

# **Prenatal Care and Breastfeeding Outcomes: A Retrospective Chart Review**

By  
Olivia Coneys

Supervisors: Dr. Meghan Azad and Dr. Nathan C. Nickel

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## **Prenatal Care and Breastfeeding Outcomes: A Retrospective Chart Review**

### **Abstract**

**Background:** The nutritional and non-nutritional benefits of breastfeeding to both infant and maternal health are well established. International guidelines recommend that healthy infants should be exclusively breastfed for 6 months with continued breastfeeding for up to two years, or beyond. While breastfeeding is a natural act, it is also a learned behaviour and therefore requires both anticipatory guidance prenatally, as well as peri/postnatal support to the mother and infant in order to sustain adequate breastfeeding practices. Initiation rates of breastfeeding in Canada have remained stable, yet duration and exclusivity at 6 months remain suboptimal. Limited and conflicting evidence exists regarding the association between utilization of prenatal care and breastfeeding outcomes, and therefore the purpose of this study was to further examine this relationship.

**Methods:** The study was a retrospective chart review of mother-infant dyads with available charts who delivered at the Health Sciences Centre (HSC) in Winnipeg, Manitoba, Canada between January and September 2016. Exposures analyzed included the both the number of prenatal visits attended by the mother as well as adequacy of care as defined using the R-GINDEX. Outcomes evaluated included both prenatal feeding intention and actual feeding method at discharge from hospital, and were classified as exclusive breast, both breast and formula or exclusive formula. An exploratory analysis of parity and breastfeeding intentions and practices was also done. Chi-Square Test was used to determine associations

**Results:** Of mothers who attended <5 prenatal care visits, 50% intended on formula feeding as compared to 23% of those who attended  $\geq 12$  prenatal care visit (p-trend = 0.07). Rates of

prenatal intention to breastfeed were similar amongst all groups ( $p = 0.418$ ). Mothers who attended  $\geq 12$  prenatal care visits were more likely to breastfeed at discharge when compared to mothers who attended  $< 5$  prenatal care visits (94% vs. 67%) ( $p$ -trend = 0.036), and were nearly twice as likely to exclusively breastfeed (39% vs. 20%), although the trend was not statistically significant ( $p = 0.220$ ). Women who were found to have received inadequate care were more likely to intend on formula feeding ( $p = 0.090$ ), and were less likely to breastfeed at discharge (74%) when compared to those who received adequate care (91%) ( $p$ -value 0.063). An exploratory analysis of parity and breastfeeding outcomes was carried out and found that women of higher parity ( $\geq 3$ ) were more likely to intend on formula feeding when compared to those of lower parity ( $p$ -trend 0.040), and while this trend was maintained into feeding at discharge, the statistical significance was not ( $p$ -trend = 0.420).

**Conclusion:** Women who attended a greater number of prenatal care visits demonstrated a significant linear trend towards improved rates of any breastfeeding at discharge when compared to mothers who attended fewer prenatal visits. Women who attended fewer prenatal care visits, those of increased parity ( $\geq 3$ ) and those found to have received inadequate care were all more likely, prenatally, to intend on formula feeding their infants peri/postnatally. Prenatal care provides a platform for healthcare professionals to provide anticipatory guidance to help promote and support mothers in order to sustain breastfeeding practices in the perinatal and postpartum period.

## **Background**

It is well established that breastfeeding and the use of human milk provide both nutritional and non-nutritional benefits to maternal and infant health, which in turn optimize infant growth and development.(1) Current international guidelines state that infants should be exclusively breastfed for 6 months with continued breastfeeding with appropriate complementary food for up to two years, or beyond. (1–3) Infants that are breastfed exclusively for 6 months compared with infants who never breastfeed demonstrate lower incidence rates of respiratory tract illness, otitis media, gastrointestinal disease, childhood obesity, atopic disease, type 1 and type 2 diabetes, leukemia, sudden infant death syndrome (SIDS), as well as improved cognitive development.(1,4,5) Both short and long term improved maternal outcomes have also been identified with breastfeeding including reduced postpartum blood loss, increased child spacing due to lactation amenorrhea, reduced rates of both adult cardiovascular disease and specific forms of cancer (breast, ovarian) and decreased rates of postpartum depression as seen in mothers who do not breastfeed or wean early.(1,6,7) The 2013 Canadian Perinatal Report states that the rates of breastfeeding initiation have remained stable in Canada at 87-88% between 2005-2010, while rates of exclusive breastfeeding have reportedly improved from 20.3% in 2005 to 25.9% in 2010.(8) Despite having relatively high breastfeeding initiation rates, the duration and exclusivity of breastfeeding at 6 months remains suboptimal, with just 14% of women exclusively breastfeeding at 6 months, and 53.9% offering some breast milk.(9), According to the World Health Organization's World Health Statistics 2015 report, rates of exclusive breastfeeding at six months were highest globally in Rwanda (85%) and lowest in European countries (1%). (10)

Rates of exclusive breastfeeding at 6 months in Canada and the United States in 2014 were 24% and 19% respectively. Low Income countries had the highest rate of exclusive breastfeeding at 6 months (47%), while upper middle income countries had the lowest (29%). Adequate information about breastfeeding initiation rates, exclusivity or continued breastfeeding was not available for most high-income countries. (10)

While breastfeeding is a natural act, it is also a learned behaviour and therefore requires support to both the mother and the infant in order to establish and sustain adequate breastfeeding practices.(2) The WHO and UNICEF created The Baby-Friendly Hospital Initiative (BFHI) which is an evidence based integrated approach for health care systems to assist in the promotion of maternal practices that support and help sustain exclusive breastfeeding.(2,11) However, with the average postpartum hospital stay being between 24 and 72 hours, there is limited time and exposure for healthcare teams to counsel and coach mothers on breastfeeding benefits and techniques. Prenatal care visits therefore become a crucial time to counsel mothers regarding the benefits and techniques required to sustain breastfeeding practices, in order to assure prospective mothers that breastfeeding is the preferable and doable feeding method for them.(12)

