistence of OP positioning.

5.3.6 Severe Perineal Lacerations

6. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who delivered infants in the OP position and the OA position experienced third or fourth degree perineal lacerations.

Women in the OP group were more than twice as likely to have a severe perineal laceration (14.3%) compared with women in the OA group (6.8%); however, the differences were not statistically significant ($p = .147$). Because parity has been shown to be a protective factor for tearing (Ponkey et al., 2003; Salameh et al., 2011; Wheeler & Richter, 2007), results were also stratified by parity; they remained non-significant. This study may not have been powered sufficiently to detect a statistically significant difference for the 7.5% increase in perineal lacerations that was observed. This study had 9.3% power to detect the 7.5% difference between groups, and a large sample size of 890 would be required to yield statistical significance (with an alpha of .005 and power of .8).

5.3.7 Episiotomy

7. Equivalent proportions of women (matched according to maternal age, membrane status and parity) who deliver infants in the OP position and the OA position had episiotomies.

Episiotomy was twice as prevalent in the OP group (16%) compared with the OA group (8%) in this study; however, the results did not reach statistical significance, $p = .132$. Again, the study may not have been powered sufficiently to detect a statistical significance arising from the 8% difference between groups. Consequently, our results do not support the literature showing higher rates of episiotomy among OP deliveries compared with OA deliveries (Pearl et al., 1993; Senécal et al., 2005).

The high use of episiotomy in OP deliveries observed in the literature is thought to be due to the increased instrument use in this group (Pearl et al., 1993; Senécal et al., 2005). In this study, women – regardless of position at delivery – were significantly more likely to receive episiotomies when birthing via instrumental delivery compared to spontaneous delivery ($\chi^2(1) = 35.442$, $p = .000$). However, when results were stratified by fetal position at delivery, this remained true only for women in the OP group (χ^2 (1) = 19.214, $p = .000$). That is, episiotomies were significantly more likely to occur in OP positioned instrument deliveries compared with OA positioned instrument deliveries.

This finding of effects of OP and instrumental deliveries undermines the perspective in the literature that increases in episiotomy rates are caused by instrumental delivery because fetal position at delivery appears to be a contributing factor to episiotomy use in instrumental deliveries. Further studies exploring relationships between fetal position at delivery, instrument use and episiotomy use would be important to help clarify the mechanisms and cause of morbidity.

5.3.8 Instrumental Delivery

8. Equivalent proportions of women delivering infants in the OP position and the OA position (matched according to maternal age, membrane status and parity) had instrumental deliveries.

Our findings are consistent with the literature which has found increased instrumental delivery among OP deliveries compared with OA deliveries (Cheng et al., 2006a; Fitzpatrick et al., 2001; Gardberg et al., 1998; Senécal et al., 2005). In this study, instrumental delivery occurred significantly more often in the OP group compared with the OA group ($p = .000$). It comprised 36% of OP deliveries, compared to only 9.3% of OA deliveries. The rate of instrumental delivery in the OP group is similar to rates found in the literature: 41.7% and 38.5% of OP deliveries respectively (Sizer & Nirmal, 2000; To & Li, 2000). Thus, our findings show that rates of instrumental delivery for OP groups is similar in our Canadian sample compared with samples across the United States, France, the United Kingdom and China (Cheng et al., 2006a; Fitzpatrick et al., 2001; Gardberg et al., 1998; Senécal et al., 2005).

When data were stratified by parity, instrumental delivery occurred significantly more often in primiparas ($p = .001$), but not multiparas ($p = .020$). This may not be surprising given the well-known protective effects that parity has on childbirth morbidity (Pillitteri, 2010). Furthermore, the fact that nulliparas have longer labours than multiparas, in combination with the longer second stage labour apparent with OP positioning in this sample, may enhance practitioners' use of instrumental delivery more quickly for these women. It is important to note that due to the Bonferroni correction our significance level was set at $p < .005$, as opposed to the more typically set level of .05. This makes our comparison of instrument delivery and fetal position at delivery, stratified by parity, non-significant for multiparas despite a p value of .020.

While results were only significant for the OP group as a whole and the primipara subgroup, the trend towards increased instrumental delivery is apparent for all groups, including multiparas.

5.3.9 Postpartum Hemorrhage

9. Equivalent proportions of women delivering infants in the OP position and the OA position (matched according to maternal age, membrane status and parity) experienced postpartum hemorrhages.

The proportions of women in OA and OP delivery groups who experienced PPH did not differ significantly ($p = .461$). These results contradict two large retrospective cohort studies which demonstrated a significant relationship between OP position at delivery and PPH (Cheng et al., 2006a; Senécal et al., 2005). Compared with this study, women in the OP delivery groups were significantly more likely to have prolonged labour compared with women in the OA delivery groups, which may contribute to the greater PPH rates seen in OP positioned deliveries (Cheng et al., 2006a; Ponkey et al., 2003; Senécal et al., 2005). Furthermore, these studies also reported increased birth weights of ≥4000g among OP delivered babies, which is also a risk factor for PPH. The discrepancy observed and normal blood loss in our population may be attributed to the lack of risk factors present in these women compared with women in studies reported from other countries. Underestimation of blood loss could also be a factor minimizing the prevalence of recorded PPH observed in women in this study.

5.3.10 Length of Labour

10. Women delivering infants in the OP and OA positions (matched according to maternal age, membrane status and parity) had equivalent lengths of labour.

There was no significant difference between OA and OP groups regarding length of first stage labour in this study ($U(1) = 6.45$, $p = .011$, $r = .21$). The median length of first stage labour

for women delivering OP positioned infants was 5 hours, compared with 3 hours and 54 minutes for women delivering OA positioned infants. While results were not statistically significant, the relatively low *p* value of .011, and differences found in mean lengths of labour between groups (5 hours and 53 minutes versus 4 hours and 38 minutes) may show a trend towards longer first stage labours among OP deliveries compared with OA deliveries.

Length of second stage labour was significantly longer for women delivering OP positioned infants compared to their OA counterparts ($U(1) = 2002.50$, $p = .003$, $r = .24$). The median length of second stage labour for OP deliveries was 45 minutes compared with 30 minutes for the OA group. Although our data show the length of second stage to be longer in OP deliveries, our data do not support the literature showing a two-fold increase in *prolonged* (greater than 3 hours) second stage in OP deliveries (Cheng et al., 2006). In this study, three deliveries in the OA group were greater than 3 hours compared with five deliveries in the OP group. Due to the low incidence of prolonged labour in our study population, further research into the effects of OP position on prolonged second stage labour would be beneficial and clarify this relationship.

5.3.11 Apgar Score

11. Equivalent proportions of infants of mothers (matched according to maternal age, membrane status and parity) who were delivered in the OP and OA position received five minute Apgar scores ≤7.

The presence of five minute Apgar scores that were ≤ 7 did not differ significantly between OA and OP delivered infants ($p = .058$). It is important to note that the relationship between five minute Apgar scores and position at delivery was difficult to ascertain in this study because of the low incidence of five minute Apgar scores of ≤ 7 (four in the OP group and 0 in

the OA group). Although Apgar scores ≤ 7 were more frequent in the OP group, further research that includes a larger sample size would be necessary to detect a statistically significant relationship. Multiple (larger) retrospective studies in the literature report significantly more low five minute Apgar scores among OP delivered infants compared with OA delivered infants (Cheng et al., 2006b; Sénecal et al., 2005; To & Li, 2000).

