

**The Effect of Increasing Medical Interventions in Labour and Delivery on Skin-to-Skin and Breastfeeding in Newborns**

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May 2017

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This Capstone Project is submitted to the Faculty of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Physician Assistant Studies

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## Abstract

**Background:** Breastfeeding provides many benefits to infants. Placing newborns skin-to-skin following delivery is associated with increased breastfeeding success. Medical interventions like pain control (analgesia), labour induction/augmentation, and Caesarian section deliveries (C-sections), have been associated with reduced rates of breastfeeding.

**Objective:** The goal of the current study was to determine how increasing medical intervention affect skin-to-skin and breastfeeding outcomes. **Method:** 147 medical charts of mother/baby pairs were audited at the Health Sciences Centre Women's Hospital in Winnipeg, Manitoba. They were divided into groups based on ascending degree of medical interventions and compared on skin-to-skin and breastfeeding outcomes using Chi-squared analysis. A secondary analysis was conducted to assess the association between skin-to-skin and breastfeeding. **Results:** Medical intervention was not significantly associated with breastfeeding outcomes. Delivery by C-section was significantly associated with decreased rates of skin-to-skin within five minutes and one hour of birth, compared with vaginal delivery (both  $p < 0.001$ ). Among vaginal deliveries, analgesia and labour induction/augmentation were not found to be associated with skin-to-skin practices. Skin-to-skin within one hour was associated with increased breastfeeding during hospital stay ( $p < 0.05$ ). **Conclusion:** C-sections predict decreased rates of skin-to-skin outcomes. However, so long as skin-to-skin is initiated within the first hour of life it can have benefit in increasing the likelihood of exclusive breastfeeding.

## Background

### Breastfeeding Benefits

Breastfeeding has many benefits to the newborn and should be strongly encouraged for most mothers (1–4). A meta-analysis from 2007 summarized that breastfeeding has been associated with reduced risk of both acute and chronic illnesses including gastroenteritis, acute otitis media, severe lower respiratory tract infections, asthma, atopic dermatitis, obesity, type 1 and 2 diabetes mellitus, childhood leukemia, sudden infant death syndrome (SIDS), and necrotizing enterocolitis (1). A review in 2016 produced similar findings (2) and added support for increased cognitive development. These findings all mirror breastfeeding benefits that are published by the World Health Association (WHO) (3) and United Nations International Children’s Emergency Fund (UNICEF) (4). Breastfeeding also has health benefits for the mother (1,2). It is associated with lower incidences of post-partum depression, reduced risk of type 2 diabetes, and breast and ovarian cancers (1,2) as well as reduction in hypertension, hyperlipidemia, and cardiovascular disease (2). The high association between breastfeeding and health benefits for both baby and mother has led to more frequent investigations aimed at identifying barriers to successful breastfeeding and developing strategies for improvement.

### Mode of Delivery

Vaginal deliveries have been associated with higher rates of breastfeeding as compared with Caesarian sections (C-sections) (5–8). Breastfeeding rates have been assessed in various ways including: initiation within one hour of delivery (9), during hospital stay (i.e. by discharge) (6), and over the months that follow hospital discharge

(6,7). An observational study conducted in Istanbul found that babies born vaginally were significantly more likely to be breastfed within the first hour of life as compared with those born via C-section (9). They attributed this to worsening discomfort at the surgical incision site associated with the proper positioning required for breastfeeding, as well as to the lasting effects of the anesthetics (9). This is important since the literature has found that breastfeeding initiation within the first hour of life is associated with better long-term breastfeeding outcomes in the days, weeks, and months that follow (7,10,11).

The association between C-sections and decreased breastfeeding success has been replicated (5–9,11–14). This gave rise to studies aimed at differentiating breastfeeding outcomes between types of C-sections (for e.g. emergency versus elective (5–7)). A study by Zanardo et al (2010) looked at elective versus emergency C-sections as predictors for exclusive breastfeeding in the delivery room, upon hospital discharge, as well as at one week, three months, and at six months of age. They had hypothesized that due to the increased labour difficulty prior to surgery (due to the stress, sleep deprivation, pharmaceuticals, augmentation, etc) the emergency group would have lower rates of breastfeeding. While they did not find a significant difference between C-section groups, they found a trend indicating that emergency C-sections were associated with less breastfeeding at delivery and at hospital discharge. They also replicated a significant association between breastfeeding and birth modality when C-sections were compared with vaginal deliveries (6). A study by Regan et al (2013) actually found the inverse of what Zanardo et al (2010) had hypothesized. They found that in women undergoing repeat C-sections, those that attempted an unsuccessful trial of labour prior to surgery were more likely to initiate breastfeeding during hospital stay than were elective repeat

C-section newborns (5). Vaginal deliveries after C-sections were, again, significantly more likely to initiate breastfeeding than both groups (5). A Canadian study looked at associations between birth mode and long-term breastfeeding behaviours. They found that elective C-sections were associated with lower rates of breastfeeding at four months of age even though emergency C-sections were associated with more difficulties with breastfeeding starting immediately with first breastfeeding attempt (7). The elective C-sections were also inversely associated with breastfeeding initiation and duration (7).

Overall the literature is consistent in finding that C-section deliveries are associated with lower rates of breastfeeding when compared with vaginal deliveries (5–9). The findings have been inconsistent in terms of whether emergency versus elective C-sections are more likely to be associated with improved breastfeeding outcomes (5–7).

### Labour Drugs: Analgesia and Labour Induction/Augmentation

Commonly used labour drugs have been found to have a negative effect on lactation (15) and latching/suckling (16–19), both of which are required for successful breastfeeding. A study by Lind et al (2014) aimed to identify if epidural/spinal analgesia had a role in delaying the onset of lactation, which is commonly associated with poorer breastfeeding outcomes (15). They found that regardless of delivery mode there was a significantly higher rate of lactation delay in women who received multiple routes of analgesia during labour (spinal/epidural plus other). This is similar to what was found by Wiklund et al (2009). They found that infants born to mothers who received epidural pain control had significantly lower rates of suckling in the first four hours after birth, more formula supplementation during hospital stay, and lower rates of exclusive breastfeeding upon hospital discharge (18). Lind et al were unable to demonstrate any

association between labour induction/augmentation pharmaceutical intervention (15). However Wiklund et al found that oxytocin administration was also associated with delay in breastfeeding initiation and with higher rates of formula supplementation (18). A recent study by Brimdyr et al (2015) looked at both epidural fentanyl and synthetic oxytocin effects on breastfeeding simultaneously. All newborns in the study were placed skin-to-skin (see below) immediately after a spontaneous vaginal delivery for one hour. They found that both the amount and duration over which the epidural fentanyl was given and the amount and duration over which the oxytocin was infused were inversely associated with successful suckling behaviour within the first hour of delivery (16). An investigation by Fernandez et al (2012) aimed to look exclusively at oxytocin use and the effect on breastfeeding, however, a major limitation of their study was that all women were also subjected to epidural pain control (19). They did find a negative association between increasing oxytocin dose and initiation of breastfeeding and exclusive breastfeeding at three months post-partum. However they did not include a control group against which to compare these findings; thus, the separation between analgesia effects and oxytocin effects remains blurred (19).

