DURHAM REGION HEALTH DEPARTMENT

IFSS Infant Feeding Surveillance System

Focused Report on…
Socioeconomic Factors Related to Infant Feeding Practices in Durham Region

March 2016

Highlights

Infant feeding practices in Durham Region:

- 93% of new mothers with infants born between 2007 and 2014 initiated breastfeeding.
- 55% continued to breastfeed for six months or more.
- 6% provided their infants exclusively with breastmilk for at least six months.
- 24% introduced solids to their infants until six months of age or later.

Factors related to infant feeding practices:

- Three infant feeding indicators were reported: breastfeeding initiation, breastfeeding duration for six months or more and introduction of solids until six months or later.
- The following maternal factors were associated with higher rates of all the three indicators: increased maternal age, higher education, higher household income, being born outside of Canada, and giving birth at a hospital outside of Durham Region.
- Maternal education was the only factor that remained significant in both bivariate (not adjusting for confounders) and multivariate analysis (adjusting for confounders) for all three infant feeding indicators mentioned above.
- Formula use in birth hospital was significantly associated with both discontinuing breastfeeding and introducing solids before six months of age; the associations remained significant when adjusted for other potential confounders.
- Income was significantly associated with all three infant feeding indicators in bivariate analysis; however, after adjusting for potential confounders, it was no longer a protective factor for any of the indicators.
- There were some geographic variations in infant feeding practices when municipality of residence was examined individually; these differences no longer existed when adjusted for confounders.

Introduction

Breastfeeding contributes to the physical and emotional well-being of both infants and mothers [1]. The World Health Organization and Health Canada recommend exclusive breastfeeding of infants for the first six months of life and continued breastfeeding to two years and beyond [2-3]. This target is also outlined in the Ontario Public Health Standards as one means of attaining and sustaining optimal health and developmental potential of children in Ontario [4].

There are many factors influencing infant feeding practices such as mother's socioeconomic status, hospital practices, social support and cultural factors. Several socioeconomic factors have been consistently reported as being associated with infant feeding practices, including household income [5], parental educational attainment [5-10], occupational category [7-8, 11], urban or rural residence [6], immigrant status [6], ethnicity [9-10] and maternal age [5-6, 9-10, 12].

The purpose of this report was to identify socioeconomic factors related to infant feeding practices in Durham Region, specifically breastfeeding initiation and breastfeeding for six months or more. Introduction of solids at six months of age or later is consistent with the goal of exclusive breastfeeding for at least six months and was also examined. This information will support the work of the Reproductive and Child Health program of Durham Region Health Department by: increasing awareness of infant feeding practices in Durham Region; helping policy makers and public health practitioners to identify priority populations; and assisting in designing programs and services aimed at improving breastfeeding rates. Data were collected through the Durham Region Infant Feeding Surveillance System (IFSS) developed by Durham Region Health Department.

Data Source

The Durham Region Infant Feeding Surveillance System (IFSS) was launched in 2007 to regularly assess infant feeding practices of Durham Region mothers. The IFSS contains data for live born infants, including multiple births, preterm and low birth weight infants.

From 2006 to 2008, IFSS data were collected in two phases. In Phase I, demographic information and breastfeeding initiation rate were extracted from a pre-existing health assessment conducted through the Healthy Babies Healthy Children (HBHC) program. The HBHC assessment usually occurred within 48 hours of hospital discharge. Phase I was used as the sampling frame for Phase II, a telephone survey developed for the IFSS conducted at six to seven months postpartum. In 2009, record level data, including demographic information, became available from the Integrated Services for Children Information System (ISCIS). Because ISCIS provides a more complete account of number of births, eligible mothers were selected from the ISCIS database from 2009 onward. Income, education and country of birth were collected from mothers of infants born in July 2007 and later.

This report was based on the analysis of 3625 IFSS records for mothers who gave birth between July 2007 and December 2014, excluding incomplete records. Mothers under 15 years old were also excluded from the analysis.

For more information on the IFSS development please refer to
http://www.durham.ca/departments/health/health_statistics/IFSSevalReport.pdf

Association between Socioeconomic Factors and Infant Feeding Practices: Bivariate Analysis

Bivariate analysis was used to explore the association between a single socioeconomic variable and an infant feeding outcome. Bivariate analysis does not consider the multiple effects that many different factors may have on an outcome. Socioeconomic factors consisted of maternal age, maternal education, household income, mother's country of birth, birth hospital, and municipality of residence. Use of breastmilk substitutes (formula) in hospital was also included in the bivariate analysis for breastfeeding duration and introduction of solids.

Breastfeeding Initiation

All of the six socioeconomic factors were significantly associated with breastfeeding initiation. Ninety-three percent (95%CI: 92.1-93.8%) of Durham Region mothers who gave birth between 2007 and 2014 initiated breastfeeding. Based on the Canadian Community Health Survey (CCHS), the breastfeeding initiation rate was 88% (95%CI: 73.2-95.3%) for Durham Region, and 91% (95%CI: 88.3-92.4%) for Ontario. Breastfeeding data were collected through CCHS among women aged 15 to 55 who gave birth in the previous 5 years. It is important to note that the differences in study design, study population and questionnaire between IFSS and CCHS compromise the comparability of the results.

Definitions

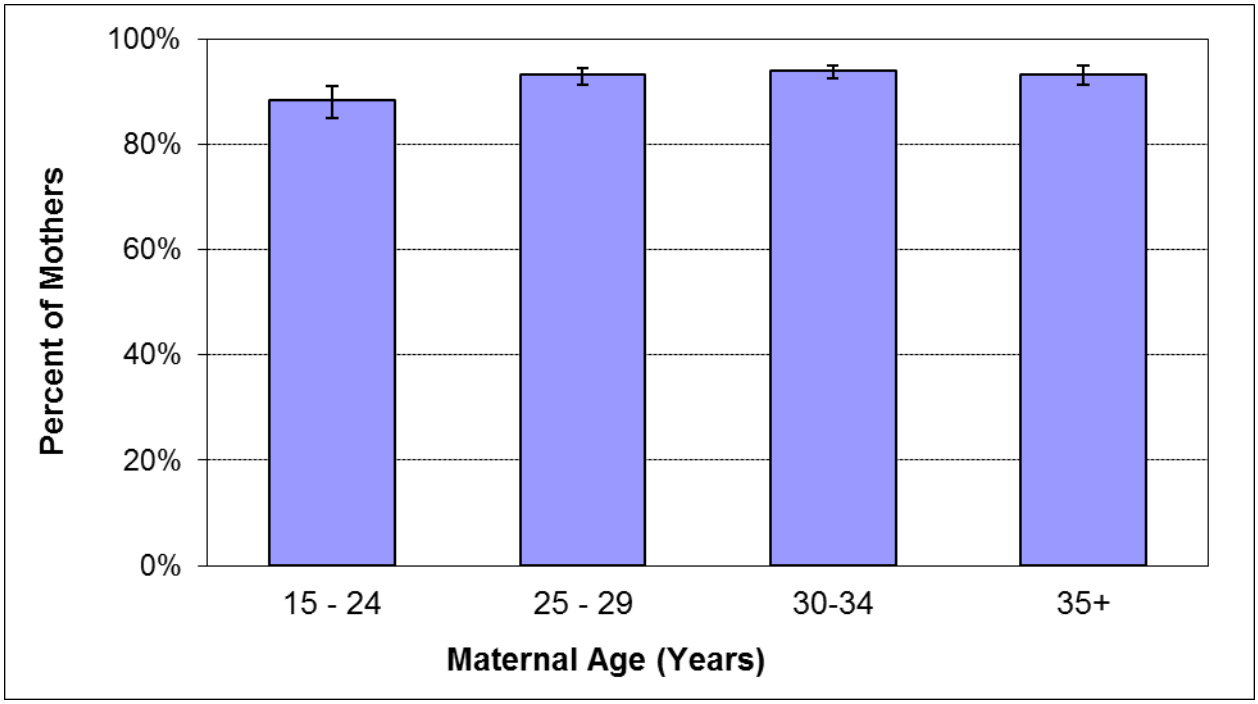
Breastmilk: Includes breastfeeding, expressed breastmilk or donor milk, and undiluted drops or syrups consisting of vitamins, mineral supplements or medicines [13].

Breastfeeding Initiation: Any attempt to provide breastmilk to an infant, whether directly from the breast or expressed.

Exclusive Breastfeeding: No food or liquid other than breastmilk, not even water, is given to the infant from birth by the mother, health care provider, or family member/supporter [13].