Adequate prenatal care itself, has also been demonstrated to have a significant impact on both fetal and maternal health outcomes. The Revised-Graduated Prenatal Care Utilization Index (R-GINDEX) developed by Alexander and Kotelchuck, was created to determine the adequacy of care delivered to mothers by health care providers in the prenatal period. The R-GINDEX defines “inadequate prenatal care” based on the trimester of pregnancy when prenatal care was initiated, the total number of prenatal care visits attended, and the infant’s gestational age at

birth.(13) Current evidence shows that adequate prenatal care reduces rates of infant still births and maternal death due to pregnancy complications, as well as enhances the likelihood of woman having a positive pregnancy experience.(14) There is also evidence to suggest that nearly two thirds of all maternal and neonatal disease burden could be alleviated by implementation of current research, via prenatal care appointments.(14) Canadian studies looking at utilization of prenatal care remain limited at this time, with some data reported from Manitoba suggesting that rates of inadequate care have increased significantly over time from 11.1% (2001/02) to 12.5% (2008/09), with the highest rates of inadequate care being in the northern part of the province at 41.0%.(15) Women who did not received adequate prenatal care were also more likely to live in poverty, have highly stressed lives, have low self-esteem and be aboriginal.(15) According to the The Canadian Maternity Experiences Survey published by the Public Health Agency of Canada in 2009, the average number of prenatal care visits for Canada was 12.9, with the lowest rates being in Nunavut (10.6) and highest rates in Nova Scotia (15.4).(16) The largest reported barrier to receiving care was “doctor/health care provider unavailable”. (16)

Given the wealth of evidence to support the benefits of prenatal care and breastfeeding practices independently, limited studies exist specifically analyzing the association between *utilization* of prenatal care visits and breastfeeding outcomes, but rather examine methods of delivering prenatal care or provider type and breastfeeding outcomes. Alexander and Kotelchuck explore some of challenges that exist around studying prenatal care utilization and of note identify that randomizing mothers into no care or inadequate care groups is unethical, that there are inconsistencies in the way adequacy of prenatal care is defined/measured and several possible confounders often exist when looking at women who attend fewer or inadequate prenatal care

such as socioeconomic status.(17) One Canadian study done in 2016 demonstrated no association between the quantity or timing of prenatal care and breastfeeding outcomes, but instead indicated that provider type was more influential on breastfeeding intention, initiation, exclusivity and 6 month termination rates. (18) However, a Brazilian study in 2011 reported that while only 22% of women were found to have received adequate prenatal care, 100% of them breastfed their infant within the first hour of birth, as compared to just 72% of those who were found to have received inadequate prenatal care. (19)

The purpose of this study was to examine the relationship between utilization of prenatal care (the number of prenatal visits attended/adequacy of prenatal care) and both prenatal feeding intention and actual feeding method at discharge from hospital, amongst women who delivered at the Health Science's Centre in Winnipeg, Manitoba, Canada. We hypothesize that a positive association exists between between increased adequacy/utilization of prenatal care and breastfeeding outcomes (exclusive breastfeeding, both breast and formula feeding or any breastfeeding).

## **Methods:**

### **Data and Sample**

The study conducted was a retrospective chart review of mother-infant dyads who delivered at the Health Sciences Centre (HSC) in Winnipeg, Manitoba, Canada between January and September 2016. Winnipeg's HSC is responsible for about 5500 deliveries per year representing about 32% of deliveries per year in Manitoba.(20) The data were collected by two researchers, with the relevant information being recorded in a secure, customized electronic database. Both

researchers were formally trained in use of the database and any discrepancies in data collection were resolved through discussion. The study included 147 randomly selected mother-infant dyads that presented to HSC during the study period, excluding those in which the infant was transferred to the neonatal intensive care unit.

## **Exposures and Outcomes**

### **Exposures: Utilization of Prenatal Care and Adequacy of Care**

The primary exposures analyzed were the number of prenatal visits attended by each mother as calculated from the Manitoba Prenatal Record, as well as adequacy of care which was defined using the Revised-Graduated Prenatal Care Utilization Index (R-GINDEX). The Manitoba Prenatal record is a standardized form used by all health care providers in Manitoba and is included in the mother's hospital chart. Recorded on the prenatal record are the details of each prenatal visit, as well as the features of each individual mother's health. A prenatal visit was defined as a documented visit to a healthcare provider (family physician, obstetrician, midwife, physician assistant or nurse practitioner) where care/education was provided to the patient regarding their current pregnancy. Currently, there are inconsistent recommendations regarding the optimal number of prenatal care visits as defined by The World Health Organization (WHO) (8 visits) and the American Congress of Obstetricians and Gynecologists (12 visits). Therefore, we decided to categorize mothers into four groups as follows: <5 visits, 5-8 visits, 9-11 visits and  $\geq 12$  visits.

The R-GINDEX was used to identify mothers who received "inadequate prenatal care." The R-GINDEX defines "inadequate prenatal care" based on the trimester of pregnancy when prenatal



care was initiated, the total number of prenatal care visits attended, and the infant's gestational age at birth.(13) Based on this information, the R-GINDEX classifies each pregnancy into one of six groups: Inadequate Prenatal Care, Intermediate Prenatal Care, Adequate Prenatal Care, Intensive Prenatal Care, No Care or Missing Care.(13) In the current study, we used the R-GINDEX to identify those mothers deemed to have "Inadequate Prenatal Care" and collapsed intermediate, adequate and intensive prenatal care into "Adequate Care". Those who were found to have no care or missing care were excluded from the analysis.