### Skin-to-Skin Contact

Skin-to-skin contact is defined as placing the naked newborn against the mother's naked abdomen or chest, often wrapping a warm blanket around mother and baby together (12,20). It has been accepted that the inborn instinct to search out a nipple for breastfeeding is strongest immediately following delivery (16,20). Removing the barrier between newborn and breast via skin-to-skin contact increases the likelihood of a successful latch and feed (12). Studies have found that placing newborns skin-to-skin

with their mother immediately after birth is associated with higher rates of exclusive breastfeeding (20,21), more effective breastfeeding (20,22), longer duration of breastfeeding sessions (22), and longer-term breastfeeding (20). Accumulating supportive evidence has led to initiatives like the Baby Friendly Hospital Initiative developed by WHO and UNICEF, which recommends that skin-to-skin be implemented immediately following deliveries and should be continued for a minimum of one hour or until the first breastfeed is complete (10,12,20,22,23) since interrupted skin-to-skin can be associated with reduced breastfeeding success (24). Studies have found that skin-to-skin contact is associated with its own health benefits for newborns including improved thermoregulation and blood glucose regulation, decreased risk of jaundice (12,22,25), while also encouraging maternal-baby bonding (22). It is recommended that infants delivered vaginally be placed on the mother immediately and that infants delivered by C-section be placed on the mother as soon as she is alert and responsive (12). C-sections have been associated with delayed skin-to-skin (8,20,26) and this has been suggested as being one of the main contributors for less successful breastfeeding in C-section deliveries (see above). A number of obstacles to skin-to-skin after surgery have been discussed throughout the literature including insufficient operating room (OR) staff, cold temperatures of the OR, altered level of alertness in the newborn, and so on (20). General routine in the OR in the past has been to focus on the surgery technique and pass the baby to a midwife or pediatrician for physical examination before the parents get to see their newborn (26). It has been found that in general, without skin-to-skin, C-sections are associated with lower rates of breastfeeding in the delivery room, at hospital discharge, and months after discharge (6). Interestingly, even when babies undergo skin-

to-skin immediately after a C-section, they still experience a delay in breastfeeding as compared with vaginally delivered infants (13,20). A randomized control trial by Armbrust et al (2016) looked at skin-to-skin immediately after delivery exclusively in C-section deliveries and found that those who underwent skin-to-skin had significantly higher breastfeeding rates than those in the control group (26).

## Summary

C-section deliveries, analgesia, labour induction/augmentation, and delaying or eliminating skin-to-skin have all been shown to decrease breastfeeding success. The consistent underlying pattern between all of the findings discussed above is that as the number and intensity of medical interventions increase, breastfeeding success generally decreases. Given that individual interventions can be challenging to separate since they are so often amalgamated, the present study will aim to incorporate these interrelated factors into one investigation where medical intervention will be categorized upon a continuum and general trends will be examined.

## Objective

The objective of this study is to uniquely consider mode of delivery, labour induction/augmentation, as well as pain control, and their effects on both newborn breastfeeding and skin-to-skin during hospital stay. These variables have not typically been considered together within the same study design. Given the strong relationship between skin-to-skin and breastfeeding, these will be considered as individual outcomes. There are two key hypotheses that will be tested. First, it is hypothesized that increasing medical intervention during labour and delivery will be associated with a decreasing likelihood of immediate skin-to-skin contact between mother and newborn. Second, it is

hypothesized that increasing medical intervention during labour and delivery will be associated with a decreasing rate of breastfeeding success within the first hour of life and during hospital stay. By categorizing the degree of medical intervention from least to most invasive, this study will be able to look at trends of how interventional management correlates with skin-to-skin and breastfeeding success. As a secondary objective, the study will also examine the relationship between skin-to-skin and breastfeeding between groups of increasing medical intervention within the same population.

## Method

### Study Design

We conducted a retrospective hospital chart review of births occurring at the Health Sciences Centre (HSC) Women's Hospital in Winnipeg, Manitoba between February 2016 and August 2016. The HSC is the site for approximately 5500 deliveries per year, approximately 33% of all annual births in Manitoba (27). Neonate fatalities and NICU admissions were excluded. A total of 147 births were randomly selected by a Decision Support Specialist from Winnipeg Regional Health Authority to be audited. Ethics approval was obtained through the University of Manitoba Bannatyne Campus Research Ethics Boards.

### Procedure

#### *Data collection*

Mother and newborn charts were requested from the hospital archives and were reviewed at the Health Information Records Office at the HSC in Winnipeg. Maternal and newborn charts were manually paired and two physician assistant students collected

the information, which was entered into an encrypted Microsoft Access Database, protected by a secure password.

*Exposure: Degree of medical intervention*

Six exposure groups were defined based on degree of medical intervention during labour and delivery. Pain control, labour induction and augmentation, and surgical management defined the degree of medical intervention. Pain control was deemed to be the least invasive and was defined as pharmaceutical (oral, intravenous, and epidural narcotics, and oral Acetaminophen), or inhalation of nitrous oxide. Labour induction and augmentation were considered synonymous for the sake of this study and were defined as the use of oxytocin infusion, prostaglandin E2 (eg, Cervadil and Prostin), or artificial rupture of membranes. C-Sections were deemed to be the most invasive medical intervention and were subdivided into elective and emergency based on physician documentation. Emergency C-sections were regarded as more medically invasive than elective since the patient had often undergone several other interventions leading up to surgical management, which is consistent with previous studies (example Zanardo et al (2010)). The use of assistance devices such as vacuums was not considered to be a medical intervention for the purposes of this study, although assisted deliveries commonly required both pain control and labour augmentation. The grouping parameters are displayed in Table 1. Ultimately, the groups were defined as follows: ‘Vaginal delivery without labour induction or augmentation nor pain control’ (i.e. ‘no medical intervention’); ‘Vaginal delivery with induction/augmentation without pain control’; ‘Vaginal delivery with pain control only’; ‘Vaginal delivery with both induction/augmentation and pain control’; ‘Elective C-section’; ‘Emergency C-section’.

*Outcomes: Breastfeeding success and skin-to-skin*

Breastfeeding success was defined in two ways: as initiating the first breastfeed within the first hour of life, or by exclusive breastfeeding (no formula supplementation) during hospital stay. Time to first breastfeed was also recorded for each newborn. With regard to skin-to-skin, this study looked at whether or not the newborn experienced contact within the first five minutes or the first hour of life, and whether or not it lasted for a minimum of 60 minutes without interruption. Time to skin-to-skin initiation was also recorded for each newborn.

*Statistical analysis*

Data was analyzed using R Studio software (28). Categorical variables (six medical intervention exposure groups and binary breastfeeding and skin-to-skin outcome variables, defined above) were tabulated and compared by Chi-squared test. Fisher's exact test was used to compare groups as an alternative to Chi-squared test when there were smaller group sizes. Mean time to breastfeeding and to skin-to-skin were also compared between groups using a one-way analysis of variance (ANOVA).

Missing data was the only exclusion criterion for analysis. Subjects could not be included in select data analyses if details were not documented or ambiguously documented in their medical chart. For this reason, some subsets of data analysis had  $N < 147$ .