Another potential reason our results were not statistically significant could be due to the normal length of second stage labour observed among our OP population (despite having significantly longer second stage labours than their OA counterparts, the incidence of *prolonged* labour was low in the study population as a whole). The literature demonstrates an association between low five minute Apgar scores and prolonged second stage labour (Nathoo, Chimbira, & Mtimavalye, 1990; Salustiano, Campos, Ibidi, Ruano, & Zugaib, 2012). Additional research studies exploring fetal position at delivery, length of labour, and Apgar scores would clarify these relationships.

5.4 Study Limitations and Strengths

5.4.1 Limitations

This study was conducted at one mid-sized community hospital. Practices that are consistent at this site, such as how labour is managed, availability of medical procedures (e.g., epidural, cesarean section, and instrumental delivery), recording of data, and nursing practices in labour, would be expected to vary across sites. As such, the generalizability of this study to other sites is limited.

Fetal position at delivery of cesarean section is not always recorded at this site, nor is "OP position" consistently cited as the reason for cesarean delivery. The retrospective nature of this study coupled with the lack of reliability of vaginal exam in determining fetal position

resulted in a decision to exclude operatively delivered, OP positioned fetuses from data collection. In studies conducted in Ireland, North America, and Switzerland, the OP position was associated with a two-fold increase in cesarean section, compared to the OA position (Fitzpatrick et al., 2001; Ponkey et al., 2003; Senécal et al., 2005). The literature has demonstrated 22%, 37.7% and 41.7% cesarean section rates among OP postioned fetuses respectively (Fitzpatrick et al., 2001; Ponkey et al., 2003; Sizer & Nirmal, 2000). As a result of this limitation, there may have been a large proportion of women with OP positioned fetuses that were excluded from this study, and maternal/neonatal morbidity may be under-reported.

Another limitation of this study is the low rate of epidural use at the community hospital. Epidural rates at this site are considerably lower than other sites across Canada. As a result, it was difficult to look at the relationship between epidural use and fetal position at delivery. There was also considerable missing data for a few variables, particularly obesity and Apgar scores; evaluating the relationship between these variables and fetal position was thus difficult.

5.4.2 Strengths

Despite the stated limitations, there was a vast array of data regarding the variables of interest available from the health records reviewed. Perinatal Services of British Columbia (PSBC) collects and monitors large quantities of data through the BC Perinatal Data Registry (PDR). Not only did this allow for this extensive health records review, but it also contributes to the systemized perinatal care provided in BC. PSBC states:

> Data from the PDR are widely used for surveillance and research purposes and to support health care providers, researchers, and policy makers in their work to improve maternal, fetal and neonatal health outcomes as well as to enhance the delivery and quality of perinatal services in BC ("About Us", 2013).

The standardized maternity care provided in BC may contribute to the low morbidity observed in women delivering OP positioned infants (and all infants in general) in this study. The lack of differences in delivery outcomes between OA and OP delivery groups observed in this study, compared with other retrospective studies conducted in China and the United States of America, could be attributed to the extensive and standardized care received by women in BC. For example, the low incidence of large birth weight babies, episiotomies, postpartum hemorrhage, prolonged labour, and five minute Apgar scores ≤ 7 for both OA and OP deliveries may be attributed to the high standards of routine care women receive in BC.

5.5 Implications for Practice

Results from this study support published findings that show increased risk of instrumental delivery and longer second stage labour among patients who deliver babies in the OP position. Indications of the morbidity associated with OP delivery requires nurses and doctors to be more vigilant in their assessments of fetal position in labour – perhaps first via Leopold's maneuvers and VE, and if suspected, confirmed with ultrasound. Despite the availability of ultrasound machines on the unit studied, it is extremely rare for doctors to use ultrasound to determine fetal position in labour. Awareness of the risks associated with OP labour may provide impetus to use more reliable methods of fetal position diagnosis during first and second stage labours, so that the most appropriate interventions can be used for these women.

5.5.1 Upright Positioning

When OP position is determined, the study results may encourage nurses, midwives, and doctors to be more assertive in assisting mothers to change positions frequently and use upright positions, and encourage movement throughout contractions. Although hands and knees

positioning has not definitively been demonstrated as an effective intervention to rotate fetuses, the benefits of changes in maternal positioning in labour are well documented, regardless of fetal position. For example, a Cochrane review provides evidence that upright/gravity promoting positions significantly reduce the length of first stage labour, specifically for nulliparas (Lawrence, Lewis, Hofmeyr, & Styles, 2013). Upright positions may also be more important for nulliparas given their increased risk of instrumental delivery. In fact, this review supported upright positions including: sitting, walking, standing, squatting, or kneeling; showing significantly less operative vaginal births among women labouring in these positions compared with women labouring in recumbent, supine, or lateral positions (Lawrence et al., 2013).

The effects of upright positions in second stage are similar. Although there is no evidence that upright positions significantly reduce the length of second stage labour, another Cochrane review has supplied evidence for decreased instrumental delivery and episiotomy use for women laboring in upright positions in second stage labour (Gupta, Hofmeyr & Shehmar, 2012).

In our current medical system, position changes by women are often inhibited by a variety of factors. It is claimed that dorsal and semi-recumbent positions "enable the midwife/obstetrician to monitor the fetus better and thus ensure a safe birth" (Gupta et al., 2012, p.2). Movement may also be inhibited by fetal monitoring, intravenous therapy, anaesthesia, medical exams, provision of perineal support, and care givers' assistance with spontaneous birth (Gupta et al, 2012). Nurses may have opportunities to challenge these beliefs and practices to provide care that is centred on women's needs as opposed to the needs of the professionals providing care. For example, ensuring the use of intermittent auscultation for fetal monitoring of low risk women (which is recommended by the Society of Obstetrics and Gynaecology Canada)

allows for improved ease of movement for women (Society of Obstetrics and Gynaecology Canada, 2007). When continuous fetal monitoring is indicated, many hospitals including this study site, have portable ultrasound telemetry units that should be used instead of the bedside ultrasound transducer.

Encouraging regular fluid intake and providing consistent support may decrease the need for intravenous therapy and intravenous analgesia, which can also inhibit movement of women (Gupta et al., 2012). Upright sitting, kneeling, and unaided or aided squatting positions can be facilitated with a variety of props as well. Nurses should be knowledgeable and skilled to assist women into a variety of these positions. Examples of materials include, sitting on a birthing ball or rocking chair; kneeling over a ball or bed, squatting on the toilet or with a birth cushion; or squatting using a squatting bar or support from a partner (Fenwick & Simkin, 1987). Increased support and creativity by nurses in suggesting and helping women into a variety of upright positions in labour can improve birth outcomes (specifically length of first stage labour, instrument delivery and episiotomy use) (Gupta et al., 2012; Lawrence et al., 2013). . While research is provided for the use of upright positions in general, future research into the use of specific positions, including hands and knees posturing, that may foster rotation may provide direction for health care workers in their management of women's labours.

5.5.2 Continuous, One-to-One Labour Support

In a Cochrane review, continuous, one-to-one support in labour was shown to shorten labour and decrease the need for instrumental delivery (in a review of 12 and 19 trials, respectively) (Hodnett, Gates, Hofmeyr, & Sakala; 2012). Continuous one-to-one support may include:

> Emotional support (continuous presence, reassurance and praise), information about labour progress and advice regarding coping techniques, comfort measures (such as comforting touch, massage, warm baths/showers, promoting adequate fluid intake and output) and advocacy (helping the woman articulate her wishes to others) (Hodnett et al., 2012, p. 3).

At a management level, adequate nursing staff is necessary to provide this type of care. Specialty training in obstetric nursing, such as is required in lower mainland health authorities, is also desirable so that nurses have the knowledge and skills to properly support women in labour. Finally, nurses can personally improve the support they provide by overtly discussing with women their goals, wishes, and plans for labour, analgesia, and birth. Although the effects of women's positions and one-to-one support in labour on fetal positioning specifically are unclear, their benefits for labour progress, spontaneous vaginal delivery and reduced morbidity are clear and may help women regardless of fetal position.