### **Outcomes: Prenatal Feeding Intent & Feeding Method at Discharge**

The primary outcomes examined were the mother's prenatal feeding intent and actual feeding method at discharge as recorded on the Newborn Feeding Record and the mother's hospital Discharge Summary. Feeding methods included exclusive breastfeeding, exclusive formula feeding and both breast and formula feeding. Exclusive breastfeeding was defined in concordance with the Interagency Group for Action on Breastfeeding (IGAB) as receiving only breastfed milk, with no supplementation by any means including glucose water, formula or donor breast milk.(21) Exclusive formula feeding on the other hand was defined as the absence of any breastfed milk fed to the infant. Both breast and formula feeding was defined as receiving a combination of both breastfed milk, as well as formula or other supplementation. We also dichotomized these further into any breast milk and any formula feeding. Infants receiving "any breast milk" included those who exclusively breastfed, and those who provided both breast and formula feeding. Any Formula feeding was defined as exclusive formula feeding and those who provided both breast and formula feeding.

Other variables documented included parity, maternal health and risk factors, infants birth weight and gestational age. Information regarding maternal health, maternal risk factors, parity, and gestational age at time of initiation of prenatal care were obtained from the Manitoba Prenatal Record, while the infants gestational age and birth weight were obtained from the Birth Summary found in the mother and infants' charts.

## **Analysis**

We tabulated the prenatal feeding intentions and feeding methods at discharge according to number of visits and adequacy of prenatal care. We used the Chi-Square Test to evaluate associations. For comparisons involving the number of prenatal visits, we used the Chi-Square Test for trend. This test is used to examine the dose-response relationship between an ordinal value (eg. number of prenatal visits) and a nominal variable with two levels (eg. any breastfeeding, or any formula feeding) reinforcing causality between the two variables. (22)

An exploratory analysis was also conducted to examine the association of parity (the number of pregnancies that have reached viability and delivered regardless of the number of fetuses) with prenatal feeding intention and feeding methods at discharge. Parity was categorized in three groups as follows: zero to one, two, or three and greater.

R studio software version 3.3.2. was used to perform all analyses.

## **Results:**

### **Sample Characteristics**

The basic characteristics of the population sampled are shown in Table 1 below. Of the 147

infant-mother dyads included in this study, the mean maternal age was 28.9 years (SD = 6.1, range 14-45 years). On average, mothers attended 9 prenatal care visits (SD = 3.4, range 2-18 visits). The mean infant gestational age was 38.9 weeks (SD = 1.7, range 28-42 weeks) and the mean infant birth weight was 3399g (SD = 488, range 2100-5072g). Detailed in table 2 are the maternal risk factors present at the time of pregnancy with 25.2% of mothers smoking cigarettes, 9.5% using street drugs and 5.4% using alcohol. In addition, 40.1% of mothers were obese (BMI >30) at the onset of pregnancy. The majority of women included in this study had a vaginal delivery (82.3%), with 17.7% undergoing cesarean sections.

Category	Mean	Standard Deviation	Range
Maternal Age (years)	28.9	6.1	14 - 45
Number of Prenatal Visits	9.1	3.4	2 – 18
Gestational Age (weeks)	38.9	1.7	28 – 42
Birth weight (g)	3399	488	2100 – 5072

**Table 1. Basic Characteristics**

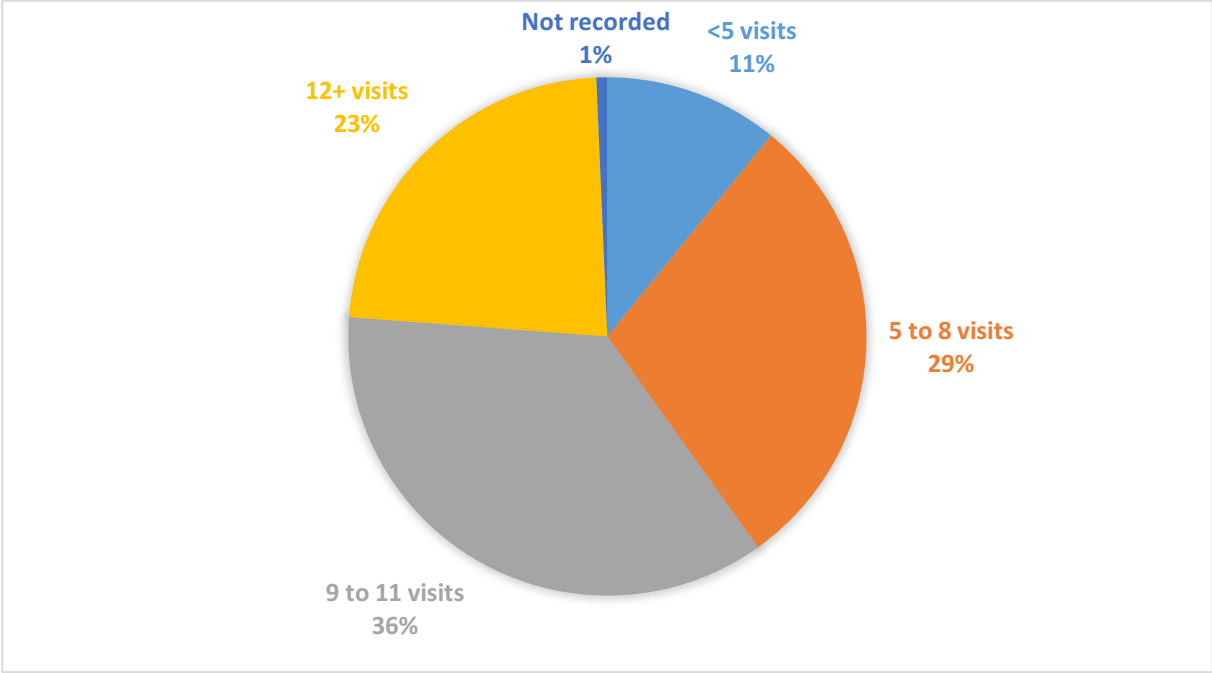
Maternal Risk Factors	n/147 (%)
Smoking	37 (25.2%)
Obesity	59 (40.1%)
Street Drug Use	14 (9.5%)
Alcohol Use	8 (5.4%)
Delivery Type	n/147 (%)
Vaginal	121 (82.3%)
Caesarean	26 (17.7%)