## Results

### Study Population

A total of 147 mother and newborn chart pairs were audited. Twenty-six (17.7%) were C-section deliveries and 121 (82.3%) were vaginal deliveries. The distribution of

subjects between medical intervention groupings were as follows: ‘Vaginal delivery without intervention’ (n = 22, 15.0%); ‘Vaginal delivery with induction/augmentation only’ (n = 8, 5.4%); ‘Vaginal delivery with pain control only’ (n = 37, 25.2%); ‘Vaginal delivery with both induction/augmentation and pain control’ (n = 54, 36.7%); ‘Elective C-section’ (n = 11, 7.5%); ‘Emergency C-section’ (n = 15, 10.2%). One delivery resulted in twins and only one of the twin’s charts was randomly selected for audit. The remaining 146 pairs were singleton pregnancies. Mothers attended an average of 9.1 prenatal visits (SD = 3.4)(Table 2). The age range of mothers was from 14 to 45 years with a mean maternal age of 28.9 years (SD = 6.1) for all subjects. The mean gestational age at delivery was 38.9 weeks (SD = 1.7) and mean birth weight was 3399 grams (SD = 488) (Table 2). Maternal risk factors are displayed in Table 3 and included obesity (40.1%), cigarette smoking (25.2%), recreational drug use with marijuana and opioids being the most common (9.5%), gestational diabetes (4.8%), and gestational hypertension (8.8%). Groups were similar across demographical and risk factors.

#### *Breastfeeding Within One Hour*

Sixty-three newborns (42.9%) had their first breastfeeding within 60 minutes of delivery. There were 55 newborns (37.4%) that waited longer than 60 minutes for their first breastfeeding. Thirteen newborns (8.8%) had a documented reason for this delay (often that mother or baby required in-depth assessment or medical attention) while 42 newborns (28.6%) did not have a documented reason. Data was missing for 29 newborns (19.7%) which indicated that these babies were either fed exclusively with formula during hospital stay, or that the chart lacked documentation.

*Breastfeeding During Hospital Stay*

During hospital stay, 55 newborns (37.4%) were fed exclusively with breast milk, 68 newborns (46.3%) received breast milk and formula supplementation, and 18 (12.2%) received formula only. This means that 123 (83.7%) of newborns were being breastfed at all during hospital stay, with or without supplement ('any breastfeeding'). Six newborns (4.1%) were missing documentation to indicate feeding method during hospital stay. Eighty-six newborns (58.5%) were receiving formula, with and without breastfeeding during hospital stay.

*Skin-to-skin Within Five Minutes*

Eighty-one newborns (55.1%) underwent skin-to-skin within the first five minutes of delivery and 33 (22.4%) did not. Another 33 newborns (22.4%) had charts that lacked documentation regarding skin-to-skin immediately following delivery and were therefore not included in analysis.

*Skin-to-skin Within One Hour*

Skin-to-skin was initiated within the first hour of life for 107 mother and newborn pairs (72.8%) while 29 pairs (19.7%) did not. Eleven pairs (7.5%) were missing documentation and length of skin-to-skin contact could not be determined.

*Skin-to-skin Interruption Within One Hour*

Interruptions in skin-to-skin contact were very rarely recorded in newborn charts and were only documented as occurring for 35 subjects (23.8%). Forty-one subjects' chart documentation (27.9%) was suggestive of having skin-to-skin continuously for 60 minutes. It was not possible to determine if interruptions occurred for 71 mother and newborn pairs (48.3%).

## Medical Intervention and Breastfeeding

### *Breastfeeding Within One Hour*

Degree of medical intervention was not found to be significantly associated with breastfeeding within one hour of birth ( $p = 0.8$ ). However, as Figure 1 demonstrates, the general trend between these two variables did follow the predicted pattern. As medical intervention increased, there was a trend towards a decrease in frequency of breastfeeding within the first hour of the newborn's life (Table 4). Nearly 59% ( $n = 10/17$ ; 58.8%) of newborns delivered vaginally without intervention were breastfed within one hour of birth, compared with 40.0% ( $n = 4/10$ ) of infants that were delivered by emergency C-section. When vaginal delivery was compared with C-section delivery, though not significant ( $p = 0.13$ ), the trend was suggestive of vaginal deliveries being more highly associated with being breastfed within the first hour of life (Figure 1, Table 4).

### *Breastfeeding During Hospital Stay*

A Chi-Square analysis did not reveal a significant association between medical intervention and feeding patterns during hospital stay ('breastfeeding only',  $p = 0.52$ ; 'any breastfeeding',  $p = 0.70$ ). Delivery method also did not reveal a significant association with feeding patterns during hospital stay ('breastfeeding only'  $p = 0.43$ ; 'any breastfeeding'  $p = 0.65$ ) (Table 4).

### *Average Time to First Breastfeeding*

A one-way between subjects ANOVA was conducted to determine the association between increasing medical intervention and mean time to first breastfeeding. No significant difference between groups was found ( $p = 0.61$ ), as shown in Figure 2. The mean time was similar across all groups, ranging from 33.8 to 75.6 minutes. Similarly,

there was no significant association between delivery mode and average time to first breastfeed (vaginal: 59.4 minutes  $\pm$  53.1, versus C-sections: 63.9 minutes  $\pm$  31.7,  $p = 0.72$ ).

## Medical Intervention and Skin-to-Skin

### *Skin-to-skin Within Five Minutes*

Degree of medical intervention significantly predicted whether or not skin-to-skin was achieved within the first five minutes of life ( $p = 0.00001$ ; Table 5). This association was primarily driven by delivery method ( $p < 0.001$  for all vaginal deliveries versus all C-sections) with vaginal deliveries being much more likely to undergo skin-to-skin than C-sections. ‘Vaginal delivery with pain control only’ was the group most likely to undergo skin-to-skin within the first five minutes ( $n = 26/30$ ; 86.7%). Other vaginal delivery groups also achieved high rates of skin-to-skin within five minutes, ranging from 75.0% to 80.0% (Figure 3). Within the first five minutes of life, no dyads within ‘Emergency C-sections’ ( $n = 0/6$ ), and only 20.0% of ‘Elective C-sections’ ( $n = 2/10$ ), underwent skin-to-skin (Figure 3).

### *Skin-to-skin Within One Hour*

Similar associations to those discussed above were observed for medical intervention and skin-to-skin within the first hour of life ( $p = 0.00035$  for 6-groups;  $p = 0.0052$  for vaginal versus C-section; Table 5). Newborns delivered vaginally, (‘Vaginal delivery with no intervention’ ( $n = 15/19$ ; 78.9%), ‘Vaginal delivery with pain control only’ ( $n = 27/32$ ; 84.4%), and ‘Vaginal delivery with pain control and induction/augmentation’ ( $n = 47/52$ ; 90.4%)) were more likely to undergo skin-to-skin than infants born by C-section. Infants born by emergency C-section (i.e., the group with

the most medical intervention) were least likely to undergo skin-to-skin in the first hour ( $n = 5/14$ ; 35.7%). Elective C-section were found to be more similar to vaginally delivered babies in that their group was more likely to experience skin-to-skin within the first hour ( $n = 9/11$ ; 81.8%). There was also no significant difference found between vaginal and C-section deliveries ( $p = 0.71$ ).

#### *Average Time to Skin-to-skin*

A one-way between subjects ANOVA was conducted to determine the association of increasing medical intervention and mean time to skin-to-skin in minutes (Figure 4). There was a significant difference between groups at the  $p < 0.01$  level. Mean time to skin-to-skin was shortest for ‘Vaginal delivery with pain control only’ (5.1 minutes  $\pm$  17.1) and longest for ‘Emergency C-sections’ (46.5 minutes  $\pm$  10.7) (Figure 4). ‘Emergency C-sections’ were statistically different from ‘Elective C-sections’ (25.0 minutes  $\pm$  16.8;  $p = 0.01$ ) (see below). ‘Vaginal delivery without intervention’ underwent skin-to-skin in an average of 10.6 minutes (SD = 22.3). When all vaginal deliveries were considered together, the average time to skin-to-skin was 7.4 minutes (SD = 19.6), which was significantly shorter ( $p < 0.001$ ) than the average time to skin-to-skin for all C-sections (33.6 minutes  $\pm$  17.9).