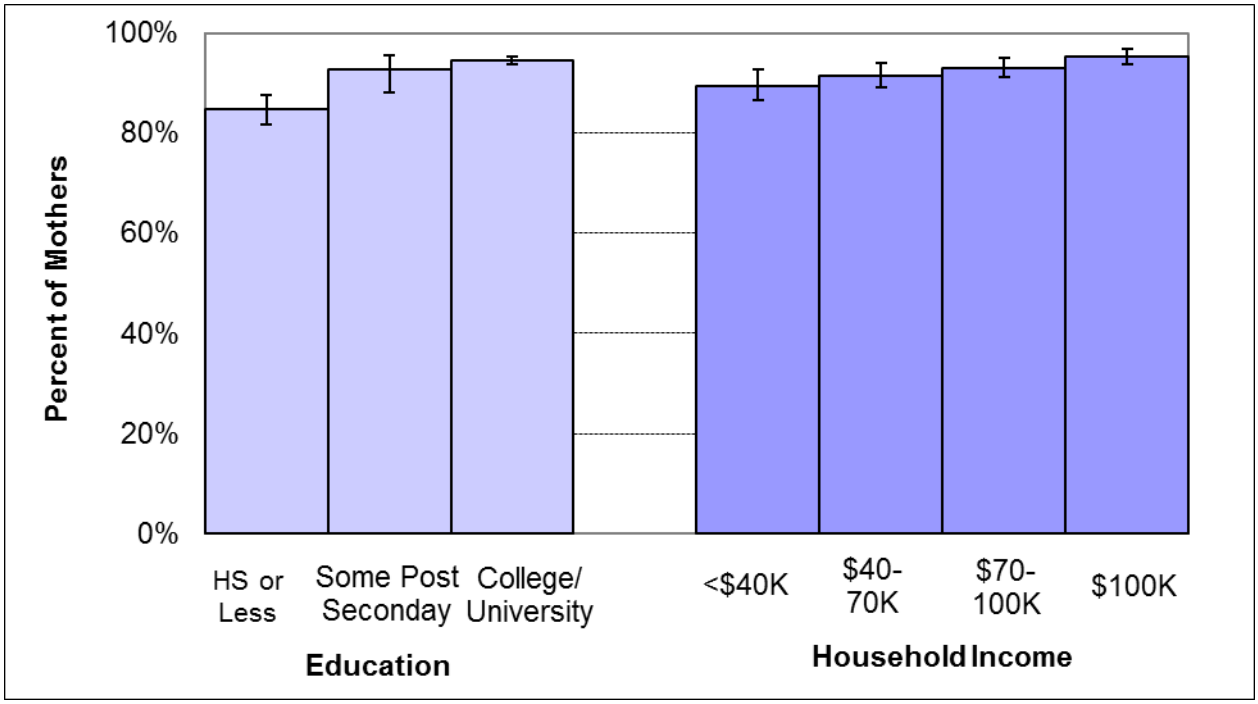
Adolescent mothers 19 years and under had a lower breastfeeding initiation rate than mothers aged 20 or older (Figure 1). Breastfeeding initiation was higher among mothers with higher education and income (Figure 2). In addition, mothers who gave birth at a hospital outside of Durham Region were more likely to initiate breastfeeding compared to those who gave birth in Durham Region. A higher percentage of foreign-born Durham Region mothers initiated breastfeeding compared to Canadian-born mothers (Figure 3). Compared to other municipalities, breastfeeding initiation rates were slightly lower in Oshawa and Clarington (Figure 4).

Figure 1: Durham Region, 2007-2014 Combined



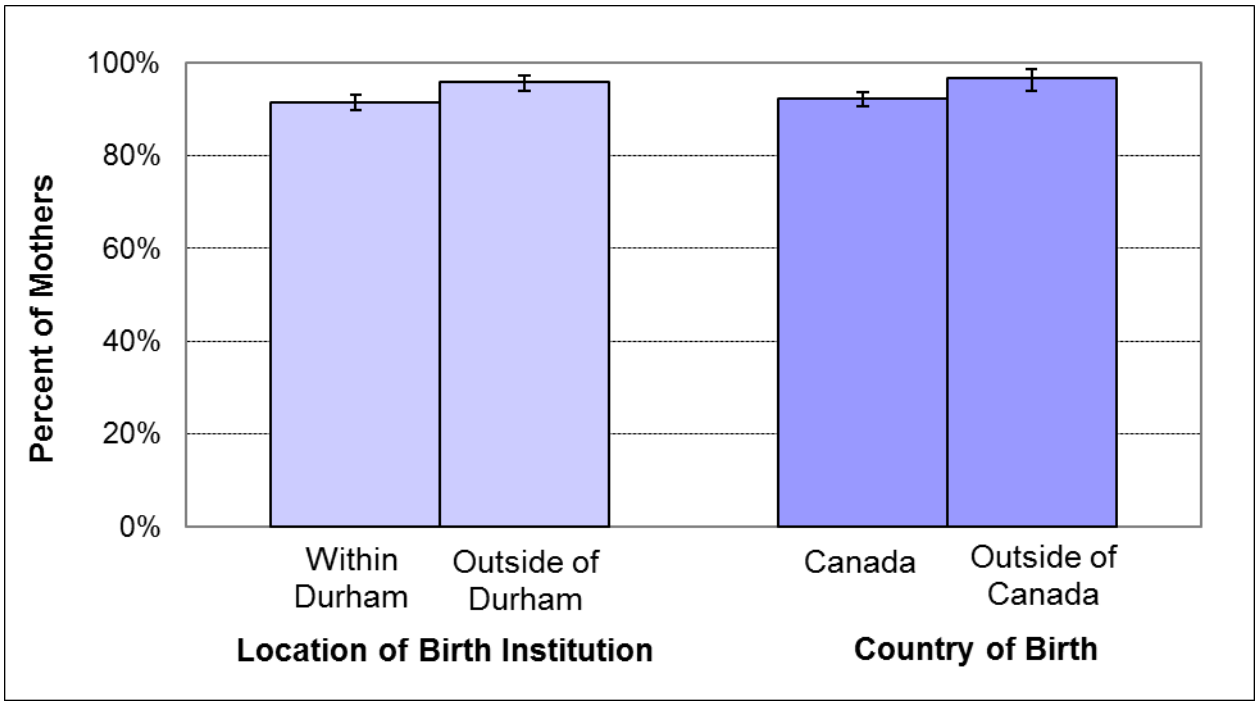
15-24	25-29	30-34	35+
88%	93%	94%	93%

Figure 2: Breastfeeding Initiation by Maternal Educational and Income, Durham Region, 2007-2014 Combined



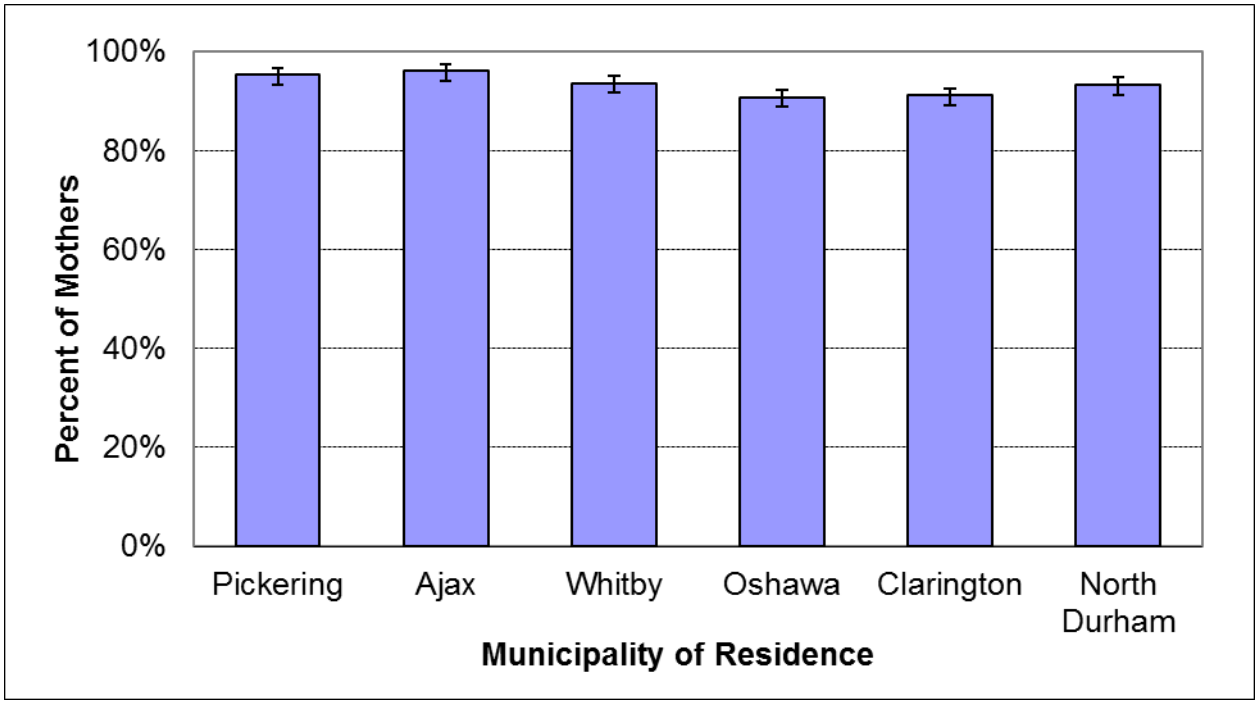
High School or Less	Some Post-secondary	College University	<$40,000 (<$40K)	$40,000-69,999 ($40-70K)	$70,000-99,999 ($70-100K)	$100,000+ ($100K+)
85%	93%	95%	89%	92%	93%	95%

Figure 3: Breastfeeding Initiation by Location of Birth Hospital and Mother's Country of Birth, Durham Region, 2007-2014 Combined



Within Durham	Outside of Durham	Canada	Outside of Canada
92%	96%	92%	97%

Figure 4: Breastfeeding Initiation by Municipality of Residence, Durham Region, 2007-2014 Combined



Pickering	Ajax	Whitby	Oshawa	Clarington	North Durham (Scugog, Uxbridge & Brock)
95%	96%	94%	91%	91%	93%