**Table 2. Maternal Risk Factors and Delivery type**

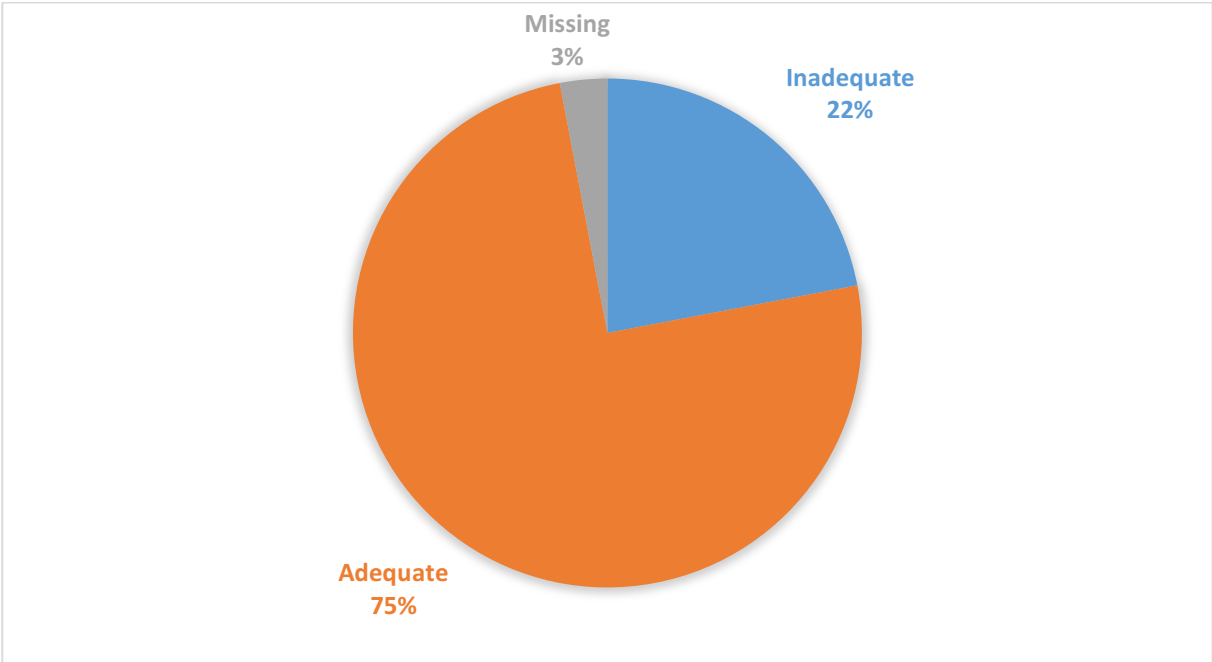
### Prenatal Care Visits

As demonstrated in Figure 1, 36% of mothers studied attended between 9 and 11 prenatal care visits, with just 11% attending less than five visits. Only one of the mothers included in the study did not have a record of her prenatal care. Of the 147 mothers studied, 22% were found to have

received inadequate prenatal care based on the R-GINDEX, while 75% received adequate prenatal care (Figure 2). Three percent were unable to be classified due to missing information.



**Figure 1. Number of prenatal visits attended**



**Figure 2. Proportions of mothers receiving inadequate Care as defined by the R-GINDEX**

## Breastfeeding Outcomes

Table 3 below details the overall values of prenatal feeding intention and feeding methods at discharge. Of the mothers studied, 79% percent intended to breastfeed their infants (any breastfeeding), with 67% intending to exclusively breastfeed. Twenty-four percent of mothers intended to formula feed, with 13% of mothers intending to exclusively formula feed. Eight percent of mothers did not have a prenatal feeding intention recorded. At discharge, 84% of mothers were breastfeeding, with 37% of mothers exclusively breastfeeding. Fifty-nine percent of mothers were formula feeding at discharge, with 12% of mothers exclusively formula feeding.