The mean time to skin-to-skin was overall, not statistically different between the vaginal deliveries ( $p = 0.72$ ). Increasing the degree of medical intervention in the form of pain control and induction/augmentation were not associated with an increased time to skin-to-skin. Elective C-sections were statistically different from Emergency C-sections ( $p = 0.01$ ) in that Elective C-sections achieved skin-to-skin more quickly than Emergency C-sections. Finally, overall, vaginal deliveries were statistically different from C-section

deliveries ( $p < 0.001$ ) in that vaginal deliveries were significantly quicker than C-sections in achieving initial skin-to-skin contact.

#### *Skin-to-skin Interruption Within One Hour*

Increased medical intervention was not significantly associated with a higher likelihood of interrupting skin-to-skin within the first hour of life ( $p = 0.16$ ), however when all vaginal deliveries ( $n = 27/65$ ; 41.5%) were compared with C-sections ( $n = 8/11$ ; 72.7%), the difference approached significance ( $p = 0.055$ ). This indicates a trend towards C-section deliveries being more likely to interrupt skin-to-skin in the first hour (Table 5).

### Breastfeeding and Skin-to-skin

#### *Skin-to-skin Within Five Minutes*

Undergoing skin-to-skin within five minutes of delivery was found to be less predictive of breastfeeding outcomes during hospital stay than was not undergoing skin-to-skin ( $n = 65/77$ ; 84.4% versus  $n = 32/33$ ; 97.0% respectively;  $p = 0.06$ ). Skin-to-skin within five minutes also did not predict formula supplementation during hospital stay ( $p = 0.7$ ; Table 6) or by the time of discharge ( $p = 0.18$ ). Overall this may suggest that skin-to-skin within five minutes of life may not necessarily be predictive of increased rates of breastfeeding.

#### *Skin-to-skin Within One Hour*

Undergoing skin-to-skin within the first hour of life was not found to be predictive of receiving breast milk during hospital stay ( $p = 0.76$ ). However, there was a significant association between undergoing skin-to-skin within the first hour of life and method of feeding during hospital stay ( $p = 0.05$ ). The dyads that underwent skin-to-skin

within the first hour of life were more likely to breastfeed exclusively during hospital stay ( $n = 45/101$ ; 44.6%) as compared with those who did not ( $n = 7/29$ ; 24.1%). They were therefore overall less likely to have any formula supplementation ( $n = 56/101$ ; 55.4% versus  $n = 22/29$ ; 75.9%,  $p < 0.05$ ; Table 6). Overall this suggests that skin-to-skin within the first hour of life is predictive of exclusive breastfeeding during hospital stay.

Overall, undergoing skin-to-skin within the first hour of life appears to be more strongly associated with breastfeeding success than undergoing skin-to-skin within the first five minutes of life.

## Discussion

### Breastfeeding

Increasing medical intervention was not found to be significantly associated with a decreased rate of breastfeeding within the first hour of life. The present study was also not able to demonstrate an association between increasing medical intervention and increasing average time to first breastfeed or with increased rates of supplementation during hospital stay. This is unexpected considering the evidence within the literature has demonstrated that C-sections (5–8,15), labour analgesia (15–19), and oxytocin augmentation (16,18,19) all decrease rates of breastfeeding.

When ‘breastfeeding within one hour’ was plotted (Figure 1), though insignificant, the general trend between medical intervention groups followed the predicted pattern, at least in terms of birth mode. As displayed in Figure 1 and Table 4, birth mode (C-section versus vaginal birth) had more effect on breastfeeding, approaching closer to significance, than did analgesia or induction/augmentation. The implication of this finding is that surgical management is the most likely intervention to

affect breastfeeding success. This would have more relevance to decision-making for mothers planning elective C-sections than for any other population since emergency C-sections would be outside of patient control. However, in both cases, more support and care may be required by clinical staff post-operatively to encourage earlier breastfeeding.

The insignificant difference in rates of breastfeeding within one hour between vaginal delivery groups is difficult to explain. One implication could be that analgesia and induction/augmentation do not interfere with breastfeeding and do not need to be considered in birth planning as contributors to breastfeeding outcomes. While pregnant women may find this notion reassuring, it is inconsistent with the existing research that have identified that both analgesia and oxytocin augmentation contribute to decreased rates of breastfeeding (16).

No notable trend was identified between medical intervention categories and ‘any breastfeeding’ or ‘exclusive breastfeeding’ during hospital stay. Even birth mode did not have a significant association. It is possible that maternal feeding choice (prenatal intention to breast versus formula feed) played a more significant role in determining feeding mode during hospital stay than did medical interventions. Since feeding intention was challenging to tease out given the retrospective nature of the present study, this hypothesis cannot adequately be explored but may be worthy of future investigations.

When ‘mean time to first breastfeed’ was plotted (Figure 2), an interesting pattern emerged. The ‘Vaginal delivery without intervention’ group actually had the longest wait time to first breastfeed, which goes against all predictions. The other five groups do increase in average time with increasing medical intervention, however, even the most invasive group (Emergency C-section) does not reach as high of an average time as the

‘no intervention’ group. This has implications in clinical practice. Women, who undergo a more “natural” labour and delivery (i.e. less drugs or procedures), may be at higher risk of delay to first breastfeed. Practitioners involved in the labour and delivery may be required to provide more encouragement to the new mother to support earlier breastfeeding. It also would be worthy of educating expectant mothers of the increase risk of delay when analgesia is waived. It could be speculated that these more “natural” deliveries are more traumatic, leading to increased pain and fatigue. These new mothers may require more rest and recovery prior to attempting first feedings. It is unknown, however, whether this delay in breastfeeding is secondary to medical requirement, or alternatively, to maternal or caregiver choice. Ultimately, though insignificant, this pattern is unexpected and would be worthy of further investigation.

### Skin-to-skin

C-section delivery was associated with a significantly decreased rate of skin-to-skin contact within the first five minutes and first hour of life as well as a longer delay to skin-to-skin contact. This is consistent with the existing literature (6,8,13,20,26). No known studies have investigated how other medical, non-surgical interventions might be playing a role with skin-to-skin initiation. This study attempted to uniquely consider both surgical and non-surgical medical interventions in labour and delivery. The six groups of increasing medical interventions were found to be significantly different ( $p = 0.0001$ ), however, when delivery mode (vaginal versus C-section) was separated, the trend among the vaginal deliveries was unexpected. When vaginal deliveries were taken alone, a pattern emerged that suggested that analgesia be more associated with skin-to-skin as compared with no analgesia, though not significantly so (Table 5). This would suggest

that medical interventions with regards to pain control may, like with less delay in breastfeeding (above), also be linked with improved skin-to-skin. One could speculate, as above, that better pain control during contractions leads to less fatigue post-delivery contributing to more immediate bonding with the newborn. This speculation could be contrasted with the exhausted mother that opted for a more “natural” labour without pain control requiring more rest post delivery subsequently delaying mother-baby bonding. It would be interesting to expand on this area to see if the severity of labour had any effect on skin-to-skin contact. For example, would increased perception of pain (mothers without pain control) or longer labors be less likely to undergo immediate, uninterrupted skin-to-skin after delivery. This may be an interesting future investigation.