Breastfeeding for Six Months or More

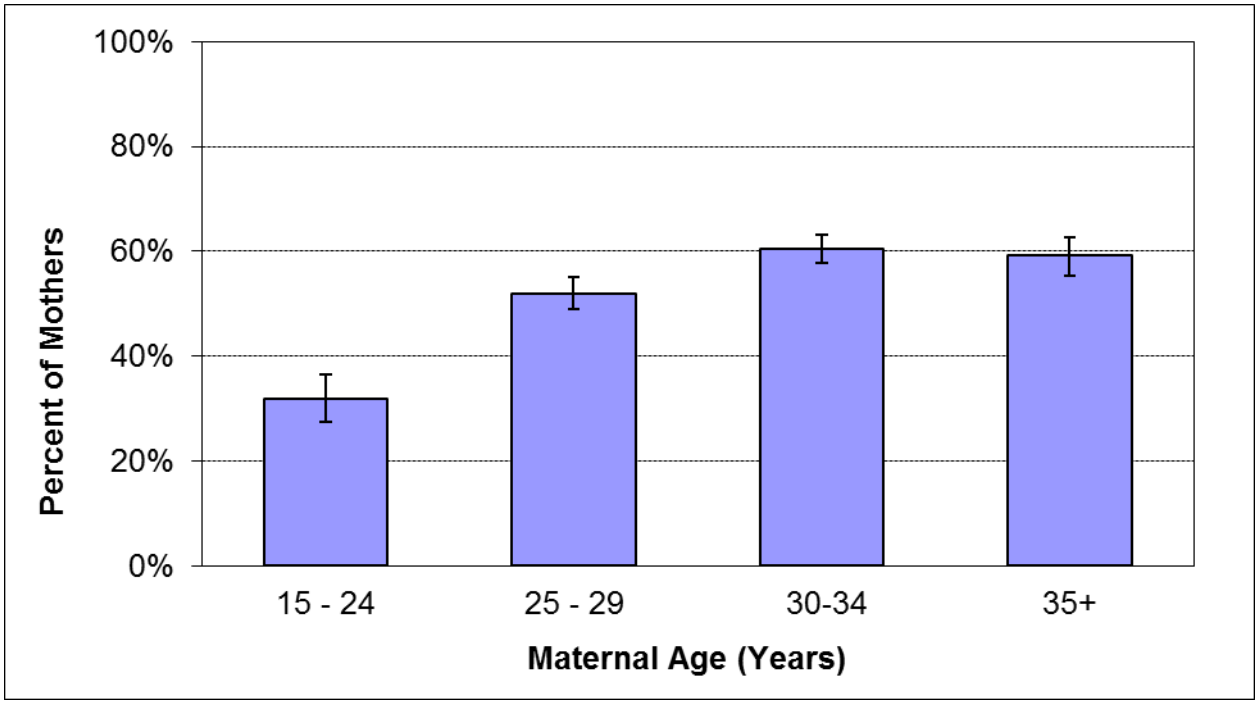
At two weeks post-partum, 87% (95%CI: 85.7-87.9%) of Durham Region mothers continued to breastfeed their infants. By six months post-partum, 55% (95%CI: 53.1-56.4%) of mothers were still breastfeeding, similar to the rate of 56% (95%CI: 38.7-72.2%) reported for Durham Region and 63% (95%CI: 59.1-67.0%) for Ontario in 2013-2014 CCHS[†].

Breastfeeding for six months or more was found to be significantly associated with all the seven factors included in the bivariate analysis. Rate of breastfeeding for six months or more was lower among younger mothers under 30 years of age, especially 15 to 24 years olds (Figure 5).

As with breastfeeding initiation, the breastfeeding duration increased with increasing maternal education level and household income (Figure 6). Fifty-nine percent (95%CI: 57.3-60.9%) of mothers with a college diploma or university degree breastfed for at least six months compared to 34% (95%CI: 30.5-38.3%) of mothers with a high school diploma or less. Longer breastfeeding duration was also found among mothers born outside of Canada, those who gave birth outside of Durham Region (Figure 7) and who resided in Pickering (Figure 8).

Formula use in hospital was also examined in this bivariate analysis. Introduction of formula in hospital had a negative impact on breastfeeding duration. Thirty-eight percent (95%CI: 35.8-40.3%) of mothers of infants who were given formula while in hospital continued to breastfeed for at least six months compared to 73% (95%CI: 70.4-74.7%) of mothers of infants who were not given formula while in the hospital (Figure 7).

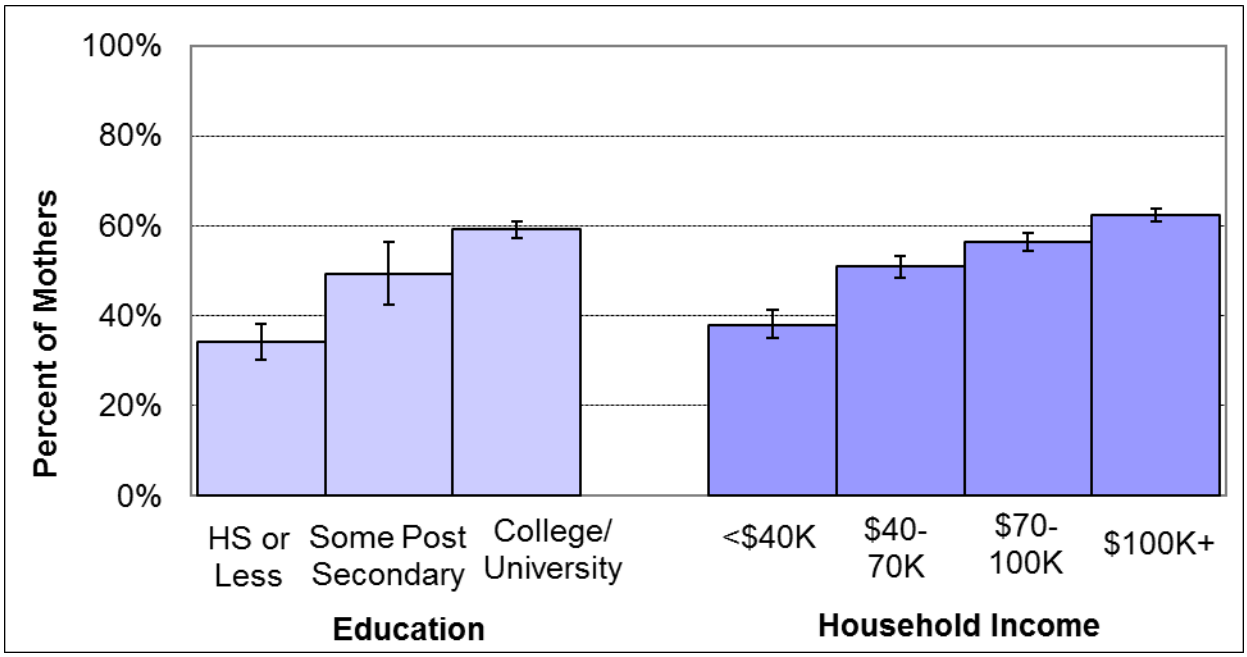
Figure 5: Breastfeeding for Six Months or More by Maternal Age, Durham Region, 2007-2014 Combined



15-24	25-29	30-34	35+
32%	52%	60%	59%

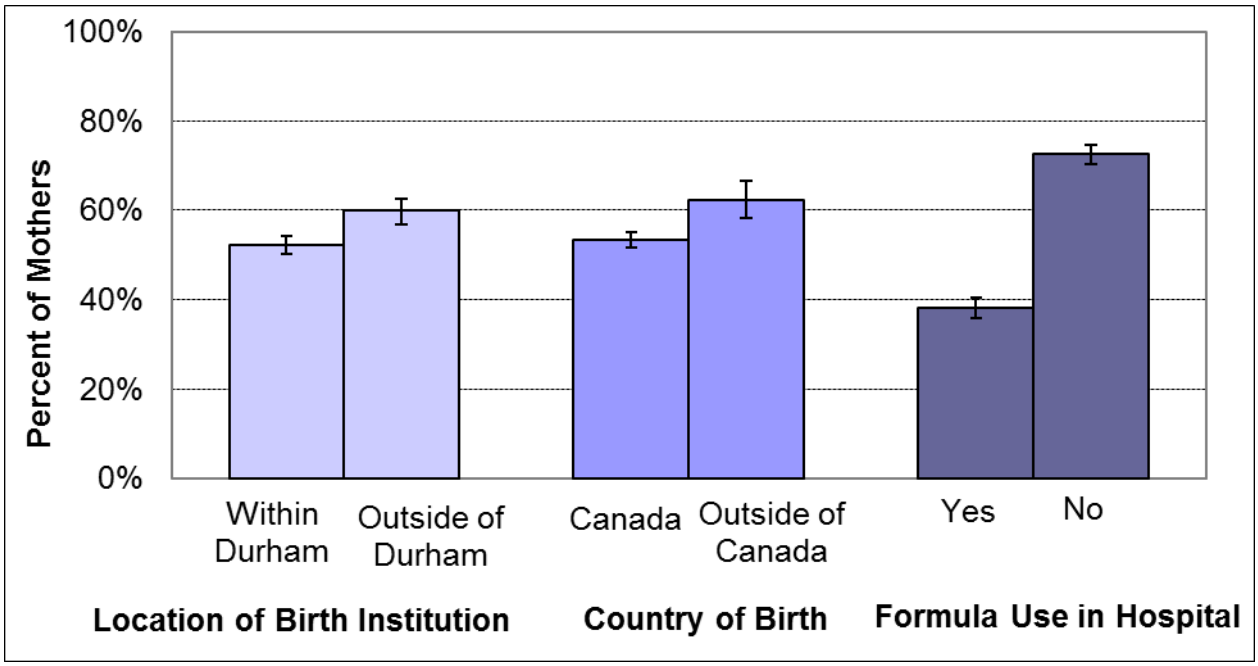
[†] It is important to note that the differences in study design, study population and questionnaire between IFSS and CCHS compromise the comparability of the results.