<b>Prenatal Feeding Intention</b>	<b>n/147(%)</b>
Exclusive Breastfeeding	99 (67.4)
Both Breast and Formula Feeding	17 (11.6)
Exclusive Formula Feeding	19 (12.9)
Any Breastfeeding	116 (78.9)
Any Formula Feeding	36 (24.9)
<b>Feeding Method at Discharge</b>	<b>n/147 (%)</b>
Exclusive Breastfeeding	55 (37.4)
Both Breast and Formula Feeding	68 (46.3)
Exclusive Formula Feeding	18 (12.2)
Any Breastfeeding	123 (83.7)
Any Formula feeding	86 (58.5)

**Table 3. Overall Values of Prenatal Feeding Intention and Feeding Methods at Discharge**

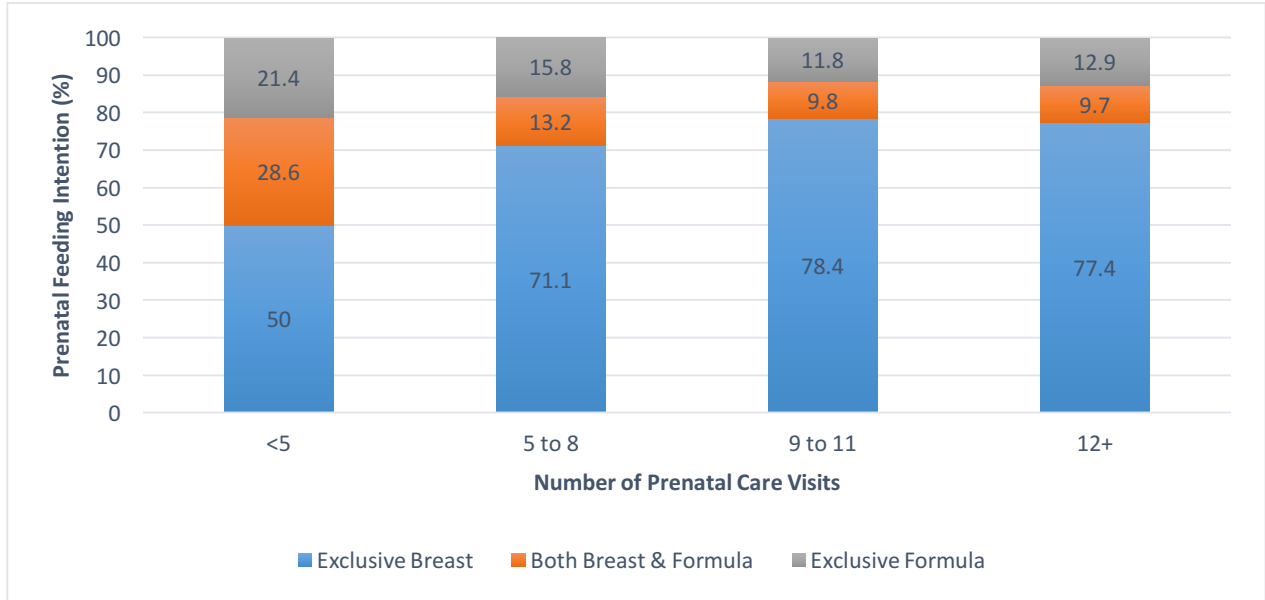
## Number of Prenatal Visits and Prenatal Feeding Intent

Of the mothers who attended  $\geq 12$  prenatal visits, 77% percent intended to exclusively breastfeed, while only 50% of mothers who attended 5 or less visits intended to exclusively breastfeed (Table 4/Figure 3). However, statistical significance was not established between the number of prenatal visits and intention to formula feed among mothers who attended fewer prenatal care visits ( $p$ -trend 0.072). While this outcome did not reach statistical significance it can be noted that of the mothers that attended less than five visits, 50% intended to use formula as a method of feeding, including 21% intending to exclusively formula feed. Of those that attended  $\geq 12$ , only

23% intended to use formula, and just 13% intended to exclusively formula feed.

Number of prenatal visits	N	Exclusive Breast n(%)	Both Breast and Formula n(%)	Exclusive Formula n(%)	Any Breast n(%)	Any Formula n(%)
<5	14	7 (50.0)	4 (28.6)	3 (21.4)	11 (78.6)	7 (50.0)
5 to 8	38	27 (71.1)	5(13.2)	6(15.8)	32 (84.3)	11 (29.0)
9 to 11	51	40 (78.4)	5 (9.8)	6 (11.8)	45 (88.2)	11 (21.6)
≥12	31	24 (77.4)	3 (9.7)	4 (12.9)	27 (87.1)	7 (22.6)
		P = 0.480			P trend = 0.418	P trend = 0.072
<i>Total</i>	<i>134</i>	<i>98 (73.1)</i>	<i>17 (12.7)</i>	<i>19 (14.2)</i>	<i>115 (85.8)</i>	<i>36(26.7)</i>

**Table 4. Number of Prenatal Visits and Prenatal Feeding Intent**



**Figure 3. Number of prenatal care visits and prenatal feeding intent**

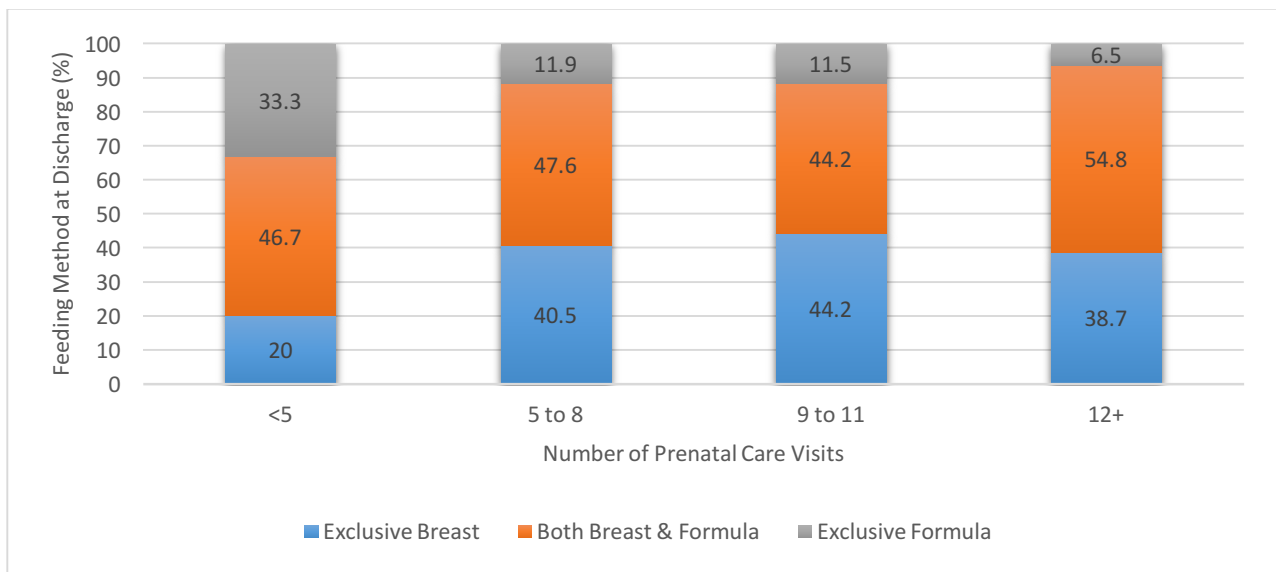
### Number of Prenatal Visits and Feeding Method at Discharge