Interrupting skin-to-skin within 60 minutes of initiating contact did not reveal any significant associations with medical intervention. However, birthing mode (C-section versus vaginal delivery; Table 5) and increased skin-to-skin interruptions did approach significance. This is consistent with previous research that found that C-sections had poorer skin-to-skin initiation and continuation as compared with vaginally delivered babies (8,20,26). Previous studies have speculated that abdominal discomfort attributed to the surgical incision as well as sedative effects of surgical analgesia may be to blame. Consistent with implications discussed above, these mothers may simply require increased support with immediate mother-baby bonding. This could be in the form of a healthcare provider, or in providing immediate education for partners or family members supporting the new mother.

## Breastfeeding and Skin-to-Skin

Undergoing skin-to-skin within the first hour of life was associated with increased rates of exclusive breastfeeding (i.e. lower rates of formula supplementation) during hospital stay, consistent with existing research (6,20,21). However, it was not associated with increased rates of ‘any breastfeeding’ (i.e. breastfeeding with or without supplementation) during hospital stay, which is less consistent with existing research (6,20–22). This could imply that early skin-to-skin is actually more common in those who wish to breastfeed exclusively rather than skin-to-skin being the predicting variable. Undergoing skin-to-skin within the first five minutes of life was also not found to be predictive of breastfeeding during hospital stay which is also inconsistent with the existing literature (6,20–22). It is reassuring however, that achieving skin-to-skin within the first hour was more associated with exclusive breastfeeding and that it was not necessary to achieve contact within five minutes since, as discussed, this can be challenged by things like birthing mode (i.e. C-sections).

The inconsistency between breastfeeding and skin-to-skin at five minutes and one hour is challenging to explain. The parameters for the present study were strict in terms of including any and all supplementation during hospital stay. As mentioned above, prenatal parental feeding choice was not considered as a contributing variable, so it is possible that some mothers elected not to breastfeed, subsequently making it appear as though breastfeeding success was poor, and skin-to-skin had absolutely no effect. Perhaps feeding intent should have been given more weight in this context so as to possibly exclude these women from analysis. Furthermore, of those women who intended to exclusively breastfeed, there might have been medical requirements for

supplementation during hospital stay (for example, hypoglycemia in the neonate or late lactation in mother), which was not considered in assessing breastfeeding success.

However, given the lack of detail that was often provided in medical documentation with supplementation with regards to reasoning, it would have been challenging to tease this out entirely.

## Strengths and Limitations

### *Strengths*

This investigation included randomly selected medical records, which contributed to the study being more representative of the population in Winnipeg, Manitoba. The HSC is one of only two major labour and delivery centers in Winnipeg so the population was large and diverse. However, it cannot be assumed that the HSC is representative of the entire Winnipeg population since the demographics of those living near HSC may differ from those living near St. Boniface Hospital, which is the only other birthing center in Winnipeg. There may be differences with regards to socioeconomic status, for example, though this was not something that was collected for the purposes of this study.

Using medical records as opposed to self-reported surveys eliminated the possibility of report bias in patients. For legal purposes, medical documentation must be as accurate as possible. Using these documents does not, unfortunately, eliminate human error however, since much of what was required for the purposes of this study was left to the nurses' discretion for accuracy.

Two clinically trained personnel conducted data collection together. This was to ensure that medical information was accurately and consistently translated and recorded into a standardized data collection form.

*Limitations*

The present study had several limitations. One of the major limitations of this study is sample size. The 'Medical Intervention' groups were unevenly distributed and one group (Vaginal delivery with induction/augmentation) was quite small ( $n = 8$ ). The small sample size is likely the culprit for not having significant findings with established relationships including a decreased rate of breastfeeding when skin-to-skin does not occur (20), for example. Previous literature has also found differences with analgesia medication in breastfeeding success regardless of mode of delivery (15,18), which we were also unable to replicate. These previous studies focused primarily on epidural administration of analgesia and they categorized this differently than other forms of analgesia. Our small sample size did not allow for as much of a continuum of medical interventions as one might have hoped. This meant that method of pain management could not be subdivided by route (oral versus intravenous versus epidural/spinal versus inhalation) or by dose, and all pain control had to be amalgamated into one category. Furthermore, induction/augmentation could not be subdivided by degree (artificial rupture of membranes, induction devices, and synthetic oxytocin infusion). Unfortunately, true accurate differentiation based on induction/augmentation would be challenging to conduct at the HSC in Winnipeg since dosing and duration of medications like Oxytocin are not recorded. Finally, the small sample size also prevented the consideration of additional interventions including assisted vaginal deliveries (using forceps, vacuums) or episiotomies, for example.

LATCH scores are used in hospitals to assess the effectiveness of breastfeeding in new mothers. A limitation of this study is that LATCH scores were not used to define

breastfeeding success. The higher the score, the more successful the feed attempt. The present study included the first breastfeed attempt regardless of LATCH score given the small overall sample size. Paying more attention to the LATCH scores could have provided additional insight into possible reasons for supplementation during hospital stay, which were unexplained by medical intervention, birth mode, or skin-to-skin. Future studies may benefit from being more restrictive in their definition of breastfeeding success, as based on the LATCH score, in assessing feeding outcomes. Furthermore, future studies may find it more revealing to examine how LATCH scores trend with reference to increasing medical intervention along a continuum.

This study was further limited by missing data in the medical charts. Given the nature of a retrospective chart audit, there was no control as to how information was documented within the chart and given the lack of a standard recording method, there was a substantial amount of missing information further reducing sample sizes for analyses. This creates a challenge in terms of moving forward with future research as it implies that an exponentially larger sample size would have to be collected to accommodate for all of the anticipated missing data. As the present study was conducted in conjunction with “The Baby Friendly Hospital Initiative”, there are implications for achieving this WHO status for Winnipeg’s HSC. This amount of missing data makes it unlikely that without changing the current documentation practice that the hospital achieves this designation.

Finally, as mentioned above, this study did not take into consideration prenatal parental feeding intention. The present study may have benefited from only including

women that had intended to breastfeed and excluding those intending to formula feed exclusively.

## Conclusion

Delivery mode had significant effect on skin-to-skin in the first five and 60 minutes of life. Undergoing skin-to-skin in the first hour is associated with higher rates of exclusive breastfeeding during hospital stay. This information could have implications for expectant mothers making birth plans as well as for clinical practitioners' roles in educating expectant mothers. It also provides guidance for patient care immediately post-delivery, especially in C-section deliveries. The present study has provided some interesting avenues for further research and also demonstrated an overall need for improved medical documentation.

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## Tables

Table 1

Defining Groups By Increasing Medical Intervention

Group	Delivery	Pain control	Induction or augmentation	N (%)
Vaginal delivery, no intervention (Least intervention)	Vaginal	No	No	22 (15.0)
Vaginal delivery, induction/augmentation	Vaginal	No	Yes	8 (5.4)
Vaginal delivery, pain control only	Vaginal	Yes	No	37 (25.2)
Vaginal delivery, pain control and induction/augmentation	Vaginal	Yes	Yes	54 (36.7)
Elective C-section	Cesarean - Elective	Yes	No	11 (7.5)
Emergency C-section (Most intervention)	Cesarean - Emergency	Yes	Yes and No	15 (10.2)
Total				147

Table 2

Population Demographics overall and by Medical Intervention groups

Group (n)	Maternal age <sup>1</sup> in years M <sup>2</sup> (SD)	Gestational Age in weeks M (SD)	Birth Weight in grams M (SD)	Risk Factors <sup>3</sup> in %	Prenatal visits <sup>4</sup> M (SD)
Vaginal delivery, no intervention (22)	-	37.9 (1.0)	3313 (523)	40.9	9.7 (2.8)
Vaginal delivery, induction/augmentation (8)	-	39.3 (1.5)	3181 (429)	65.5	10.5 (3.5)
Vaginal delivery, pain control only (37)	-	38.9 (1.4)	3420 (476)	70.3	8.1 (3.8)
Vaginal delivery, pain control and induction/augmentation (54)	-	39.2 (2.1)	3419 (529)	64.8	9.4 (2.9)
Elective C-section (11)	-	39.4 (1.6)	3377 (509)	63.6	9.5 (4.7)
Emergency C-section (15)	-	38.6 (1.5)	3511 (412)	53.3	8.5 (3.4)
Overall	28.9 (6.1)	38.9 (1.7)	3399 (488)	61.2	9.1 (3.4)

<sup>1</sup> Age was not linked to dataset originally so only overall mean and SD was calculated.