Figure 6: Breastfeeding for Six Months or More by Maternal Education and Income, Durham Region, 2007-2014 Combined



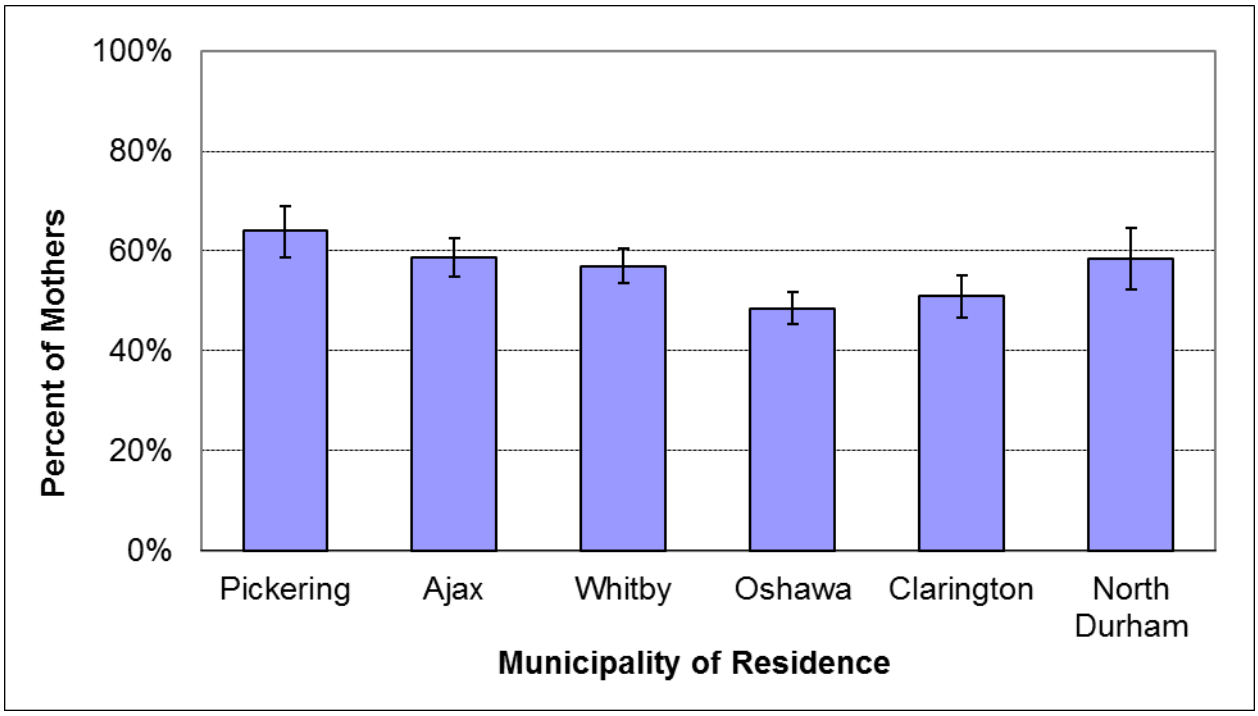
High School or Less	Some Post-secondary	College/ University	<$40,000 (<$40K)	$40,000-69,999 ($40-70K)	$70,000-99,999 ($70-100K)	$100,000+ ($100K+)
34%	49%	59%	38%	51%	56%	62%

Figure 7: Breastfeeding for Six Months or More by Location of Birth Hospital, Country of Birth and Formula Use in Hospital, Durham Region, 2007-2014 Combined



Within Durham	Outside of Durham	Canada	Outside of Canada	Yes	No
52%	60%	53%	62%	38%	73%

Figure 8: Breastfeeding for 6 Months or More by Municipality of Residence, Durham Region, 2007-2014 Combined



Pickering	Ajax	Whitby	Oshawa	Clarington	North Durham (Scugog, Uxbridge and Brock)
64%	59%	57%	49%	51%	59%

Exclusive Breastfeeding for Six Months or More

In Durham Region, 6% (95%CI: 5.1 – 6.6%) of mothers who gave birth between 2007-2014 exclusively breastfed for six months or more, substantially lower than the Durham Region rate (33%) and Ontario rate (30%) from the 2013-2014 CCHS. It is important to note that the differences in study design, study population and questionnaire compromise the comparability of the two rates. Compared to our study, the CCHS is more likely to have recall bias on liquid and solid introduction and, therefore, it could result in a higher exclusivity rate.

Duration of exclusive breastmilk provision is known to be associated with the same socioeconomic factors that have been shown to be related to breastfeeding initiation and duration [5]. However, the associations could not be explored for Durham Region because of the low prevalence of exclusive breastfeeding for six months or more.

Introduction of Solids at Six Months or Later

Health Canada recommends exclusive breastfeeding for the first six months of life for healthy term infants [3]. Infants should be introduced to nutrient-rich, solid foods with particular attention to iron at six months, with continued breastfeeding for up to two years and beyond. Delaying the introduction of other liquids and solids until six months does not impact growth rates nor iron status [3]. In addition, it provides additional protection against gastrointestinal infections [3].

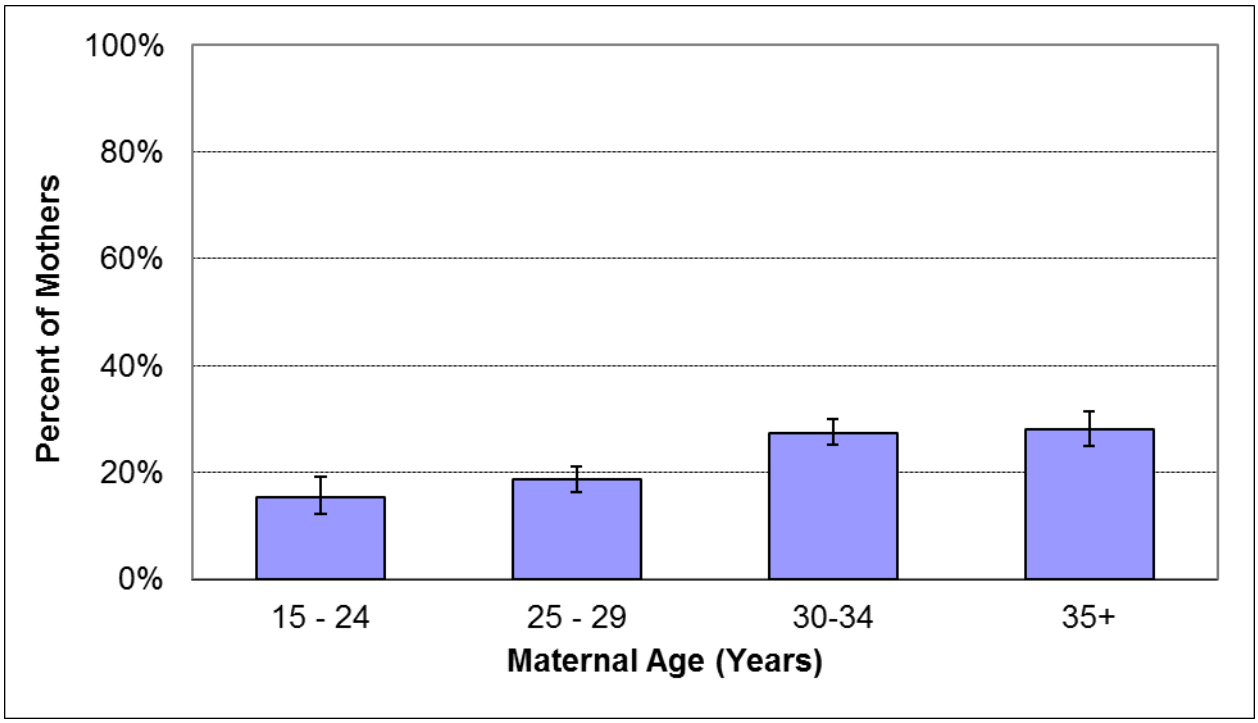
The IFSS respondents were asked when solids (such as cereal, fruits or vegetables, meats, legumes, milk products or bread products) were introduced to their infants. In Durham Region, only 24% (95%CI: 22.4-25.3%) of mothers introduced solids at six months or later for 2007-2014 birth years.

Introduction of solids at six months or later was associated with maternal age, education, income, location of birth hospital, municipality of residence, and formula use in hospital (Figure 9-12). A smaller proportion of mothers under 30 years of age delayed introduction of solids until six months compared to mothers aged 30 and older (Figure 9). Mothers with lower education level, especially those who did not graduate from high school, were less likely to delay introduction of solids until six months. Delayed introduction of solids until six months was also less common among mothers with annual household income under $40,000 (Figure 10).

Mothers who gave birth at a hospital outside of Durham Region were more likely to introduce solids at six months or later than those who gave birth within Durham Region. With respect to other infant feeding practices, formula use in hospital had a negative impact on delayed introduction of solids until six months (Figure 11). The rates of solids introduction at six months or later varied by municipality with the highest rate found in Whitby and the lowest in Oshawa and Clarington (Figure 12).