5.6 Conclusion

Based on Andrews and Andrews (2004) Theory to Guide Rotation of Fetal Malposition, and the literature on POP labour and delivery, this study was designed to compare the morbidity and use of hands and knees position in labour in an OP and OA delivery group. A retrospective review of Health Records at a mid-sized community hospital yielded 150 records of women who delivered infants in the OA and OP positions, matched according to timing of ROM, age, and parity. Instrument use in delivery was seen significantly more often among women in the OP group compared with the OA group. Women in the OP delivery group also had significantly longer second stage labours than their OA counterparts. No significant differences were found between groups in labour regarding exposure to hands and knees positioning, labour induction,

epidural analgesia (EA), obese BMI's, severe perineal lacerations, large fetuses (>4000g), and, in the postpartum period, postpartum hemorrhage, and five minute Apgar scores ≤7. However, while statistical significance was not reached, the proportions of women experiencing morbidity were higher in the OP group for each variable examined. It is possible that a larger sample size would have enhanced power to detect differences between groups.

The limited differences in morbidity between groups reported in this study may be indicative of high standard of prenatal and intrapartum care women receive in BC. As was evidenced by the extensive health records reviewed in this study, women in BC are monitored frequently and systematically prenatally, and throughout the intrapartum period. If morbidity levels are low in general, it is difficult to detect differences between groups based on positioning in labour. The levels of antenatal and intrapartum care in studies that have reported significant increases in morbidity in OP labour and birth may indicate systemic or cultural differences between countries.

The morbidity associated with POP labour and delivery observed in the literature is driving research to develop economical and effective interventions to rotate malpositioned fetuses. Although there is a lack of support from existing studies to recommenduse of hands and knees positioning in labour as an intervention for POP position, further prospective research, which uses reliable methods to determine fetal position and incorporates interventions to rotate OP positioned fetuses will hopefully improve birth outcomes for mothers and babies.

References

Adachi, K., Shimada, M., & Usui, A. (2003). The relationship between the parturient's positions and perceptions of labour pain intensity. *Nursing Research*, *52*(1), 47–51.

Akmal, S., Kametas, N., Tsoi, E., Hargreaves, C., & Nicolaides, K. H. (2003). Comparison of transvaginal digital examination with intrapartum sonography to determine fetal head position before instrumental delivery. *Ultrasound in Obstetrics & Gynecology, 21*(5), 437–440. doi:10.1002/uog.103

Akmal, S., Tsoi, E., Howard, R., Osei, E., & Nicolaides, K. H. (2004). Investigation of occiput posterior delivery by intrapartum sonography. *Ultrasound in Obstetrics & Gynecology, 24*(4), 425–428. doi:10.1002/uog.1064

Akmal, S., Tsoi, E., Kametas, N., Howard, R., & Nicolaides, K. H. (2002). Intrapartum sonography to determine fetal head position. *The Journal of Maternal-Fetal & Neonatal Medicine, 12*(3), 172–177. doi:10.1080/jmf.12.3.172.177

Alcorn, K. L., O'Donovan, A., Patrick, J. C., Creedy, D., & Devilly, G. J. (2010). A prospective longitudinal study of the prevalence of post-traumatic stress disorder resulting from childbirth events. *Psychological Medicine*, *40*(11), 1849–1859. doi:10.1017/S0033291709992224

Andrews, C. M., & Andrews, E. C. (2004). Physical theory as a basis for successful rotation of fetal malpositions and conversion of fetal malpresentations. *Biological Research for Nursing*, *6*(2), 126–140. doi:10.1177/1099800404268318

Badawi, N., Kurinczuk, J. J., Keogh, J. M., Alessandri, L. M., O'Sullivan, F., Burton, P. R., … Stanley, F. J. (1998). Intrapartum risk factors for newborn encephalopathy: The Western

Australian case-control study. *British Journal of Obstetrics and Gynaecology*, *317*(7172), 1554–1558. doi:10.1136/bmj.317.7172.1554

Biancuzzo, M. (1993). How to Recognize and Rotate an Occiput Posterior Fetus. *The American Journal of Nursing*, *93*(3), 38. doi:10.2307/3464160

Bodner-Adler, B., Bodner, K., Kaider, A., Wagenbichler, P., Leodolter, S., Husslein, P., & Mayerhofer, K. (2001). Risk factors for third-degree perineal tears in vaginal delivery, with an analysis of episiotomy types. *The Journal of Reproductive Medicine*, *46*(8), 752–756.

Bofill, J. A., Vincent, R. D., Ross, E. L., Martin, R. W., Norman, P. F., Werhan, C. F., & Morrison, J. C. (1997). Nulliparous active labour, epidural analgesia, and cesarean delivery for dystocia. *American Journal of Obstetrics and Gynecology*, *177*(6), 1465–1470. doi:10.1016/S0002-9378(97)70092-9

Briggs, N. D. (1989). Outcome of labour in occipitoposterior positions in an African population. *British Journal of Obstetrics and Gynaecology*, *96*(10), 1234–1236.

Buppasiri, P., Lumbiganon, P., Thinkhamrop, J., & Thinkhamrop, B. (2010). Antibiotic prophylaxis for third- and fourth-degree perineal tear during vaginal birth. *The Cochrane Database of Systematic Reviews*, (11), CD005125. doi:10.1002/14651858.CD005125.pub3

Caldeyro-Barcia, R. (1979). The influence of maternal position on time of spontaneous rupture of the membranes, progress of labour, and fetal head compression. *Birth*, *6*(1), 7–15. doi:10.1111/j.1523-536X.1979.tb01297.x

Canadian Institute for Health Information. (2015). Childbirth indicators by place of residence: Epidural rate for vaginal deliveries. *Discharge Abstract Database/Hospital Morbidity*

Database. Retrieved on Mar 26, 2015 from http://indicatorlibrary.cihi.ca/display/HSPIL/Epidural+Rate+for+Vaginal+Deliveries

Cheng, Y. W., Shaffer, B. L., & Caughey, A. B. (2006a). Associated factors and outcomes of persistent occiput posterior position: A retrospective cohort study from 1976 to 2001. *The Journal of Maternal-Fetal & Neonatal Medicine, 19*(9), 563–568. doi:10.1080/14767050600682487

Cheng, Y. W., Shaffer, B. L., & Caughey, A. B. (2006b). The association between persistent occiput posterior position and neonatal outcomes. *Obstetrics and Gynecology*, *107*(4), 837–844. doi:10.1097/01.AOG.0000206217.07883.a2

Chou, M. R., Kreiser, D., Taslimi, M. M., Druzin, M. L., & El-Sayed, Y. Y. (2004). Vaginal versus ultrasound examination of fetal occiput position during the second stage of labour. *American Journal of Obstetrics and Gynecology*, *191*(2), 521–524. doi:10.1016/j.ajog.2004.01.029

Desbriere, R., Blanc, J., Le Dû, R., Renner, J.-P., Carcopino, X., Loundou, A., & d' Ercole, C. (2013). Is maternal posturing during labour efficient in preventing persistent occiput posterior position? A randomized controlled trial. *American Journal of Obstetrics and Gynecology*, *208*(1), 60.e1–8. doi:10.1016/j.ajog.2012.10.882

Dixon, L. (2005). Building a picture of labour: How midwives use vaginal examinations during labour. *Journal of New Zealand Midwives, 42*(33), 22–26.