<sup>2</sup> M = Mean

<sup>3</sup> Risk factors include obesity, smoking, drug use, diabetes (type 2 and gestational), and hypertension (pre-existing and gestational). Obesity by far was the most common risk factor followed by smoking (see Table 3). Percentages indicate the proportion of mothers with at least one risk factor.

<sup>4</sup> Prenatal visits were recorded to indicate the degree of prenatal care received.

Table 3

## Maternal Risk Factors

Risk Factor	Yes n/147 (%)
Smoking	37 (25.2)
Drug use	14 (9.5)
Alcohol use	8 (5.4)
Obesity	59 (40.1)
Type 1 Diabetes	0
Type 2 Diabetes	2 (1.4)
Gestational Diabetes	7 (4.8)
Hypertension	2 (1.4)
Gestational Hypertension	13 (8.8)
Any Risk Factor	90 (61.22)

Table 4

The Association between Increasing Medical Intervention and Breastfeeding Within the First One-Hour of Life and Exclusively During Hospital Stay

Group <sup>1</sup>	<u>Breastfeeding within First Hour</u> Yes: n/N (%)	<u>Exclusive Breastfeeding During Hospital Stay</u> Yes: n/N (%)
Overall	61/106 <sup>2</sup> (57.5)	55/141 <sup>3</sup> (39.0)
Vaginal delivery, no intervention	10/17 (58.8)	9/21 (42.9)
Vaginal delivery, induction/augmentation	3/5 (60.0)	4/8 (50.0)
Vaginal delivery, pain control only	16/26 (61.5)	12/36 (33.3)
Vaginal delivery, pain control and induction/augmentation	24/39 (61.5)	22/51 (43.1)
Elective C-section	4/9 (44.4)	5/10 (50.0)
Emergency C-section	4/10 (40.0)	3/15 (20.0)
Difference Between 6 Groups*	P = 0.80	P = 0.52
Vaginal vs. C-section**	P = 0.13	P = 0.43

<sup>1</sup>Comparisons by \*Fisher Exact test (due to small sizes) or \*\*Chi-squared test.

<sup>2</sup>Documentation was missing or unclear for 41 subjects with regards to whether or not breastfeeding was successfully initiated within the first hour of life and they were therefore excluded from analysis.

<sup>3</sup>Documentation was missing or unclear for 6 subjects with regards to feeding type during hospital stay and they were therefore excluded from analysis.

Table 5

The Association between Increasing Medical Intervention and Skin-to-Skin Within the First Five Minutes of life, the First Hour of Life, and Interruptions of Skin-to-Skin Contact

Group <sup>1</sup>	<u>First 5 Minutes</u>	<u>First Hour</u>	<u>Interrupted<sup>4</sup></u>
	Yes: n/N (%)	Yes: n/N (%)	Yes: n/N (%)
Overall	81/114 <sup>2</sup> (71.0)	107/136 <sup>3</sup> (78.7)	35/76 <sup>5</sup> (46.1)
Vaginal delivery, no intervention	12/16 (75.0)	15/19 (78.9)	6/13 (46.2)
Vaginal delivery, induction/augmentation	4/5 (80.0)	4/8 (50.0)	4/5 (80.0)
Vaginal delivery, pain control only	26/30 (86.7)	27/32 (84.4)	7/22 (31.8)
Vaginal delivery, pain control and induction/augmentation	37/47 (78.7)	47/52 (90.4)	10/25 (40.0)
Elective C-section	2/10 (20.0)	9/11 (81.8)	4/6 (66.7)
Emergency C-section	0/6	5/14 (35.7)	4/5 (80.0)
Difference Between 6 Groups*	P = 0.00001	P = 0.00035	P = 0.16**
Vaginal vs. C-section**	P < 0.001	P = 0.0052	P = 0.055

<sup>1</sup>Comparisons by \*Fisher Exact test (due to small sizes) or \*\*Chi-squared test.

<sup>2</sup>Documentation was missing or unclear for 33 subjects with regards to whether or not skin-to-skin was started within five minutes and they were therefore excluded from analysis.

<sup>3</sup>Documentation was missing or unclear for 11 subjects with regards to whether or not skin-to-skin was started within one hour and they were therefore excluded from analysis.

<sup>4</sup>'Interrupted' is defined as skin-to-skin contact being stopped or interrupted prior to achieving 60 minutes of continuous contact.

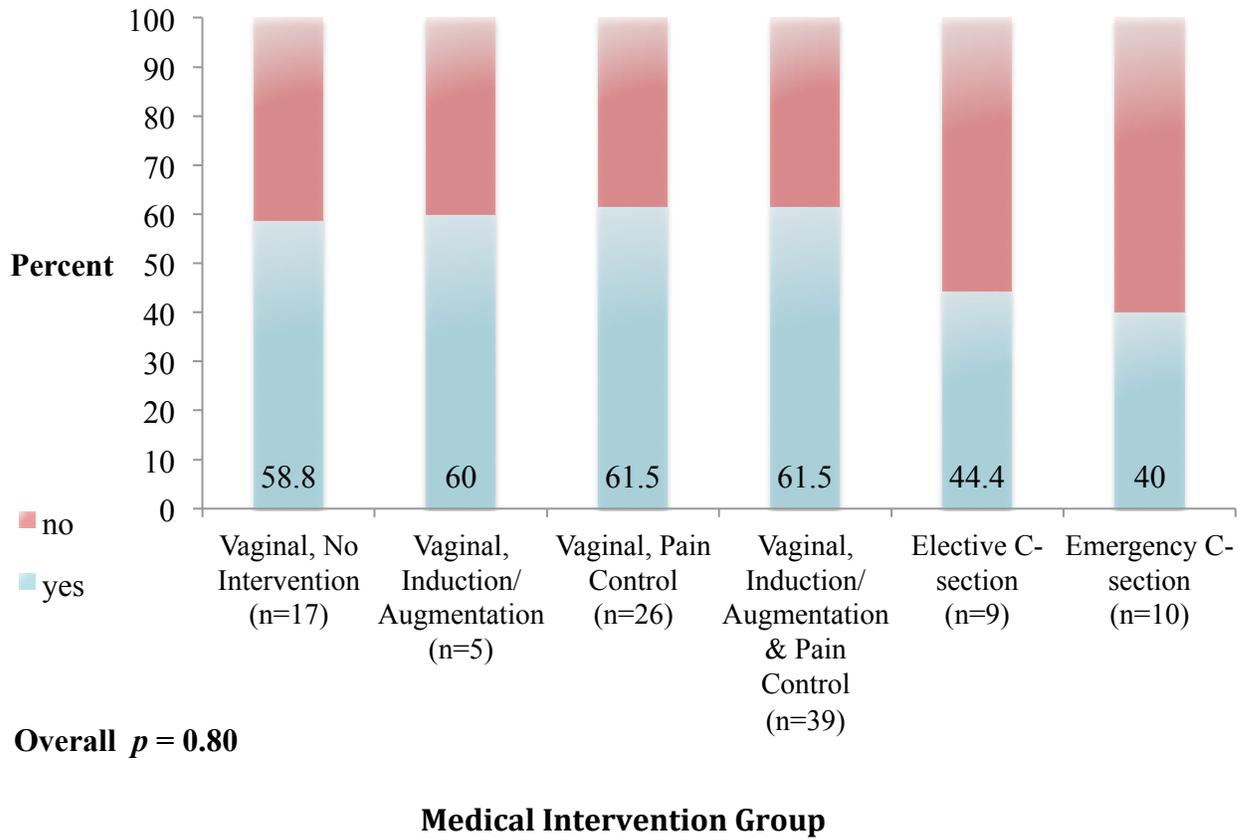
<sup>5</sup>Documentation was missing or unclear for 71 subjects. In some instances no skin-to-skin stop time was recorded whatsoever. These subjects were therefore, not included in analysis.