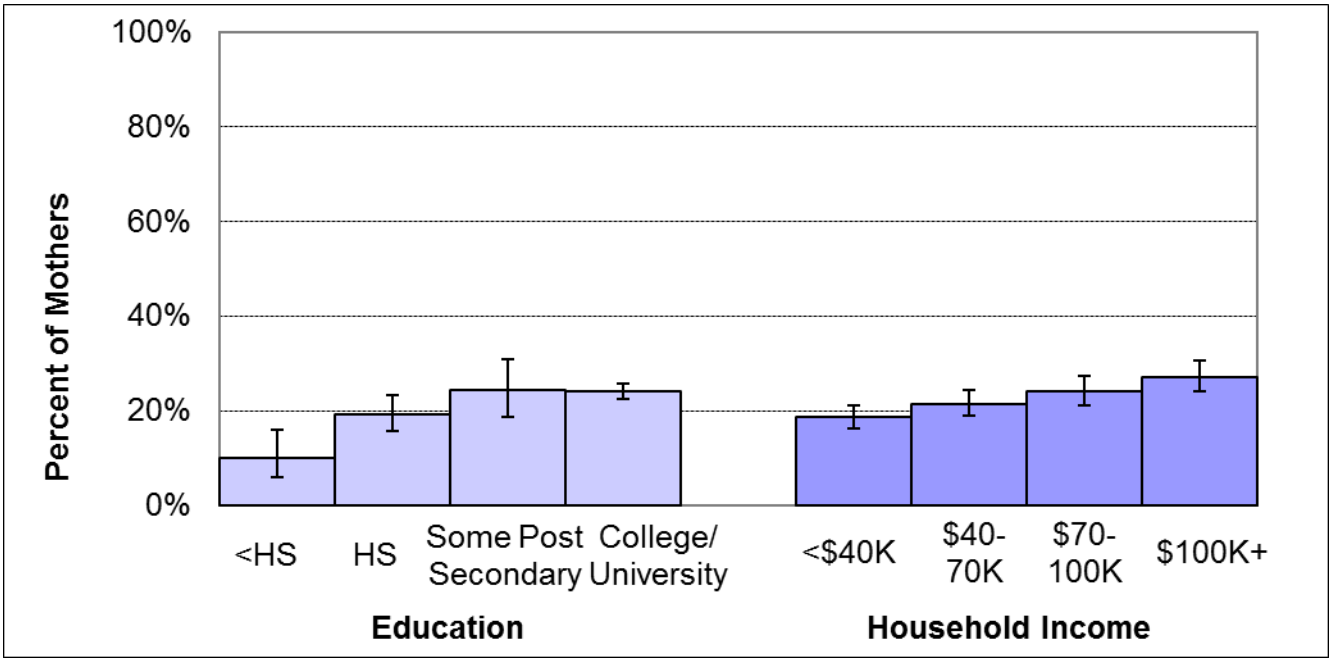
The most common reasons reported by mothers for introducing solids to their infants before six months were: the perception that milk was not sufficient; advice from health professionals; and the belief that the infant was ready for solids (data not shown). In this bivariate analysis, introduction of solids at six months or later was not associated with mother’s country of birth.

Figure 9: Introduction of Solids at Six Months or Later By Maternal Age, Durham Region, 2007-2014 Combined



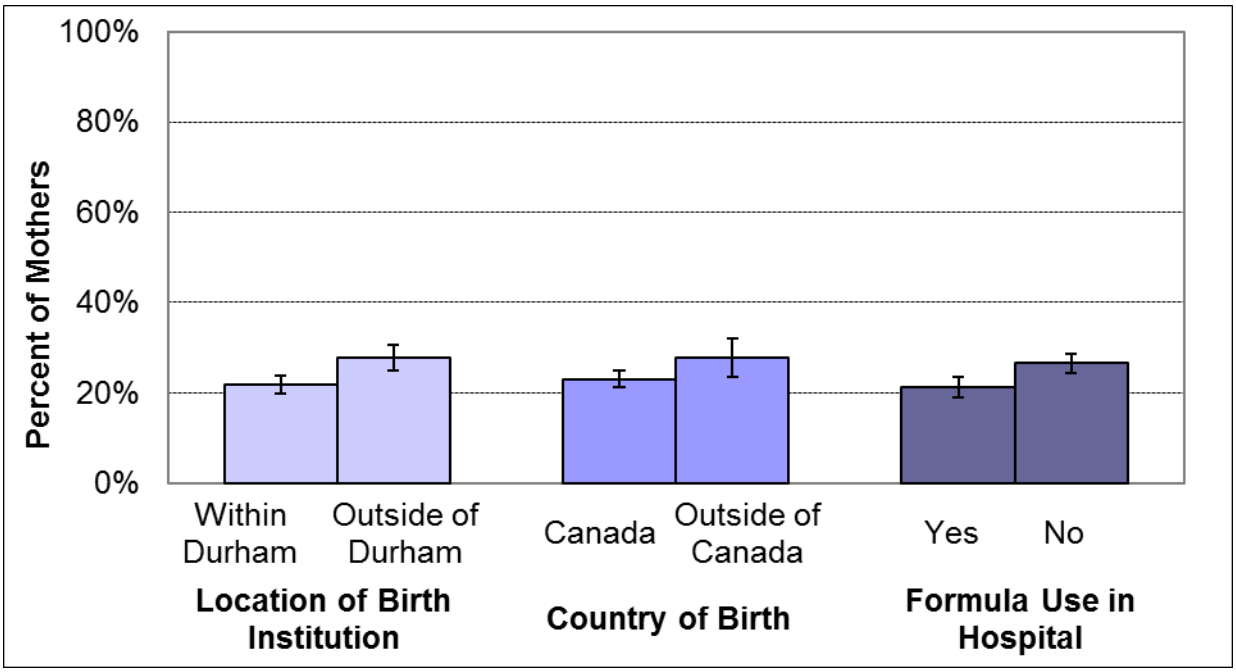
15-24	25-29	30-34	35+
15%	19%	27%	28%

Figure 10: Introduction of Solids at Six Months or Later By Education and Income, Durham Region, 2007-2014 Combined



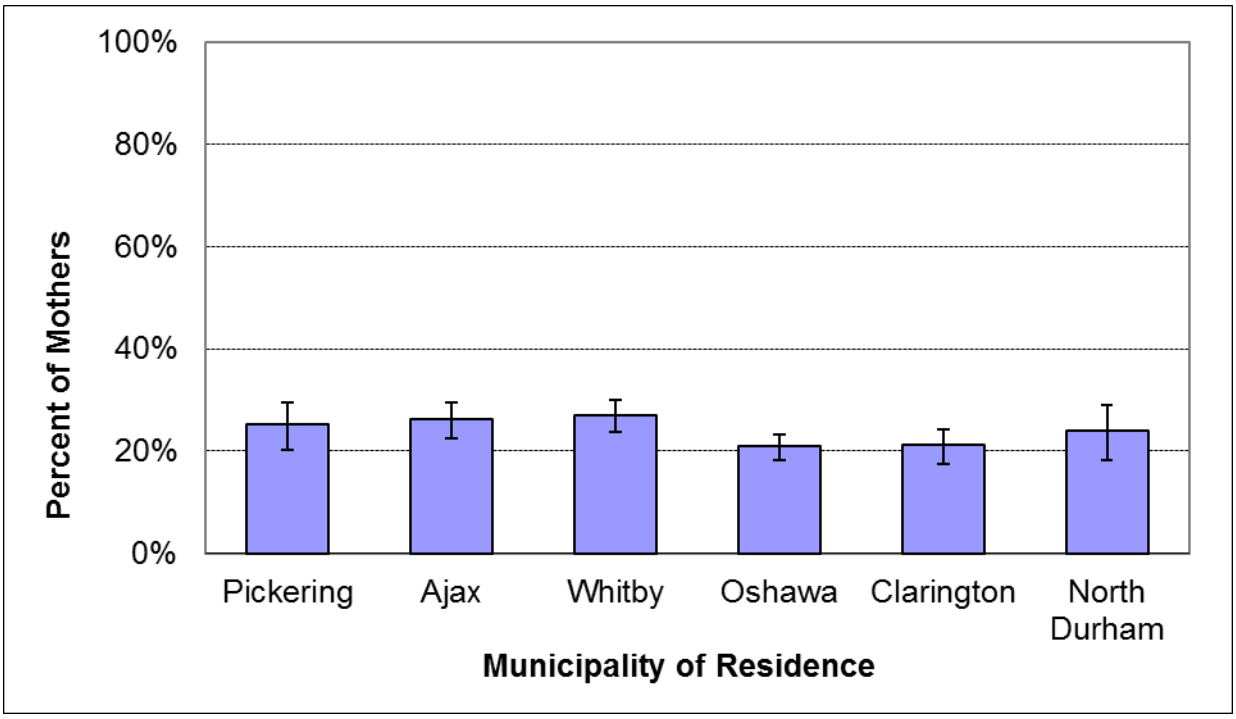
< High School (HS)	High School (HS)	Some Post Secondary	College/ University	<$40,000 (<$40K)	$40,000-69,999 ($40-70K)	$70,000-99,999 ($70-100K)	$100,000+ ($100K+)
10%	19%	25%	25%	19%	21%	24%	27%

Figure 11: Introduction of Solids at Six Months or Later By Location of Birth Hospital, Country of Birth and Formula Use in Hospital, Durham Region, 2007-2014 Combined



Within Durham	Outside of Durham	Canada	Outside of Canada	Yes	No
22%	28%	23%	28%	21%	27%

Figure 12: Introduction of Solids at Six Months or Later By Municipality of Residence, Durham Region, 2007-2014 Combined



Pickering	Ajax	Whitby	Oshawa	Clarington	North Durham (Scugog, Uxbridge and Brock)
25%	26%	27%	21%	21%	24%

Putting it all together: Controlling for Multiple Factors

Socioeconomic factors associated with infant feeding practices are complex and may be interrelated. By considering several factors simultaneously, variables that independently influence a specific infant feeding practice can be identified. In so doing, relationships that are identified in the preceding bivariate analysis may not hold and new associations may be uncovered.