As demonstrated in Table 5/Figure 4 below, a significant trend was identified between increased numbers of prenatal care visits and breastfeeding outcomes at discharge ( $p$ -trend 0.036). Of the mothers who attended less than five visits, 67% breastfed, with just 20% exclusively breastfeeding at discharge. Of the mothers who attended twelve or more appointments, 94% breastfed their infants, with 39% of mothers exclusively breastfeeding at discharge.

The association of prenatal care visits and formula feeding did not reach statistical significance ( $p$ -trend 0.340), however the results did follow the hypothesized direction. Of the mothers who attended less than five visits, 80% used formula with 33% exclusively formula feeding their infants, as compared to the mothers who attended twelve or more visits, where only 61% used formula to feed their infant, with just 7% exclusively formula feeding at discharge.

Number of prenatal visits	n	Exclusive Breast n(%)	Both Breast and Formula n(%)	Exclusive Formula n(%)	Any Breast n(%)	Any Formula n(%)
<5	15	3 (20.0)	7 (46.7)	5 (33.3)	10 (66.7)	12 (80.0)
5 to 8	42	17 (40.5)	20 (47.6)	5 (11.9)	37 (88.1)	25 (59.9)
9 to 11	52	23 (44.2)	23 (44.2)	6 (11.5)	46 (88.4)	29 (55.7)
≥12	31	12 (38.7)	17 (54.8)	2 (6.5)	29 (93.5)	19 (61.3)
		P = 0.220			P trend = 0.036	P trend = 0.340
<i>Total</i>	<i>140</i>	<i>55 (39.3)</i>	<i>67 (47.9)</i>	<i>18 (12.9)</i>	<i>122 (87.1)</i>	<i>85 (60.7)</i>

**Table 5. Number of prenatal care visits and feeding method at discharge**



**Figure 4. Number of prenatal care visits and feeding method at discharge**

### Inadequate Care (R-GINDEX) and Prenatal Feeding Intent

As demonstrated in Table 6, the results of this study identify a relatively small number of mothers in the inadequate care group (28 vs 103 adequate care). The number of mothers prenatally who intended to perform any breastfeeding (79%) was lower in the inadequate care group when compared to those found to have received adequate care (88%) ( $p = 0.183$ ). Similarly, mothers who received inadequate care were more likely to intend on formula feeding their infants (39%) when compared to mothers who received adequate prenatal care (23%) ( $p = 0.090$ ).

Adequacy of Prenatal Care	n	Exclusive Breast n (%)	Both Breast & Formula n (%)	Exclusive Formula n (%)	Any Breast n (%)	Any Formula n (%)
Inadequate	28	17 (60.7)	5 (17.9)	6 (21.4)	22 (78.6)	11 (39.3)
Adequate	103	79 (76.7)	12 (11.7)	12 (11.7)	91 (88.4)	24 (23.4)
		<b>P = 0.228</b>			P = 0.183	P = 0.090
<b>Total</b>	<b>131</b>	<b>96 (73.3)</b>	<b>17 (13.0)</b>	<b>18 (13.7)</b>	<b>113 (86.3)</b>	<b>35 (26.7)</b>

**Table 6. Adequacy of prenatal care and prenatal feeding intention.**

*\*The R-GINDEX defines “inadequate prenatal care” based on the trimester of pregnancy when prenatal care was initiated, the total number of prenatal care visits attended, and the infant’s gestational age at birth*

### Inadequate Care (R-GINDEX) and Feeding Method at Discharge

When we examined actual feeding methods at discharge (Table 7), a trend was identified between mothers who were found to have inadequate prenatal care and reduced rates of breastfeeding at discharge ( $p = 0.063$ ). Amongst the women who were found to have inadequate prenatal care 74% fed their infants breast milk, while 91% of mothers who received adequate



care breastfed their infants ( $p = 0.019$ ). Thirty-six percent of mothers who were found to have received inadequate care were exclusively breastfeeding at discharge, compared to 42% of those who received adequate prenatal care. In regards to formula feeding, 65% of mothers who received inadequate prenatal care formula fed their infants, with 26% exclusively formula feeding at discharge, compared to 58% formula feeding and 9.5% exclusive formula feeding among mothers who received adequate prenatal care.