**Table 6**  
The Association between Skin-to-skin and Feeding During Hospital Stay

Skin-to-skin	N	<u>Any Breastfeeding</u>		<u>Any Formula</u>	
		n (%)	p	n (%)	p
<b>Within 5 mins</b>					
No	33	32 (97.0)	0.06	18 (54.5)	0.70
Yes	77	65 (84.4)		45 (58.4)	
Total	110	97 (88.2)		63 (57.3)	
<b>Within 1 hour</b>					
No	29	26 (89.7)	0.53	22 (75.9)	0.05
Yes	101	86 (85.1)		56 (55.4)	
Total	130	112 (86.2)		78 (60.0)	

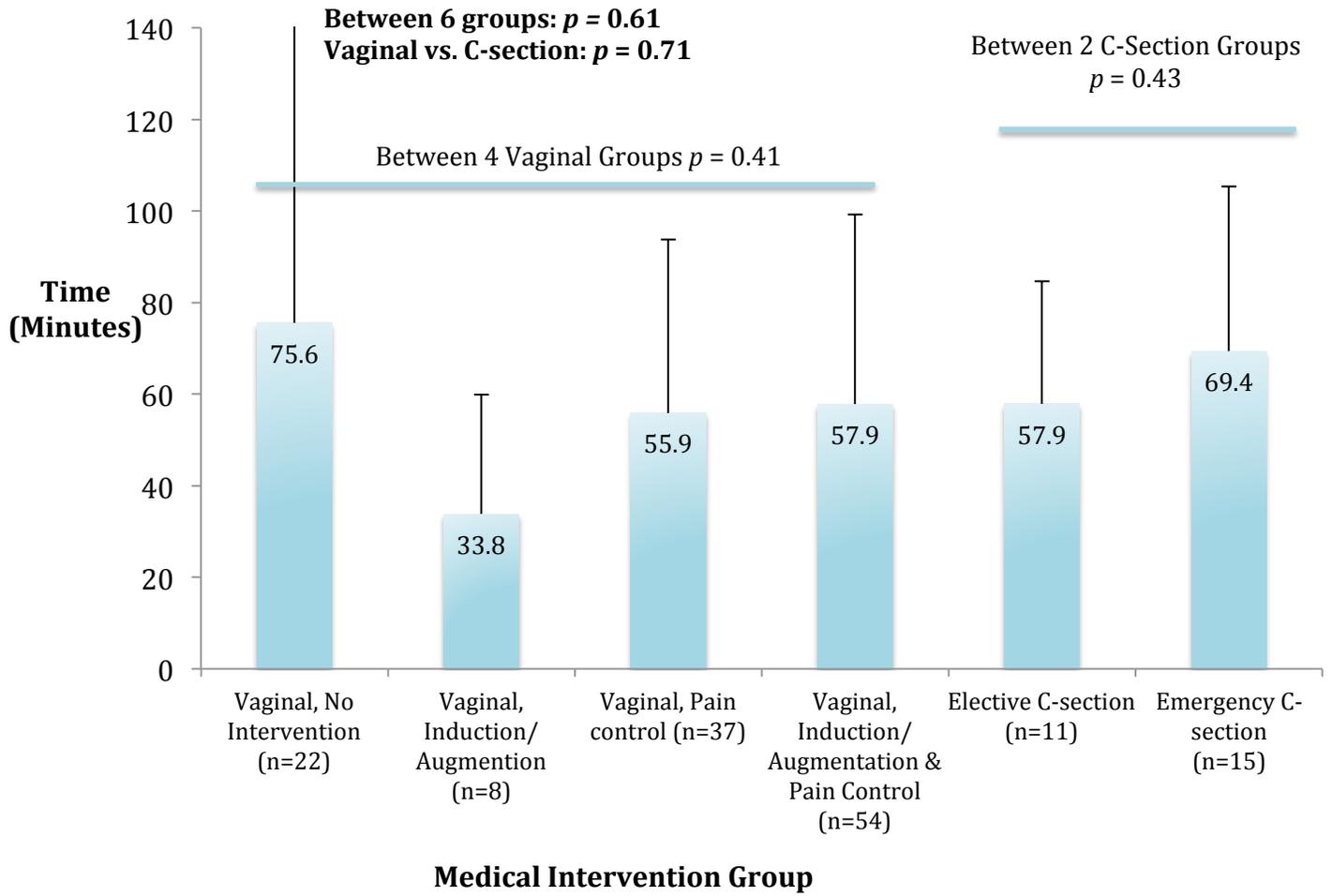
Comparison by Chi-square uncorrected.