Dupuis, O., Ruimark, S., Corinne, D., Simone, T., André, D., & René-Charles, R. (2005). Fetal head position during the second stage of labour: Comparison of digital vaginal examination and transabdominal ultrasonographic examination. *European Journal of*

Obstetrics, Gynecology, and Reproductive Biology, *123*(2), 193–197. doi:10.1016/j.ejogrb.2005.04.009

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.

Fenwick, L., & Simkin, P. (1987). Maternal positioning to prevent or alleviate dystocia in labour. *Clinical Obstetrics and Gynecology*, *30*(1), 83–89.

Fitzpatrick, M., McQuillan, K., & O'Herlihy, C. (2001). Influence of persistent occiput posterior position on delivery outcome. *Obstetrics and Gynecology*, *98*(6), 1027–1031.

Floberg, J., Belfrage, P., & Ohlsén, H. (1987). Influence of the pelvic outlet capacity on fetal head presentation at delivery. *Acta Obstetricia et Gynecologica Scandinavica*, *66*(2), 127–130.

Gardberg, M., Laakkonen, E., & Sälevaara, M. (1998). Intrapartum sonography and persistent occiput posterior position: A study of 408 deliveries. *Obstetrics and Gynecology*, *91*(5), 746–749.

Gardberg, M., Leonova, Y., & Laakkonen, E. (2011). Malpresentations: Impact on mode of delivery. *Acta Obstetricia et Gynecologica Scandinavica*, *90*(5), 540–542. doi:10.1111/j.1600-0412.2011.01105.x

Gardberg, M., & Tuppurainen, M. (1994). Anterior placental location predisposes for occiput posterior presentation near term. *Acta Obstetricia et Gynecologica Scandinavica*, *73*(2), 151–152.

Gearing, R. E., Mian, I. A., Barber, J., & Ickowicz, A. (2006). A methodology for conducting retrospective chart review research in child and adolescent psychiatry. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, *15*(3), 126–134.

Gei, A. F., & Belfort, M. A. (1999). Forceps-assisted vaginal delivery. *Obstetrics and Gynecology Clinics of North America*, *26*(2), 345–370.

Geneletti, S., Richardson, S., & Best, N. (2009). Adjusting for selection bias in retrospective, case–control studies. *Biostatistics*, *10*(1), 17–31. doi:10.1093/biostatistics/kxn010

Ghi, T., Giunchi, S., Pilu, G., Youssef, A., Morselli-Labate, A. M., Arcangeli, T., … Pelusi, G. (2010). Neonatal hypoxic-ischemic encephalopathy in apparently low risk pregnancies: A retrospective analysis of the last five years at the University of Bologna. *The Journal of Maternal-Fetal & Neonatal Medicine, 23*(6), 516–521. doi:10.3109/14767050903186293

Gupta, J., Hofmeyr, G., & Shehmar, M. (2012). Position in the second stage of labour for women without epidural anaesthesia. *The Cochrane Database of Systematic Reviews,* (5), CD002006. doi:10.1002/14651858.CD002006.pub3

Gupta, J. K., & Nikodem, C. (2000). Maternal posture in labour. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, *92*(2), 273–277.

Hart, J., & Walker, A. (2007). Clinical Rounds: Management of Occiput Posterior Position. *The Journal of Midwifery & Women's Health*, *52*(5), 508–513. doi:10.1016/j.jmwh.2006.10.018

Hodnett, E. D., Gates, S., Hofmeyr, G., & Sakala, C. (2012). Continuous support for women during childbirth. *The Cochrane Database of Systematic Reviews,* (10), CD003766. doi:10.1002/14651858.CD003766.pub4

Holmberg, N. G., Lilieqvist, B., Magnusson, S., & Segerbrand, E. (1977). The influence of the bony pelvis in persistent occiput posterior position. *Acta Obstetricia et Gynecologica Scandinavica. Supplement*, *66*, 49–54.

Howell, C. J., Kidd, C., Roberts, W., Upton, P., Lucking, L., Jones, P. W., & Johanson, R. B. (2001). A randomised controlled trial of epidural compared with non-epidural analgesia in labour. *The British Journal of Obstetrics and Gynaecology*, *108*(1), 27–33.

Humenick, S. S. (2006). The Life-Changing Significance of Normal Birth. *The Journal of Perinatal Education*, *15*(4), 1–3. doi:10.1624/105812406X151330

Hunter, S., Hofmeyr, G. J., & Kulier, R. (2007). Hands and knees posture in late pregnancy or labour for fetal malposition (lateral or posterior). *The Cochrane Database of Systematic Reviews*, (4), CD001063. doi:10.1002/14651858.CD001063.pub3

Jones, K. D. (2000). Incidence and risk factors for third degree perineal tears. *International Journal of Gynaecology and Obstetrics, 71*(3), 227–229.

Kaminski, H. M., Stafl, A., & Aiman, J. (1987). The effect of epidural analgesia on the frequency of instrumental obstetric delivery. *Obstetrics and Gynecology*, *69*(5), 770–773.

Kanto, J., Erkkola, R., Mansikka, M., & Aärimaa, L. (1983). Segmental epidural analgesia: A modern method for safe and effective management of labour pains. *Biological Research in Pregnancy and Perinatology*, *4*(4), 172–176.

Khan, K. S., Khan, B. F., Rasul, S., & Chohan, U. (1993). The safety of epidural analgesia in labour and its effect on delivery: A case control study in Pakistani women. *The Journal of the Pakistan Medical Association*, *43*(6), 115–117.

Klein, M. C., Grzybowski, S., Harris, S., Liston, R., Spence, A., Le, G., … Kaczorowski, J. (2001). Epidural analgesia use as a marker for physician approach to birth: Implications for maternal and newborn outcomes. *Birth*, *28*(4), 243–248.

Kreiser, D., Schiff, E., Lipitz, S., Kayam, Z., Avraham, A., & Achiron, R. (2001). Determination of fetal occiput position by ultrasound during the second stage of labour. *The Journal of Maternal-Fetal Medicine*, *10*(4), 283–286.

Lawrence, A., Lewis, L., Hofmeyr, J. & Styles, C. (2013). Maternal positions and mobility during first stage labour. *The Cochrane Database of Systematic Reviews,* (10), CD003934. doi:10.1002/14651858.CD003934.pub4

Le Ray, C., Carayol, M., Jaquemin, S., Mignon, A., Cabrol, D., & Goffinet, F. (2005). Is epidural analgesia a risk factor for occiput posterior or transverse positions during labour? *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, *123*(1), 22–26. doi:10.1016/j.ejogrb.2005.02.009

Lewallen, S., & Courtright, P. (1998). Epidemiology in Practice: Case-Control Studies. *Community Eye Health*, *11*(28), 57–58.

Lieberman, E., Davidson, K., Lee-Parritz, A., & Shearer, E. (2005). Changes in fetal position during labour and their association with epidural analgesia. *Obstetrics and Gynecology*, *105*(1), 974–982. doi:10.1097/01.AOG.0000158861.43593.49

Lieberman, E., & O'Donoghue, C. (2002). Unintended effects of epidural analgesia during labour: A systematic review. *American Journal of Obstetrics and Gynecology*, *186*(5), S31–68.

Liu, Y. C. (1989). The effects of the upright position during childbirth. *Image: The Journal of Nursing Scholarship*, *21*(1), 14–18.

LoBiondo-Wood, G., Haber, J., Cameron, C., & Singh, M. (2004). *Nursing Research in Canada: Methods, Critical Appraisal, and Utilization* (3rd ed.). St. Louis, MO: Elsevier Mosby.