Logistic regression was used to identify factors associated with the three infant feeding practices: breastfeeding initiation, duration for six months or more, and introduction of solids until six months or later. The following variables from the Durham Region IFSS were included in the multivariate analysis: maternal age, maternal education, household income, location of birth hospital, municipality of residence and mother's country of birth. Formula use in hospital was also included for breastfeeding duration and solid introduction. Strength of associations between study factors and infant feeding practices were measured using adjusted odds ratios. Only factors with adjusted odds ratios at a level of significance of $p<0.05$ were selected in the final model and presented in this report.

Definitions

Odds Ratio, Adjusted Odds Ratio, 95% Confidence Interval, Significant Difference

The **Odds Ratio (OR)** is the ratio of the probability of an event occurring in one group as compared to the event occurring in another group. It is a measure of strength of association. A higher odds ratio indicates a higher association compared to the reference group. An OR of 2.0 means that an event, such as initiating breastfeeding, is two times more likely to occur in one group (e.g., college or university graduates) than another (e.g., mothers who have not graduated from high school).

An **Adjusted Odds Ratio** is used in regression models whereby the OR is statistically adjusted for many other factors in order to better understand the effect of one specific factor.

The **95% Confidence Interval (CI)** is used to reflect the amount of variability or precision that is around an estimate, such as an odds ratio. Smaller CIs indicate greater precision, usually as a result of a larger sample size. In charts, the 95% confidence interval is represented by an error bar (I) around each point or bar. An odds ratio is considered statistically significant if its 95% confidence interval does not contain the value of one.

Significant Difference refers to a difference between two percentages that is not likely due to chance. In this study, a significant difference was determined using a Chi-square (χ^2) test at the $p<0.05$ level of statistical significance whereby less than 5% of these differences would be likely to occur by chance alone.

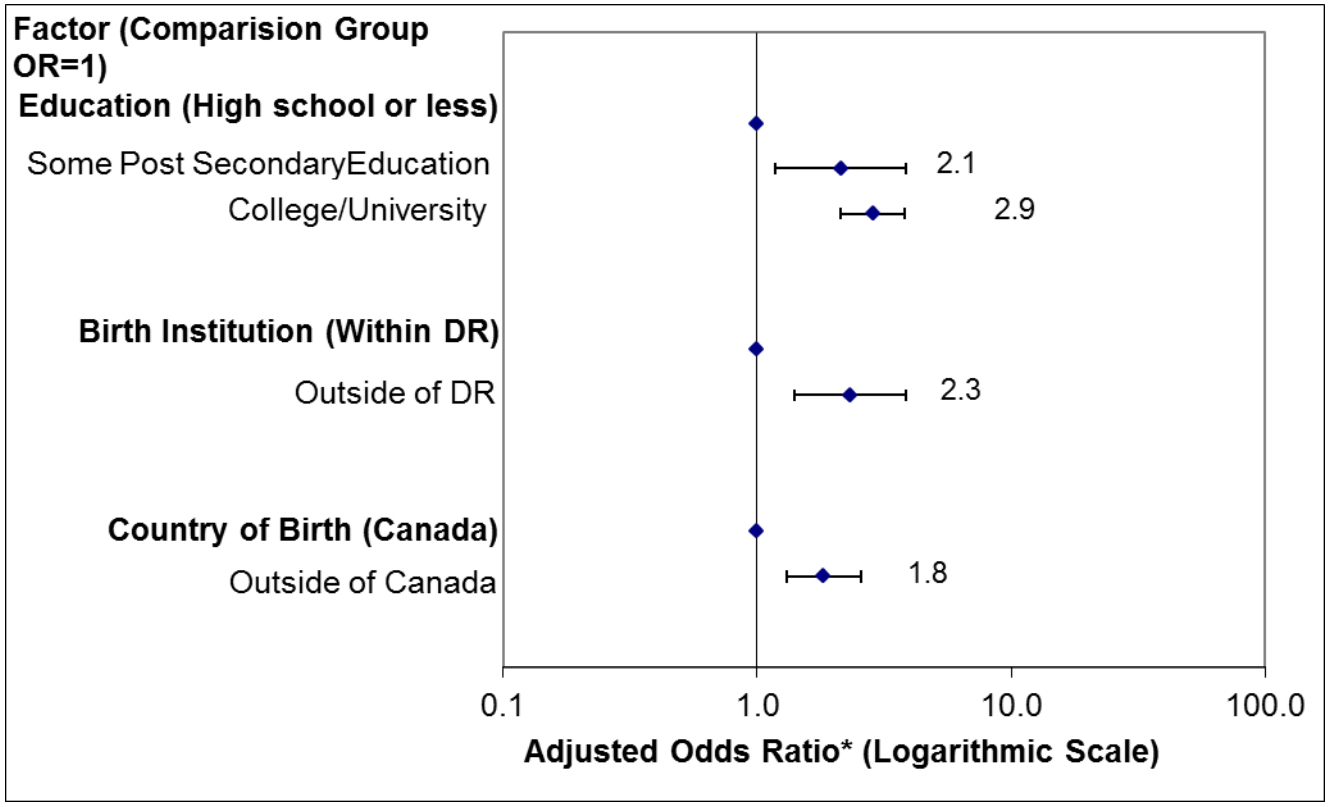
Breastfeeding Initiation

When all the studied factors were taken into account simultaneously in the multivariate analysis, maternal education, location of birth hospital and mother's country of birth were still significantly associated with breastfeeding initiation (Figure 13). Maternal age, household income and municipality of residence were no longer significant in the regression analysis and excluded from the final model.

Mother's education level was the strongest factor influencing breastfeeding initiation. Mothers with college/university education were almost three times (OR=2.9) more likely to initiate breastfeeding compared to those with high school or less, even when the location of birth hospital and whether the mother was born in Canada were also taken into consideration.

The second strongest factor was location of birth hospital. Mothers who gave birth outside of Durham Region were two times (OR=2.3) more likely to initiate breastfeeding than mothers who gave birth in Durham Region hospitals when education and country of birth were controlled for in the analysis. Finally, a significant association was found between whether or not the mother was born in Canada and breastfeeding initiation. Foreign-born mothers were 1.8 times more likely to initiate breastfeeding than Canadian-born mothers.

Figure 13: Factors Associated With Breastfeeding Initiation, Durham Region, 2007-2014 Combined



Data Source: Durham Region IFSS, 2007 – 2014 Births

Data Notes:

*: Odds ratios were adjusted for factors including maternal education, location of birth hospital and country of birth.

**: Horizontal bars denote the 95% confidence interval for the odds ratio. An odds ratio is not statistically significant compared to the reference group if its 95% confidence interval includes the value of 1.

Breastfeeding for Six Months or More

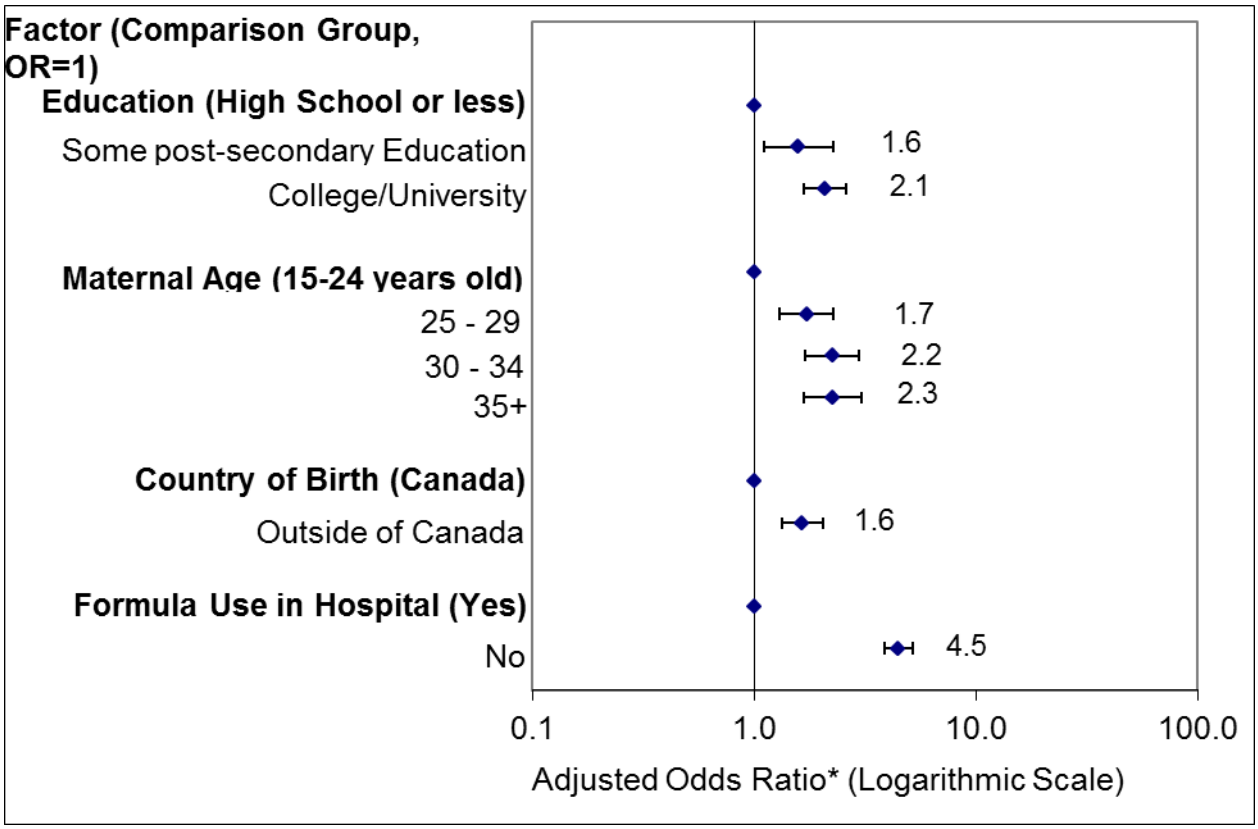
When the factors were examined individually in bivariate analysis, breastfeeding for six months or more was significantly related to all seven of the study factors: maternal age, maternal education, household income, location of birth hospital, residence of municipality, mother's country of birth and formula use in hospital. In multivariate analysis, when all seven were taken into account only four factors remained significant: maternal age education, mother's country of birth and formula use in hospital. The adjusted odds ratios of the four factors are shown in Figure 14.