### Figures

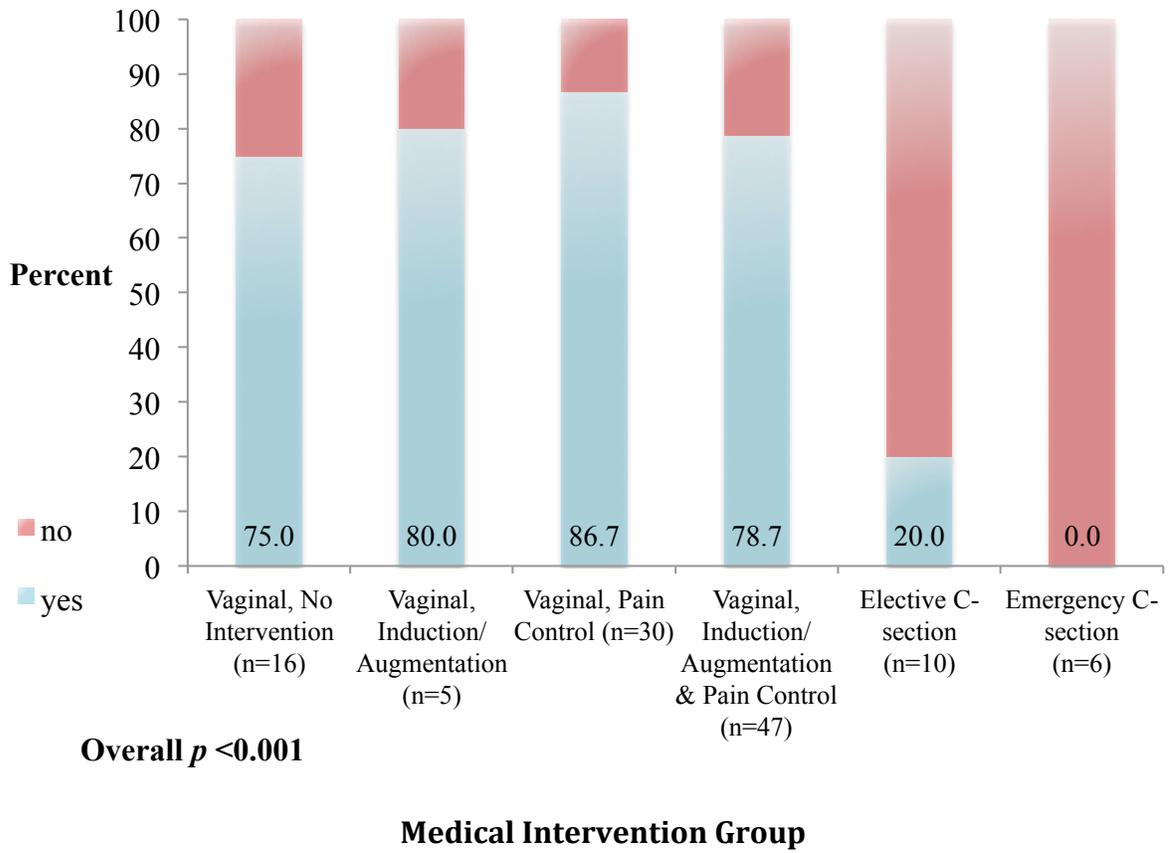


**Figure 1**  
**Breastfeeding within one hour by increasing medical intervention.** Comparison by Chi-square test.

**Figure 2**



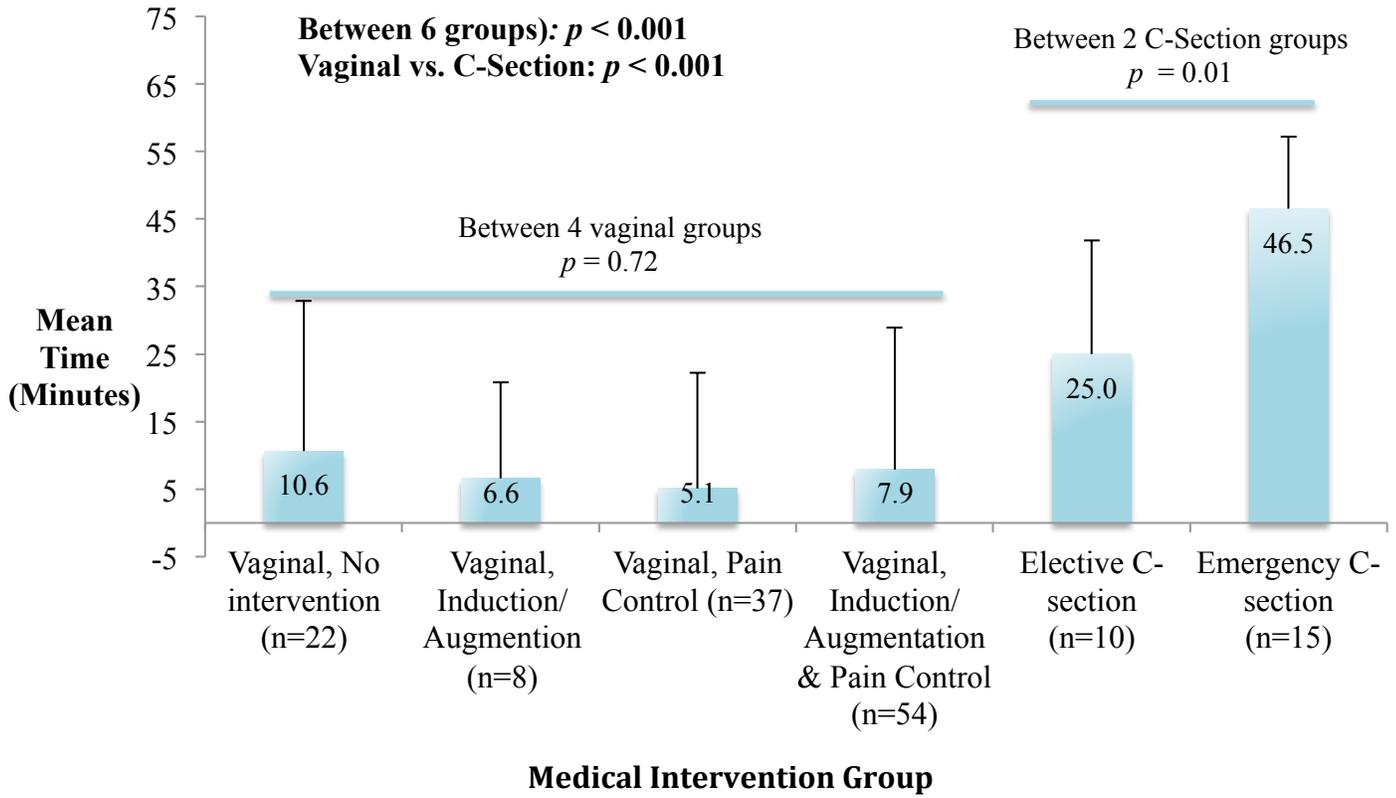
**Mean time to breastfeeding after delivery according to medical intervention.** Bars indicate standard deviations. Comparisons by one-way between subjects ANOVA.



**Figure 3**

**Skin-to-Skin in the First 5 Minutes of Life by increasing medical intervention.**

Comparison by Chi-square test. Note that delivery method (vaginal versus C-section) was also significantly different ( $p < 0.001$ ).



**Figure 4**

**Mean time to Skin-to-skin after delivery according to medical intervention.** Bars indicate standard deviations. Comparisons by one-way ANOVA t-test.

## Acknowledgments

I would first like to thank Dr. Meghan Azad, my Capstone advisor and mentor. I was very excited that she chose to take me on as a student. Her knowledge and research expertise was an immeasurable asset. I am very grateful for all the time she took to help me design, execute, and write-up this project that required endless e-mails, edits, and panicked moments. Her patience with the slow-moving progress during this very demanding year was so appreciated and I could not have completed this project without her encouragement, dedication, and motivation.

I would like to thank Dr. Nathan Nickel for assisting me with designing this project and providing helpful resources to become immersed in the “Baby Friendly Hospital” world.

To Faisal Atakora, I owe many thanks for completing my statistical analyses no fewer than six times, and always in a very timely fashion! He saved me reading “Statistical Analysis for Dummies” for which I am very grateful.

I need to thank the faculty of the MPAS program. They saw my potential to make a great PA and have allowed me to follow my dream to practice medicine (which as a PA will have a very healthy work-life balance!) To them I owe much more than thanks, they’ve shaped my bright future.

I thank Olivia Coneys, my capstone partner in crime. Without her we probably would still be collecting data. She also provided the candy that made data collection sessions possible.

I want to thank the rest of my class for their support through this very challenging two years. I specifically would like to thank Sheena Graham and Mychele Gregoir for

providing me a shoulder to cry on, endless support and friendship, and new sisters to bring with me into the future. Both with make exceptional physician assistants come this fall!

Finally, I would like to thank my family (Mom, Dad, Brad, and Phoebe) and my fiancé, Mark, for always believing that I could be nothing but successful in this program. I could not have done this without their unwavering faith.