Lowdermilk, D. L., Perry, S., Cashion, K., & Alden, K. R. (2012). *Maternity and Women's Health care* (10th ed.). St. Louis, MO: Elsevier Mosby.

McFarlin, B. L., Engstrom, J. L., Sampson, M. B., & Cattledge, F. (1985). Concurrent Validity of Leopold's Maneuvers in Determining Fetal Presentation and Position. *Journal of Nurse-Midwifery*, *30*(5), 280–284. doi:10.1016/0091-2182(85)90043-6

Melzack, R., & Schaffelberg, D. (1987). Low-back pain during labour. *American Journal of Obstetrics and Gynecology*, *156*(4), 901–905.

Meyer, S., Hohlfeld, P., Achtari, C., Russolo, A., & De Grandi, P. (2000). Birth trauma: Short and long term effects of forceps delivery compared with spontaneous delivery on various pelvic floor parameters. *British Journal of Obstetrics Gynaecology*, *107*(11), 1360–1365.

Meyer, S., Schreyer, A., De Grandi, P., & Hohlfeld, P. (1998). The effects of birth on urinary continence mechanisms and other pelvic-floor characteristics. *Obstetrics and Gynecology*, *92*(1), 613–618.

Nathoo, K., Chimbira, T., & Mtimavalye, L. (1990). Mortality and immediate morbidity in term babies with low Apgar scores. *Annals of Tropical Paediatrics, 10*(3), 239-244.

Nizard, J., Haberman, S., Paltieli, Y., Gonen, R., Ohel, G., Le Bourthe, Y., & Ville, Y. (2009). Determination of fetal head station and position during labour: A new technique that combines ultrasound and a position-tracking system. *American Journal of Obstetrics & Gynecology*, *200*(4), 404.e1–404.e5. doi:10.1016/j.ajog.2008.10.051

Palencia, R., Gafni, A., Hannah, M. E., Ross, S., Willan, A. R., Hewson, S.…Term Breech Trial Collaborative Group. (2006). The costs of planned cesarean versus planned vaginal birth

in the Term Breech Trial. *Canadian Medical Association Journal,174*(8), 1109–1113. doi:10.1503/cmaj.050796

Pattinson, R. C. (2000). Pelvimetry for fetal cephalic presentations at term. *The Cochrane Database of Systematic Reviews*, (2), CD000161. doi:10.1002/14651858.CD000161

Pearl, M. L., Roberts, J. M., Laros, R. K., & Hurd, W. W. (1993). Vaginal delivery from the persistent occiput posterior position. Influence on maternal and neonatal morbidity. *The Journal of Reproductive Medicine*, *38*(12), 955–961.

Perinatal Services of British Columbia. (2013). About us. Retrieved on November 20, 2014 from http://www.perinatalservicesbc.ca/AboutUs/default.htm

Perinatal Services of British Columbia. (2008). British Columbia Newborn Record Part 1. Retrieved on November 20, 2014 from http://www.perinatalservicesbc.ca/NR/rdonlyres/8F9282A0-50B4-40EE-90FA-E4B990E67C3F/0/FormsNewbornRecord1and21583A.pdf

Perinatal Services of British Columbia. (2011). Decision Support Tool No. 4: Evaluation of Progress of Labour/Dystocia. Retrieved on March 20, 2014 from http://www.perinatalservicesbc.ca/NR/rdonlyres/97019F1F-9F02-456A-8EA7-5576EFF2D090/0/CoreCompDSTEvalofLabourDystocia4.pdf

Perlman, J. M., & Risser, R. (1996). Can asphyxiated infants at risk for neonatal seizures be rapidly identified by current high-risk markers? *Pediatrics*, *97*(4), 456–462.

Phillips, R. D., & Freeman, M. (1974). The management of the persistent occiput posterior position. A review of 552 consecutive cases. *Obstetrics and Gynecology*, *43*(2), 171–177.

Pillitteri, A. (2010). *Maternal & Child Health Nursing: Care of the Childbearing & Childrearing Family*. Lippincott Williams & Wilkins.

Ponkey, S. E., Cohen, A. P., Heffner, L. J., & Lieberman, E. (2003). Persistent fetal occiput posterior position: Obstetric outcomes. *Obstetrics and Gynecology*, *101*(5), 915–920.

Portman, R. J., Carter, B. S., Gaylord, M. S., Murphy, M. G., Thieme, R. E., & Merenstein, G. B. (1990). Predicting neonatal morbidity after perinatal asphyxia: A scoring system. *American Journal of Obstetrics and Gynecology*, *162*(1), 174–182.

Posner, G., Black, A., Jones, G., & Dy, J. (2013). *Oxorn Foote Human Labour and Birth* (6th ed.). McGraw-Hill.

Puddicombe, J. F. (1955). Maternal posture for correction of posterior fetal position. *The Journal of the International College of Surgeons*, *23*(1), 73–77.

Reichman, O., Gdansky, E., Latinsky, B., Labi, S., & Samueloff, A. (2008). Digital rotation from occipito-posterior to occipito-anterior decreases the need for cesarean section. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, *136*(1), 25–28. doi:10.1016/j.ejogrb.2006.12.025

Ridley, R. T. (2007). Diagnosis and intervention for occiput posterior malposition. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 36*(2), 135–143. doi:10.1111/j.1552-6909.2007.00130.x

Robertson, P. A., Laros, R. K., Jr, & Zhao, R. L. (1990). Neonatal and maternal outcome in low-pelvic and midpelvic operative deliveries. *American Journal of Obstetrics and Gynecology*, *162*(6), 1436–1442.

Robinson, C. A., Macones, G. A., Roth, N. W., & Morgan, M. A. (1996). Does station of the fetal head at epidural placement affect the position of the fetal vertex at delivery? *American Journal of Obstetrics and Gynecology*, *175*(4), 991–994.

Salameh, C., Canoui-Poitrine, F., Cortet, M., Lafon, A., Rudigoz, R.-C., & Huissoud, C. (2011). [Does persistent occiput posterior position increase the risk of severe perineal laceration?]. *Gynécologie, Obstétrique & Fertilité*, *39*(10), 545–548. doi:10.1016/j.gyobfe.2011.07.030

Salustiano, E., Campos, J., Ibidi, S., Ruano, R., & Zugaib, M. (2012). Low apgar scores at 5 minutes in a low risk population: Maternal and obstetrical factors and postnatal outcomes. *Revista da Associação Médica Brasileira, 58*(5), 587-593.

Senécal, J., Xiong, X., & Fraser, W. D. (2005). Effect of fetal position on second-stage duration and labour outcome. *Obstetrics and Gynecology*, *105*(4), 763–772. doi:10.1097/01.AOG.0000154889.47063.84

Shaffer, B. L., Cheng, Y. W., Vargas, J. E., & Caughey, A. B. (2011). Manual rotation to reduce caesarean delivery in persistent occiput posterior or transverse position. *The Journal of Maternal-Fetal & Neonatal Medicine*, *24*(1), 65–72. doi:10.3109/14767051003710276

Sharma, J. B. (2009). Evaluation of Sharma's modified Leopold's maneuvers: A new method for fetal palpation in late pregnancy. *Archives of Gynecology and Obstetrics*, *279*(4), 481–487. doi:10.1007/s00404-008-0745-x

Sherer, D. M., Miodovnik, M., Bradley, K. S., & Langer, O. (2002a). Intrapartum fetal head position I: Comparison between transvaginal digital examination and transabdominal ultrasound assessment during the active stage of labour. *Ultrasound in Obstetrics & Gynecology*, *19*(3), 258–263. doi:10.1046/j.1469-0705.2002.00641.x

Sherer, D. M., Miodovnik, M., Bradley, K. S., & Langer, O. (2002b). Intrapartum fetal head position II: Comparison between transvaginal digital examination and transabdominal

ultrasound assessment during the second stage of labour. *Ultrasound in Obstetrics & Gynecology, 19*(3), 264–268. doi:10.1046/j.1469-0705.2002.00656.x

Simkin, P. (2010). The fetal occiput posterior position: State of the science and a new perspective. *Birth*, *37*(1), 61–71. doi:10.1111/j.1523-536X.2009.00380.x

Simpson, K. R., & James, D. C. (2005). Efficacy of intrauterine resuscitation techniques in improving fetal oxygen status during labour. *Obstetrics and Gynecology*, *105*(6), 1362–1368. doi:10.1097/01.AOG.0000164474.03350.7c

Sizer, A. R., & Nirmal, D. M. (2000). Occipitoposterior position: Associated factors and obstetric outcome in nulliparas. *Obstetrics and Gynecology*, *96*(5), 749–752.