<b>R-GINDEX</b>	<b>n</b>	<b>Breastfeed n (%)</b>	<b>Both Breast &amp; Formula n (%)</b>	<b>Formula n (%)</b>	<b>Any Breast n(%)</b>	<b>Any Formula n(%)</b>
<b>Inadequate</b>	31	11 (35.5)	12 (38.7)	8 (25.8)	23 (74.2)	20 (64.5)
<b>Adequate</b>	105	44 (41.9)	51 (48.6)	10 (9.5)	95 (90.5)	61 (58.1)
		P = 0.063			P = 0.019	P = 0.522
<b>Total</b>	136	55 (40.4)	63 (46.3)	18 (13.2)	118(86.7)	81 (59.6)

**Table 7. R-GINDEX evaluating rates of “inadequate care” and feeding method at discharge.**

### **Parity and Prenatal Feeding Intent and Feeding Method at Discharge**

The association between parity and prenatal feeding intent and feeding method at discharge was examined as an exploratory analysis after a possible trend was identified during the data collection process.

We identified a significant linear trend between mothers of higher parity ( $\geq 3$ ) and prenatal intention to formula feed (38%), when compared to mothers of lower parity (0-1) with intention rates of formula feeding at just 18% ( $p$ -trend 0.040). However, the significance of these differences did not translate to actual feeding methods at discharge, where actual feeding practices were similar regardless of parity. Seventy-five percent of mothers with higher parity ( $\geq 3$ ) were formula feeding their infants at discharge, while 66% of mothers of lower parity (0-1) were formula feeding at discharge. Eighty-three percent of mothers with a parity of  $\geq 3$  were

breastfeeding at discharge and 88% of mothers with a parity of 0-1 were breastfeeding at discharge.

Parity	n	Exclusive Breast n(%)	Both Breast and Formula n(%)	Exclusive Formula n(%)	Any Breast n(%)	Any Formula n(%)
0-1	45	37(82.2)	2 (4.4)	6 (13.3)	39 (86.6)	8 (17.7)
2	13	10 (76.9)	2 (15.4)	1 (7.7)	12 (92.3)	3 (23.1)
≥3	40	25 (62.5)	7 (17.5)	8 (20)	32 (80.0)	15 (37.5)
		P = 0.220			P-trend = 0.404	P-trend = 0.040
<i>Total</i>	98	72 (73.5)	11 (11.2)	15 (15.3)	83 (84.7)	26 (26.5)

**Table 7. Parity and Prenatal Feeding Intention.**

Parity	n	Exclusive Breast n(%)	Both Breast and Formula n(%)	Exclusive Formula n(%)	Any Breast n(%)	Any Formula n(%)
0-1	50	17 (34.0)	27 (54.0)	6 (12.0)	44 (88.0)	33 (66.0)
2	16	9 (56.2)	6 (37.5)	1 (6.2)	15 (93.7)	7 (43.7)
≥3	40	10 (25.0)	23 (57.5)	7 (17.5)	33 (82.5)	30 (75.0)
		P = 0.250			P-trend = 0.468	P-trend = 0.420
Total	106	36 (34)	56 (52.8)	14 (13.2)	92 (86.8)	70 (66.0)

**Table 8. Parity and Feeding Method at Discharge**

## Discussion:

### Key Findings

The results of this study identify a significant association between the amount and adequacy of prenatal care and breastfeeding intentions and practices. Mothers who attended more prenatal care visits were significantly more likely to breastfeed their infants at discharge from hospital when compared to mothers who attended fewer prenatal care visits (94% vs. 67%) ( $p$ -trend = 0.036). Similarly, women who attended  $\geq 12$  prenatal care visits were almost twice as likely to

exclusively breastfeed their infants when compared to mothers who attended less than 5 visits (39% vs 20%). Eighty percent of mothers who attended < 5 prenatal care visits formula fed their infants; 33% were exclusively formula feeding.

Mothers who attended fewer prenatal care visits (< 5) were more likely to intend on formula feeding their infants (50% formula, 21% exclusive formula) when compared to mothers who attended twelve or more prenatal care visits (23% formula, 12% exclusive formula; p-trend = 0.072). Of the mothers who attended <5 prenatal care visits, 80% were providing some formula at discharge, with 33% exclusively formula feeding. Rates of prenatal intention to breastfeed were similar amongst all groups. Interestingly though, of the 67% of mothers who intended to exclusively breastfeed prenatally, only 37% of mothers were successful with this at discharge from hospital.

Women who were found to have received inadequate care were more likely to intend on formula feeding ( $p = 0.090$ ), and were less likely to breastfeed at discharge (74%) when compared to those who received adequate care (91%) ( $p$ -value 0.063). Women of increased parity were also more likely to intend on formula feeding when compared to those of lower parity ( $p$ -trend 0.040), however while this trend was maintained into feeding at discharge, the result was not statistically significant ( $p$ -trend = 0.420). Given that this was an exploratory analysis however, the study was not powered accordingly and therefore could be an area of focus in future research.

Another observation made upon analysis of the collected data was that 13% of mothers prenatal feeding intention was to exclusively formula feed, and 12% of postpartum mothers were

exclusively formula feeding at discharge. Future research could track individual mothers prenatal feeding intention, and their actual feeding method at discharge to identify if these mothers are definitively set on formula feeding from the prenatal period and if so, identify the perceived barriers to breastfeeding for this population.