A strong negative association was noted between having formula introduced in hospital and continuing to breastfeed for at least six months. After adjusting for potential confounders (including maternal age, education and country of birth), mothers of infants who were given formula while in hospital were almost five times less likely to continue to breastfeed for six months or more compared to mothers of infants who were not given formula while in hospital (OR=4.5).

Mother's education level was also significantly associated with breastfeeding duration. Compared to those with education levels of high school or less, the likelihood of breastfeeding for at least six months was 1.6 times higher among mothers with some post-secondary education and 2.1 times higher among mothers with a college/university degree. Similar to education level, breastfeeding duration also increased with maternal age.

As with breastfeeding initiation, Durham Region mothers born outside of Canada were more likely to breastfeed for at least six months (OR =1.6) compared to Canadian-born mothers.

Figure 14: Factors Associated with Breastfeeding for Six Months or More, Durham Region, 2007-2014 Combined



Data Source: Durham Region IFSS, 2007 – 2014 Birth years

Data Notes:

*: Odds ratios were adjusted for factors including maternal education, maternal age, country of birth, and formula use in hospital.

**: Horizontal bars denote the 95% confidence interval for the odds ratio. An odds ratio is not statistically significant compared to the reference group if its 95% confidence interval includes the value of 1.

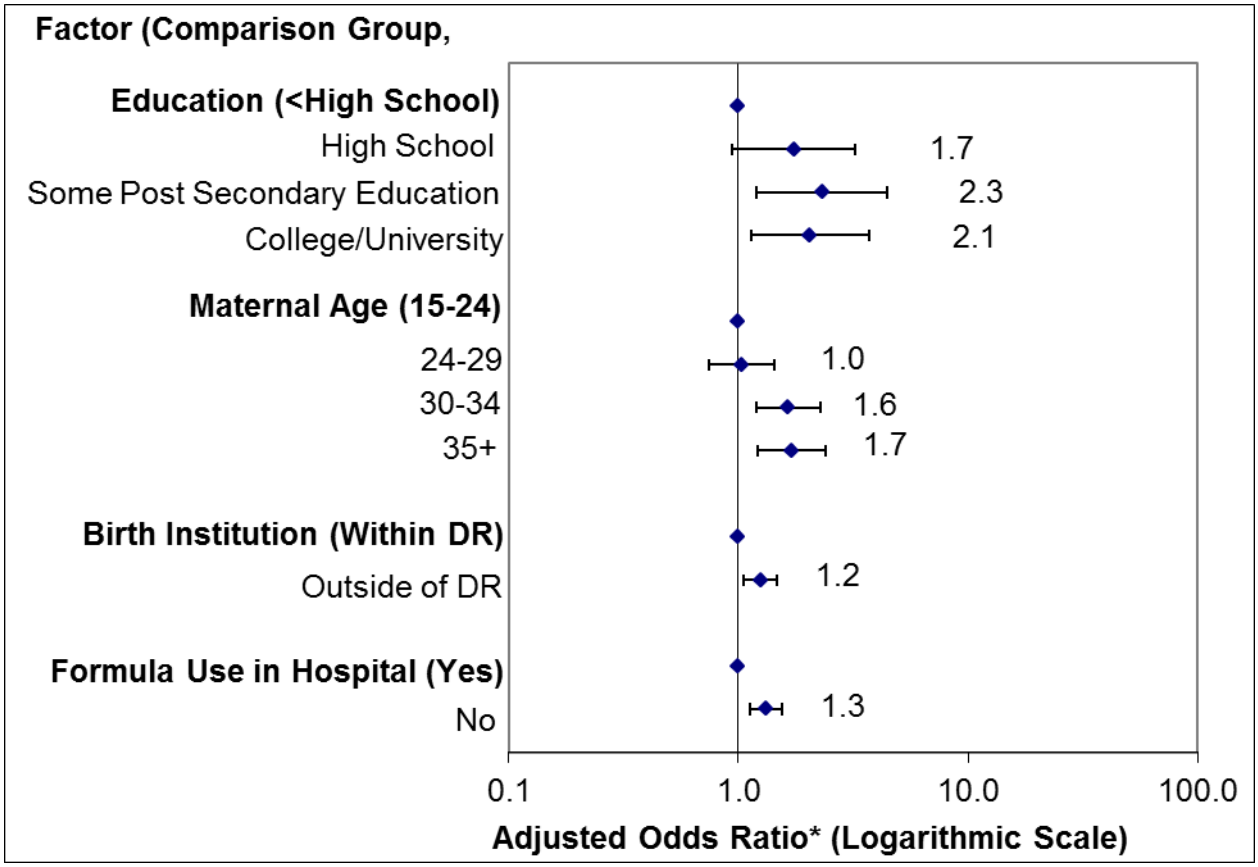
Introduction of Solids at Six Months or Later

In the bivariate analysis, introduction of solids at six months or later was significantly associated with all the study factors except country of birth. When controlling for all the seven factors using multivariate analysis, only four factors were still significant: maternal age, education, location of birth hospital and formula use in hospital (Figure 15).

Similar to breastfeeding initiation, mother's education level had the strongest impact on introduction of solids at six months or later. Mothers with at least some post-secondary education were about two times more likely to delay introducing solids until six months than mothers who did not complete high school. Older mothers were also more likely to introduce solids at six months or later than mothers in younger age categories.

Finally, formula use in hospital had a negative impact on delayed solid introduction. Mothers whose infants were given formula in hospital were 1.3 times less likely to introduce solids at six months or later than those whose infants were not given formula in hospital.

Figure 15: Factors Associated with Introduction of Solids at Six Months or Later, Durham Region, 2007-2014 Combined



Data Source: Durham Region IFSS, July 2007 – December 2010 Births

Data Notes:

*: Odds ratios were adjusted for factors including maternal education, maternal age, location of birth hospital, and formula use in hospital.

**: Horizontal bars denote the 95% confidence interval for the odds ratio. An odds ratio is not statistically significant compared to the reference group if its 95% confidence interval includes the value of one.

The associations between study factors and infant feeding practices in Durham Region based on the bivariate and multivariate analysis are summarized in Table 1.

Table 1: Associations between Study Factors and Infant Feeding Practices in Durham Region: Summary of Bivariate and Multivariate Analysis, 2007-2014 combined

Socioeconomic Factors	BF Initiation Bivariate	BF Initiation Multivariate	BF Duration > 6 Mos Bivariate	BF Duration > 6 Mos Multivariate	Intro of Solids > 6 Mos Bivariate	Intro of Solids > 6 Mos Multivariate
Maternal Age	+	—	+	+	+	+
Education	+	+	+	+	+	+
Household Income	+	—	+	—	+	—
Location of Birth Hospital	+	+	+	—	+	+
Municipality of Residence	+	—	+	—	+	—
Country of Birth	+	+	+	+	—	—
Formula Use in Hospital	▨	▨	+	+	+	+

+: Statistically significant association was found ($p<0.05$)

-: No statistically significant association was found

▨ : Not included in the analysis

Discussion and Program Implications

Although the majority of mothers in Durham Region (93%) initiated breastfeeding, only about half (55%) continued to breastfeed for at least six months, and only one in four (24%) delayed introduction of solids until six months. Similar results were found in some other health units in Ontario [14-16].

The difference between rates of breastfeeding initiation and breastfeeding duration for six months or more is considerable. Nutritional concerns, such as the perception of insufficient milk supply, and breastfeeding concerns, such as difficulty latching and sore nipples were the most frequently reported reasons for Durham Region mothers to discontinue breastfeeding (data not shown). Although the majority of mothers initiated breastfeeding, these findings suggest that many may lack the knowledge, expertise or social supports to continue breastfeeding.

Bivariate analysis showed that most of the study factors listed in table 1 were significantly associated with breastfeeding initiation, duration for six months or more, and introduction of solids at six months or later. In general, increased maternal age, higher education, higher household income, mothers being born outside of Canada and giving birth at a hospital outside of Durham Region were associated with higher initiation rates, longer duration and delayed introduction of solids until six months. Geographic variations were also found for infant feeding practices with higher breastfeeding rates usually seen in Pickering and Ajax and lower rates in Oshawa and Clarington. In addition to these socioeconomic factors, formula use in birth hospitals had a negative impact on infant feeding practices. Our findings are consistent with the scientific literature [5-6, 12, 15, 17-19].

Socioeconomic factors are usually correlated. For example, higher income is often found among older mothers with higher education. Their effects on infant feeding may often be confounded by each

other. Income may influence breastfeeding by being a marker of knowledge and education. Therefore, when examining their associations with infant feeding practices, it is necessary to take all these factors into consideration simultaneously by using methods such as multivariate analysis.

Education was the only factor that remained significant in both bivariate and multivariate analysis for all three infant feeding indicators (initiation, breastfeeding duration for six months or more, and introduction of solids at six months or later). Based on the strength of the association measured by adjusted odds ratios, education was the most important factor for breastfeeding initiation and introduction to solids, and the second strongest factor related to breastfeeding duration.