Society of Obstetrics and Gynaecology Canada (2007). Fetal health surveillance: Antepartum and intrapartum consensus guideline. *Journal of Obstetrics and Gynaecology Canada, 29*(9), S1-56.

Souka, A. P., Haritos, T., Basayiannis, K., Noikokyri, N., & Antsaklis, A. (2003). Intrapartum ultrasound for the examination of the fetal head position in normal and obstructed labour. *The Journal of Maternal-Fetal & Neonatal Medicine, 13*(1), 59–63. doi:10.1080/jmf.13.1.59.63

Stremler, R. H. (2006). Randomized controlled trial of hands-and-knees positioning for occipitoposterior position in labour. *Birth, 32*(4), 243–51. doi:10.1111/j.0730-7659.2005.00382.x

Stremler, R., Halpern, S., Weston, J., Yee, J., & Hodnett, E. (2009). Hands-and-knees positioning during labour with epidural analgesia. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 38*(4), 391–398. doi:10.1111/j.1552-6909.2009.01038.x

Thorp, J. A., Eckert, L. O., Ang, M. S., Johnston, D. A., Peaceman, A. M., & Parisi, V. M. (1991). Epidural analgesia and cesarean section for dystocia: Risk factors in nulliparas. *American Journal of Perinatology*, *8*(6), 402–410. doi:10.1055/s-2007-999426

Thorp, J. A., Hu, D. H., Albin, R. M., McNitt, J., Meyer, B., Cohen, G. R. & Yeast, J. D. (1993). The effect of intrapartum epidural analgesia on nulliparous labor: A randomized, controlled, prospective trial. *American Journal of Obstetrics and Gynecology, 169*(4), 851-858. Doi: 10.1016/0002-9378(93)90015-B

To, W. W., & Li, I. C. (2000). Occipital posterior and occipital transverse positions: Reappraisal of the obstetric risks. *The Australian & New Zealand Journal of Obstetrics & Gynaecology*, *40*(3), 275–279.

Wheeler, T. L., 2nd, & Richter, H. E. (2007). Delivery method, anal sphincter tears and fecal incontinence: New information on a persistent problem. *Current Opinion in Obstetrics & Gynecology*, *19*(5), 474–479. doi:10.1097/GCO.0b013e3282ef4142

Zwelling, E. (2010). Overcoming the challenges: Maternal movement and positioning to facilitate labour progress. *The American Journal of Maternal Child Nursing*, *35*(2), 72–78. doi:10.1097/NMC.0b013e3181caeab3

Appendices

Appendix A: Labour and Birth Summary Record

British Columbia Labour and Birth Summary Record

1. Newborn Hospital ID

☐ Singleton ☐ Twin A ☐ Twin B ☐ Triplet A ☐ Triplet B ☐ Triplet C

Gest Age: wks.

(status prior to this delivery as on Antenatal Record, Part 1)

G T P A L EDD

Surname Given Name

Address

Phone number

Personal Health Number Physician/Midwife Name

2. Labour

☐ No Labour

☐ Spontaneous

☐ Augmented ☐ ARM ☐ Oxytocin ☐ Other: _____ Indication: _____

☐ Induced ☐ Foley ☐ ARM ☐ Oxytocin ☐ Prostaglandin, # Inserted: _____ ☐ Other: _____ Primary Indication: _____

3. Intrapartum

Liquor ☐ Clear ☐ Meconium ☐ Bloody

Fetal Surveillance ☐ Intermittent Auscultation ☐ External EFM ☐ Internal EFM ☐ IUPC Indication for EFM: _____

☐ Fetal Blood Sampling: Lowest: pH _____ Base Excess _____

Fetal Presentation ☐ Cephalic ☐ Breech ☐ Frank ☐ Complete ☐ Incomplete ☐ Footling

Other presentation *(specify)*:

Analgesia/Anaesthesia

☐ None ☐ Opioids ☐ Entonox

☐ Local ☐ Pudendal ☐ Other:

Labour ☐ Epidural ☐ Spinal ☐ Combined

CS ☐ Epidural ☐ Spinal ☐ Combined ☐ General

Prophylactic Antibiotics

☐ None

☐ Intrapartum, # doses _____

☐ Intraoperative

☐ Other:

4. Delivery

Fetal Position at Onset of Labour *(specify)*: _____

Fetal Position at Delivery: ☐ OA ☐ OP ☐ Other: _____

☐ SVD

VBAC Candidate ☐ No ☐ Yes: ☐ Trial of Labour ☐ Elective CS

☐ Assisted ☐ Vacuum

Forceps: ☐ Outlet ☐ Low ☐ Mid ☐ Rotation

Application: ☐ Easy ☐ Mod. Difficult ☐ Difficult

☐ Cesarean ☐ Primary ☐ Repeat: CS # _____

Primary Indication: _____

☐ Elective ☐ Urgent ☐ Emergent

Decision at _____ dd/mm/yyyy _____ hrs. Time _____ cm. Cervix Dilated

Maternal Position at Delivery *(specify)*:

Oxytocin ☐ None ☐ IM ☐ IV ☐ Infusion

Placenta

Complete ☐ Yes ☐ No

☐ Maternal Effort

☐ Controlled Traction

☐ Manual

☐ Operative

Sent to Pathology ☐ Yes ☐ No

Cord

Vessels ☐ 2 ☐ 3

Cord Gases ☐ Yes ☐ No

Cord Clamped ☐ Early (< 2 min.) ☐ Late (≥ 2 min.)

Abnormalities/Complications:

Perineum/Vagina/Cervix

☐ Intact

☐ Laceration ☐ 1st ☐ 2nd ☐ 3rd ☐ 4th degree

☐ Episiotomy ☐ Midline ☐ Mediolateral

☐ Cervical Tear

☐ Other Trauma: _____

Initials

Sponge Count Correct ☐ Yes ☐ No _____

Needle Count Correct ☐ Yes ☐ No _____

Repaired by: _____ MD/RM

Estimated Blood Loss

☐ < 500 mL ☐ 500–1000 mL ☐ > 1000 mL

Intervention Required ☐ Yes ☐ No

If yes, ☐ Medication ☐ Blood Products ☐ Other

5. Time Summary

	Hours	Min.	Day	Month	Year
Membranes Ruptured					
1st Stage					
2nd Stage					
Time of Birth					
Placenta Delivered					

Duration

	Hours	Min.
1st Stage		
2nd Stage		
3rd Stage		

Duration of Ruptured membranes	Hours

Delivered By: _____ ☐ MD ☐ RM ☐ RN ☐ OTHER *(specify)*:

MD/RM Present: _____

Nurses Present: _____

Others Present: _____

☐ Male

☐ Female

☐ Undifferentiated

Apgar at 1 min.	at 5 min.	at 10 min.	Weight
			g.