### **Comparison with Other Studies**

Results of this study demonstrate that the more prenatal visits a mother attends the more likely she is to breastfeed and the less likely she is to formula feed her infant. Similarly, the fewer prenatal care visits a mother attends or if she is found to have “inadequate” prenatal care, the more likely she is to formula feed and the less likely she is to provide breast milk to her infant. There is limited existing research available that examines the association between the *utilization* of prenatal care visits and breast feeding outcomes. As mentioned above, a Canadian study done in 2016 demonstrated no association between the quantity or timing of prenatal care and breastfeeding outcomes, but instead indicated that provider type was more influential on breastfeeding intention, initiation, exclusivity and 6 month termination rates. (18) However, a Brazilian study done in 2011 reported that while only 22% of women were found to have received adequate prenatal care, 100% of them breastfed their infant within the first hour of birth, as compared to just 72% of those who were found to have received inadequate prenatal care. (19) A wealth of research exists examining methods of delivering prenatal education and provider type associated with delivery. A recent Cochrane Review done in 2016 reported “no conclusive evidence supporting any antenatal breastfeeding education for improving initiation of breastfeeding, proportion of women giving any breastfeeding or exclusively breastfeeding at three or six months or the duration of breastfeeding”. (23) However, this study examined

*methods* of breastfeeding education (single, multiple or targeted breastfeeding education), as opposed to simply the utilization/quantity of exposure (number of prenatal care visits) to well educated professionals delivering standard prenatal care. Other published literature suggests that regardless of class type or whether prenatal education is delivered by a health care professional or non-healthcare professional, evidence exists demonstrating that educating women prenatally about the benefits and techniques of breastfeeding is associated with improved breastfeeding initiation rates.(12,24,25) While these studies examined provider type and method of education, a common theme exists that regardless mode of delivery or provider-type delivering the education, utilization of prenatal care improves breastfeeding outcomes. Together, with the results of this study and the existing literature we can take away that providers regardless of designation must understand that repeated exposure to dedicated breastfeeding education during the prenatal period has been shown to improve both breastfeeding initiation and rates of breastfeeding at 6 months.

The results of our exploratory analysis of parity seem to be consistent with existing literature that primiparous women have higher *intentions* of breastfeeding, while multiparous women generally breastfeed for longer duration either exclusively or in combination with supplementation. (9) This may be due to lack of education to primiparous women regarding the challenges they may face with breastfeeding, and how to overcome these challenges. Multiparous women on the other hand may have figured out solutions to these problems through trial and error or sought out help/education in previous pregnancies.

## **Strengths and Weaknesses**

One of the main strengths of this study is that it is contributing to the limited body of existing literature looking at the relationship between the utilization of prenatal care and breastfeeding outcomes in Canada. All data used in this study was retrieved from hospital records, and therefore didn't depend on survey or self-report, eliminating response bias or inconsistencies that can occur with retrospective recall surveys. The data utilized in this study was collected by two individuals who had clinical training and therefore were well equipped to navigate, understand and interpret information in the patients' charts. Both prenatal care (number of visits/adequacy of care) and feeding methods (intention/actual feeding method) were documented and presented in two separate ways allowing for both a qualitative and quantitative analysis. Lastly, a large inclusion criteria was used, excluding only dyads in which the infant was transferred to the NICU. This allowed for inclusion of a diverse population representing a broad range of demographics and socioeconomic status making it generalizable to the population in Winnipeg, Manitoba.

One of the possible limitations of this study is it being retrospective in nature and therefore there may be inadequate estimates of prenatal care represented if physicians provided care whom didn't have access to the patients Manitoba Prenatal Record that had been initiated by another physician or documents were missing from the hospital chart. Education and care provided through prenatal classes or community support groups are not recorded on the prenatal record and therefore are not captured in this study. This is an area where education/support is provided to mothers regarding both the benefits and challenges of breastfeeding, and would be interesting to incorporate into future studies. The size of the study could be larger in future studies to

minimize the likelihood of having small groups limiting the ability to draw firm conclusions. Also, the indicators evaluated only reflect the quantity of prenatal visits and not the content or quality of prenatal care delivered to the patient. While the prenatal record exists to help guide practitioners regarding the suggested prenatal content, the content may vary depending on the professional delivering the information (ie. obstetrician vs. general practitioner vs. midwife). The prenatal record also includes an area to mark content discussed during prenatal visits, including breastfeeding, however it is not consistently used by practitioners and therefore could not be relied on. Possible confounders like socioeconomic status (SES) and maternal age were documented, but not accounted for in the current analysis. Low SES has been shown to be associated with increased rates of inadequate prenatal care, as well as reduced rates of breastfeeding initiation and duration and therefore may contribute to the significance of these results if accounted for.(15,26)

### **Opportunities for Further Research**

As stated above, it would be interesting for future studies to control for SES and identify if it is truly the lack of prenatal care driving the breastfeeding outcomes or in fact SES itself. While this study examined the association between parity and breastfeeding outcomes, future studies could examine possible interactions between parity and prenatal care. This would allow for better insight into whether it is higher parity that is responsible for the increased intention to formula feed, or if mothers of higher parity attend less prenatal care visits and that is what is driving this relationship. A multivariable analysis that simultaneously accounts for all of these factors would help determine their independent association with breastfeeding outcomes. Future studies could also examine feeding methods at 6 months to identify if an association exists between prenatal

care and long-term breastfeeding outcomes. Manitoba is currently developing a provincial infant feeding database to collect this information from mothers when they present for their infants 6 month well baby check/immunizations. As mentioned earlier, analyzing individual mothers prenatal feeding intent and actual feeding method at discharge would be interesting for future research to reveal if a cohort of mothers exists that is firmly intent on formula feeding and successful in achieving this in the postpartum period.

**Conclusions:**

This study shows that increasing prenatal care visits attended by a mother is associated with improved breastfeeding rates at discharge from hospital and lower rates of formula use. Mothers who attend  $\geq 12$  prenatal care visits are twice as likely to breastfeed than those who attend  $< 5$  prenatal care visits. These findings suggest that prenatal care provides a platform for healthcare professionals to provide anticipatory guidance about a choice that has been shown to have longstanding health benefits to both infant and maternal health, and in turn save lives and health care expenditure globally. (1,2,4–7,14,27)



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