Stillbirth: ☐ Antepartum ☐ Intrapartum

Comments on Labour and Birth:

☐ Normal If not, *specify*:

Place of Birth: ☐ Hospital ☐ Home ☐ Other:

Consult To:

☐ Obstetrician ☐ Paediatrician

☐ Family Physician ☐ Other:

SIGNATURE RM/RN

SIGNATURE MD/RM

BAR CODE AREA—DO NOT USE

PSBC 1588 – MARCH 2008 ©Perinatal Services BC

WHITE: MOTHER'S CHART YELLOW: INFANT'S CHART PINK: PHYSICIAN/MIDWIFE

Appendix B: British Columbia Labour Partogram

Date	Hour Time	1	2	3	4	5	6
3 FETAL ASSESSMENT	AUSC • / EXT X / FECG O (200–50)						
	Rhythm [R, I]/Variability						
	Accelerations						
	Decelerations						
	Classification [N, ATYP, ABN]						
4 CONTRACTIONS	Frequency [in 10 min]/Intensity						
	Duration [in sec]						
	Resting tone [F, S, mmHg]						
	IV Oxytocin: _____ I.U./_____ mL ☐ Augmentation ☐ Induction — Time / Mu/min						
5 MEDS (dose/route/time) PROCEDURES TREATMENTS							
6 MATERNAL ASSESSMENT	Blood pressure: Systolic ∨ / Diastolic ∧ / Pulse • / Temp X (190–50)						
	RR/O_2 Sat						
	Non-pharmacologic						
	Activity/Position						
	Urine/Blood sugar [mmol/L]						
7 REGIONAL ANALG.	☐ Epidural ☐ Spinal ☐ Combined ☐ PCEA — 1st Bolus at _____ h — Continuous infusion at _____ h — Shift/total infused _____ mL						
	Dr. / Called at _____ h / Arrived at _____ h — Bolus/Rate						
	R/L sensory						
	R/L motor						
	Pain/Sedation Scale						
	Initials						

Legend (For any variance * = see Variance Record/Progress Notes)

FETAL ASSESSMENT
Rhythm (for IA)
R = Regular
I = Irregular
Variability (for EFM)
ø = Absent (undetectable)
↓ = Minimal (≤ 5 bpm)
+ = Moderate (6–25 bpm)
↑ = Marked (> 25 bpm)

Accelerations
✔ = Present/Spontaneous
ø = Absent/Not heard
SS = Present/Scalp Stimulation
Decelerations
✔ = Present
ø = Absent/Not heard

Decelerations (cont'd)
E = Early
V = Variable*
L = Late*
P = Prolonged*
* Charting includes:
↓ _____ bpm x _____ sec/min

Classification
N = Normal
ATYP = Atypical
ABN = Abnormal

CONTRACTIONS
Intensity
M = Mild
Mod = Moderate
S = Strong
_____ mmHg (IUPC)

Resting Tone
S = Soft
F = Firm
_____ mmHg (IUPC)

7	8	9	10	11	12	Hour Time	Date

FETAL ASSESSMENT

200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50

AUSC •
EXT X
FECG O

Rhythm **[R, I]**/Variability
Accelerations
Decelerations
Classification **[N, ATYP, ABN]**

CONTRACTIONS

Frequency **[in 10 min]**/Intensity
Duration **[in sec]**
Resting tone **[F, S, mmHg]**
Time — IV Oxytocin: _____ I.U./_____ mL
Mu/min — ☐ Augmentation ☐ Induction

MEDS (dose/route/time)
PROCEDURES
TREATMENTS

MATERNAL ASSESSMENT

°C 40 **39** 38 37 36 **35**

190 180 170 **160** 150 140 130 120 **110** 100 90 80 70 60 50

Blood pressure
Systolic v
Diastolic ^
Pulse •
Temp X

RR/O_2 Sat
Non-pharmacologic
Activity/Position
Urine/Blood sugar **[mmol/L]**

REGIONAL ANALG.

☐ Epidural ☐ Spinal ☐ Combined ☐ PCEA 1st Bolus at _____ h Continuous infusion at _____ h Shift/total infused _____ mL

Bolus/Rate
R/L sensory
R/L motor
Pain/Sedation Scale

Dr.
Called at _____ h
Arrived at _____ h

Initials

Legend **(For any variance * = see Variance Record/Progress Notes)**

MATERNAL ASSESSMENT

Activity/Position
- **Sit** = Sitting
- **Std** = Standing
- **RL** = Right lateral
- **LL** = Left lateral
- **SU** = Supine
- **LI** = Lithotomy
- **SF** = Semi-Fowler's
- **AMB** = Ambulating
- **BB** = Birthing ball
- **HK** = Hands & knees
- **KC** = Knee-chest
- **Sq** = Squatting
- **TR** = Trendelenberg

Urine
- **P** = Protein
- **K** = Ketones
- **V** = Void
- **I&O** = In and out catheter
- **FC** = Foley catheter inserted

REGIONAL ANALGESIA
- **R/L sensory** = Right/Left sensory level testing
- **R/L motor** = Right/Left motor block
- **0** = None
- **1** = Partial
- **2** = Almost complete
- **3** = Complete

Pain Scale (0–10)
- **0** = No pain
- ↓
- **10** = Worst pain possible

Sedation Scale
- **1** = Fully awake and oriented
- **2** = Drowsy
- **3** = Eyes closed but rousable to command
- **4** = Eyes closed but rousable to mild physical stimulation (earlobe tug)
- **5** = Eyes closed but unrousable to mild physical stimulation

Appendix C: British Columbia Triage Record

1 Date | Time

Arrived by ambulance ☐ Yes ☐ No

Language preferred

REASON FOR VISIT _____ Accompanied by _____

G ____ T ____ P ____ A ____ L ____ LMP _____ EDD dates _____ US _____ Gestational age ____

2 INITIAL ASSESSMENT

Contractions	Membranes	Bleeding	Fetal movement
☐ Yes ☐ No	☐ Intact ☐ Ruptured ☐ Query	☐ Yes ☐ No ☐ Show	☐ Normal
Date ____ Time started ____	Date _____	Date ____ Time started ____	☐ ↑ ☐ ↓ since Date _____
☐ Regular ☐ Irregular q ____ min	Time _____	Amount _____	Time _____
Intensity _____	Colour _____	Colour/consistency _____	
Duration _____			

Infectious history Recent infectious disease/contact ☐ No ☐ Yes, *specify* _____ *e.g. MRSA, VRE, chickenpox, Hep B, TB, HSV*

Antibiotic Resistant Organism screen completed ☐ Yes ☐ No Initials _____

Triaged as ☐ Emergent ☐ Urgent ☐ Non-urgent Triaged to ☐ LDR ☐ Assessment room ☐ Waiting room ☐ _____

STOP

3 HISTORY/RISK FACTORS *Antenatal Record Part 1 & 2* ☐ *Reviewed* ☐ *Not available (complete below)*

ALLERGIES ☐ NKA ☐ Yes, *specify/reactions* _____ ABO group ____ Rh ____

GBS result ☐ Unk ☐ Neg ☐ Pos ☐ Swabs taken Last done _____

Current medications/complementary therapy ☐ Vitamins only ☐ Other meds & last dose _____

☐ *See Medication Reconciliation Form*

Height ____ cm/in Pre-pregnant wt. ____ kg/lb Pre-pregnant BMI ____ Current wt. ____ kg/lb Wt. gain ____ kg/lb

Pregnancy concerns ☐ None

Past obstetric concerns ☐ None

Medical/surgical/anesthetic concerns ☐ None

Psychosocial concerns ☐ None ☐ Substance use ☐ Mental health ☐ Current tobacco use #/day ____ If quit, last use _____

Previous admission this pregnancy ☐ None ☐ Yes, reason

4 ASSESSMENT Last ate _____ Last drank _____ Symphysis fundal ht. consistent with gestational age ☐ Yes ☐ No ____ cm

Presentation _____ Lie _____ Position _____ Engaged ☐ Yes ☐ No

FH assessment mode ☐ AUSC ☐ EFM ☐ NST If EFM/NST, *specify reason* _____

FHR					
	Time				
	FHR [bpm]				
	Rhythm/ Variability				
	Accelerations				
	Decelerations				
	Classify as				

MATERNAL					
	Time				
	Contractions				
	BP				
	Pulse				
	Temp/Resp				
	Urine P/K				
	Blood sugar				
	INITIALS				

VAGINAL EXAM			
	Time		
	Cx dilatation [cm]		
	Cx length [cm]		
	Station		
	Cx position [Anterior, Mid, Posterior]		
	Cx consistency [Soft, Med, Firm]		
	EXAMINED BY		

TESTS		
	Bishop score	Urine sent ☐ R&M ☐ C&S
	Amniotic fluid Nitrazine ☐ Neg ☐ Pos	Blood work:
	Ferning ☐ Neg ☐ Pos	
	Swabs done ☐ fFN ☐ C&S ☐ Other	

Provider name _____

Notified by _____ at ____ h

Provider arrived at ____ h

Completed by _____ Signature

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Appendix D: British Columbia Antenatal Record Part 1

British Columbia Antenatal Record Part 1

1. Hospital | Attending physician/midwife: | Referring physician/midwife:

Mother's name	Date of birth (DD/MM/YYYY)	Age at EDD
Mother's maiden name	Ethnic origin	Language preferred
Occupation	Work hrs/day	No. of school yrs. completed
Partner's name / Age	Ethnic origin of newborn's father	Partner's work

Surname | Given name
Address
Phone number | Personal health number

2. Allergies ☐ None known ☐ Yes (reaction) | Medications/herbals | Beliefs & practices

3. Obstetrical History Gravida Term Preterm Abortion (Induced _____ Spontaneous _____) Living

Date	Place of birth/abortion	Hrs. in labour	Gest. age	Type of birth	Perinatal complications	Children: Sex	Birth Weight	Breastfed	Present health

4. LMP (DD/MM/YYYY) | Menses cycle | Contraceptives | When stopped (DD/MM/YYYY) | EDD by dates (DD/MM/YYYY) | Confirmed EDD (DD/MM/YYYY) | 1st US (DD/MM/YYYY) | GA by US (WEEKS + DAYS)

5. Present Pregnancy

No — *Yes (specify)*

- ☐ IVF pregnancy _____
- ☐ Bleeding _____
- ☐ Nausea _____
- ☐ Infections or fever _____
- ☐ Other _____

6. Family History

No — *Yes (specify)*

- ☐ Heart disease _____
- ☐ Hypertension _____
- ☐ Diabetes _____
- ☐ Depression/psychiatric _____
- ☐ Alcohol/drug use _____
- ☐ Thromboembolic/coag. _____ *Maternal* *Newborn's Father*
- ☐ Inherited disease/defect _____
- ☐ Ethnic (e.g. Taysachs, Sickle) _____
- ☐ Other _____

7. Medical History

No — *Yes (specify)*

- ☐ Surgery _____
- ☐ Anesthesia _____
- ☐ Uterine/Cx procedure _____
- ☐ STIs/infections _____
- ☐ Susceptible to chicken pox _____
- ☐ Thromboembolic/coag. _____
- ☐ Hypertension _____
- ☐ GI _____
- ☐ Urinary _____
- ☐ Endocrine/diabetes _____
- ☐ Neurologic _____
- ☐ Hx of mental illness _____
  - ☐ Anxiety ☐ Depression ☐ Bipolar
  - ☐ PP depression ☐ Unknown ☐ Other
- ☐ Other _____

8. Lifestyle & Social

Discussed — *Concerns* — *Referred*

- ☐ Diet/Food Safety _____ ☐
- ☐ Folic acid _____
- ☐ Physical Activity/rest/work _____ ☐
- ☐ OTC drugs/vitamins _____ ☐
- ☐ Alcohol ☐ never ☐ quit (DD/MM/YYYY) _____
  Drinks/wk: before pregnancy _____ current _____
  Binge drinking ☐ No ☐ Yes ☐
- ☐ TWEAK score _____ (see reverse)
- ☐ Substance use ☐ No ☐ Yes ☐
  - ☐ Heroin ☐ Cocaine ☐ Marijuana
  - ☐ Methadone ☐ Solvents ☐ Other
  - ☐ Prescription ☐ Unknown _____
- ☐ Smoking ☐ never ☐ quit (DD/MM/YYYY) _____
  Cig/day: before pregnancy _____ current _____ ☐
- ☐ Exposure 2nd hand smoke ☐ No ☐ Yes
- ☐ Financial & housing _____ ☐
- ☐ Support system _____ ☐
- ☐ IPV _____ ☐
- ☐ Public Health Nursing follow-up/assessment ☐

9. Physical Examination

Date (DD/MM/YYYY)	BP	Height (CM)	Pre-pregnant weight (KG)	Pre-pregnant BMI

Head & neck | Musculoskeletal
Breasts & nipples | Varicles & skin
Heart & lungs | Pelvic exam
Abdomen | Swabs/cervix cytology

10. First Trimester Topics Discussed:

- ☐ Prenatal Genetic Screening ☐ Genetic counselling offered ☐ HIV & other tests
- ☐ Baby's Best Chance ☐ Prenatal education ☐ Breastfeeding
- ☐ Seat belt use ☐ Sexual relations

Plans to breastfeed: ☐ Yes ☐ No ☐ Maybe

11. Summary

SIGNATURE: MD/MW

BAR CODE AREA – DO NOT USE

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WHITE: MOTHER'S CHART YELLOW: INFANT'S CHART PINK: PHYSICIAN/MIDWIFE

Appendix E: Data Abstraction Tool

Labour and Birth Summary Record Data

1. **Inclusion/Exclusion Criteria**

   No Oligohydramnios □

2. **Position at delivery**

   OA □ OP □

3. **Induced**

   Y N

4. **Epidural**

   Y N

5. **Assisted delivery**

   Y N

6. **Perineum/Vagina/Cervix**

   Laceration – I □ 1st □ 2nd □ 3rd □ 4th □

   Episiotomy Y N

7. **Estimated Blood Loss**

   <500ml □ ≥500ml (PPH) □

8. **Membranes Ruptured (time/date)**

   ROM _____ , (___/___/___)

   □ SROM □ AROM

   1st stage _____ (___/___/___)

9. **Length of Labour**

   1st stage: Hrs_____ Min_____

   2nd stage: Hrs _____Min_____

10. **Apgar scores**

    1min_____ 5min_____

11. **Birth Weight Baby**

    _____g

Triage Record

1. **BMI**_____units OR

   Wt _____lbs/kg **Ht**_____cm/in

Labour Partogram

1. **Hands and Knees**

   Presence □ Absence □ #intervals ____

Antenatal Record Part 1

1. **Ethnic origin**

   _____

2. **Parity**

   Nulliparous□ Primiparous/Multiparous□

Matching Variables Quick Reference

1. **Parity**

   Nulliparous□ Primiparous/Multiparous□

2. **ROM**

   Early (Y) □ In Active Labour (N) □

3. **Maternal Age**

   ≤35 □ >35year □

4. **Month of infant's birth** _____