In contrast, income was no longer a protective factor for any of the three infant feeding indicators after adjusting for confounders. The results indicate that income is often correlated with other socioeconomic factors such as education and maternal age; the variations in infant feeding practices among different income groups may be partly explained by these other socioeconomic factors. As a result, when adjusting for these factors, income may no longer be related to infant feeding practices or have only a weak association.

Similar to our results, many other studies have also shown that compared to income, maternal education is more strongly associated with infant feeding [20-23]. The education measured in this study refers to formal education rather than education about breastfeeding; whether such education actually provides any direct health information specific to breastfeeding is unclear. In general, having more formal education may help parents understand the health benefits of breastfeeding, increase the likelihood of parents to search for information regarding optimal infant nutrition, and allow them to make well-informed decisions on infant feeding practices.

Consistent with previous studies of Canadian women [6, 15, 17], the breastfeeding practices of foreign-born mothers differed from those of Canadian-born mothers. Cultural traditions of ethnic minorities have been shown to positively influence breastfeeding practices at the community level [9]. In Durham Region, foreign-born mothers were more likely to initiate breastfeeding and to continue to breastfeed for at least six months compared to their Canadian-born counterparts; this association remained when adjusting for confounders. The results may reflect some unmeasured socioeconomic effects, and differences in culture, attitudes and beliefs towards breastfeeding by different ethnic groups.

The Better Outcomes Registry Network (BORN Ontario) reported that Durham Region had the highest formula supplementation rates (34%) and the lowest exclusive breastfeeding rates in hospital (52%) compared to other public health units in Central East Ontario in 2008 [24]. This finding is consistent with the results from the Durham Region IFSS; almost half of the infants (49%) born in 2010 were given formula while in hospital.

Formula use in birth hospital was significantly associated with both discontinuing breastfeeding and early introduction of solids before six months of age in both bivariate and multivariate analysis. Compared to other factors in this study, it had the strongest impact on discontinuing breastfeeding. The negative association between formula use in hospital and breastfeeding duration has been identified in many other studies [19, 25-29]. In-hospital formula supplementation can impact breastfeeding practices in many ways. Administering bottles to infants, particularly when breastfeeding is first being established, reduces infants' sucking on breast and results in a physiologic inhibition of milk secretion. This practice can also undermine breastfeeding by suggesting to the mother that her breastmilk is insufficient to meet the baby's nutritional needs and by decreasing the mother's confidence in breastfeeding.

There were some geographic variations in infant feeding practices when municipality of residence was examined individually; however, these variations no longer existed when adjusting for confounders. The results indicate that geographic variations in infant feeding practices are largely due to geographic differences in socioeconomic status such as education, income, and country of birth [30]. As a result, when adjusting for socioeconomic factors, the effects of municipality of residence on

infant feeding practices disappear. Location of birth hospital is usually linked to where people live and also hospital practices. This could partly explain the non-significant association between location of birth hospital and breastfeeding duration for at least six months after adjusting for formula use in hospital and other confounders.

Although many important factors influencing infant feeding practices were considered in this analysis, not all could be included. Variables, such as birth weight, gestational age, and parity, were not available in the IFSS for all the years included in this study. Factors that may impact infant feeding practices such as prior breastfeeding experience [18], maternal employment status and occupation [7], intention to breastfeed [31], family structure [11] and prenatal care [32] are not currently available in the IFSS. In addition, socioeconomic factors related to exclusive breastfeeding for six months or more could not be examined due to its low prevalence in Durham Region.

In summary, the study found a marked socioeconomic gradient in infant feeding practices. Women with higher education and household income, those giving birth outside of Durham Region, and mothers born outside of Canada were more likely than their counterparts to breastfeed and delay introduction to solids until six months. Formula use in hospital had a strong impact on discontinuing breastfeeding. After adjustment for potential confounders, education was the only factor that remained significantly associated with breastfeeding initiation, duration and introduction to solids.

Acquiring information on factors influencing infant feeding practices may better equip policy makers and public health practitioners to design effective programs for at-risk groups, and bridge the gap between the current infant feeding practices and recommendations from Health Canada and the World Health Organization.

What is Durham Region Health Department Doing to Promote and Support Infant Feeding Practices?

The Durham Region Health Department promotes infant feeding practices consistent with Breastfeeding Committee of Canada, the Canadian Paediatric Society, Dietitians of Canada and Health Canada to support healthy child development in Durham Region. The Health Department uses communication, education, capacity building and policy development strategies to achieve this goal. The Department offers a variety of programs and resources to protect, promote, and support breastfeeding:

- Prenatal programs and resources on breastfeeding increase awareness and knowledge about the importance of breastfeeding.
- The Durham Health Connection Line provides telephone support, written information and access to breastfeeding services in the community.
- Healthy Babies Healthy Children program provides telephone contact to new mothers identified with risk within 48 hours of hospital discharge, conducts home visits and provides referrals to appropriate resources as required.
- Breastfeeding clinics provide one-to-one support for families experiencing complex breastfeeding issues.
- Breastfeeding home visits for families experiencing non-complex breastfeeding issues
- Breastfeeding groups enable new mothers to support and learn from one another, and to increase breastfeeding duration through mutual aid.

The Durham Region Health Department also works with community partners to achieve common goals related to supporting optimal infant feeding practices and delivering a consistent, coordinated message to new mothers.

References

1. Godfrey JR, Lawrence RA. Toward optimal health: The multifaceted maternal benefits of breastfeeding. J Womens Health. 2010;19(9):1-6.
2. The World Health Organization. The global strategy for infant and young child feeding. Geneva: WHO; 2003 [cited March 2016]. Available from: http://whqlibdoc.who.int/publications/2003/9241562218.pdf
3. Health Canada. Exclusive Breastfeeding Duration: 2004 Health Canada Recommendation. 2004 [cited March 2016]. Ottawa. Available from: www.healthcanada.gc.ca/nutrition
4. Ministry of Health and Long-Term Care. Ontario Public Health Standards. 2008 [cited March 2016]. Available from: http://www.health.gov.on.ca/english/providers/program/pubhealth/oph_standards/ophs/index.html
5. Dubois L, Girard M. Social determinants of initiation, duration and exclusivity of breastfeeding at the population level. Can J Public Health. 2003;94(4):300–305.
6. Millar WJ, Maclean H. Breastfeeding practices. Health Reports. 2005;16(2):23-31.
7. Skafida V. The relative importance of social class and maternal education for breast-feeding initiation. Public Health Nutr. 2009;12(12):285-292.
8. Heck KE, Braveman P, Cubbom C, Chavez GF, Kiely JL. Socioeconomic status and breastfeeding initiation among California mothers. Public Health Reports. 2006;121:51-59.
9. Griffiths LJ, Tate AR, Dezateau C. The contribution of parental and community ethnicity to breastfeeding practices: evidence from the Millennium Cohort Study. Int J Epidemiol. 2005;24:1378-1386.
10. Kuo AA, Introduction of solid food to young infants. Matern Child Health J. 2010; Sept15 [cited March 2016]. Available from: http://www.springerlink.com/content/k326j6311057522j/fulltext.pdf
11. Kelly YJ, Watt RG. Breastfeeding initiation and exclusive duration at 6 months by social class – results from the Millennium Cohort Study. Public Health Nutr. 2005;8(4);417–421.
12. Scott JA, Binns CW, Graham KI, Oddy, WH. Predictors of the early introduction of solid foods in infants: results of a cohort study. BMC Pediatrics. 2009;9:60-68.
13. Breastfeeding Committee for Canada. Breastfeeding definitions and data collection periods. 2006 [cited March 2016]. Available from: http://breastfeedingcanada.ca/documents/BCC_BFI_Breastfeeding_Definitions_and_Data_Collection_English.pdf
14. Nadler E. Region of Waterloo Public Health infant feeding study 2006/2007. Waterloo, Ontario: Region of Waterloo Public Health. September, 2007.
15. James A, Hardy B, Devouge L, Garrison A. Breastfeeding practices in the Region of Peel 2004/2005. Brampton, Ontario: Peel Public Health.
16. Moynagh K, Chuey E, Di Bon C. Infant feeding in Halton: initiation, duration and exclusivity of breastfeeding. Oakville, Ontario: Halton Region Health Department. March 2010.
17. Simard I, O'Brien HG, Beaudoin A, Turcotte D, Damant D, Ferland s, et al. Factors influencing the initiation and duration of breastfeeding among low-income women followed by the Canadian Prenatal Nutrition Program in 4 regions of Quebec. J Hum Lact. 2005;21(3):27-37.

18. Milligan RA, Pugh LC, Bronner YL, Spatz, DL, Brown LP. Breastfeeding duration among low income women. J of Midwifery Women's Health. 2000;45(3):246-252.
19. Merten S, Dratva J, Ackermann-Liebrich U. Do baby-friendly hospitals influence breastfeeding duration on a national level? Pediatrics. 2005;116;e702-708.
20. Heck KE, Braveman P, Cubbin C, Chávez GF, Kiely JL. Socioeconomic status and breastfeeding initiation among California mothers. Public Health Rep. 2006 Jan-Feb;121(1):51-59.
21. Dubois L, Girard M. Social determinants of initiation, duration and exclusivity of breastfeeding at the population level: the results of the longitudinal study of child development in Quebec (ELDEQ 1998-2002). Can J Public Health. 2003 Jul-Aug;94(4):300-305.
22. Al-Sahab B, Lanes A, Feldman M, Tamim H. Prevalence and predictors of 6-month exclusive breastfeeding among Canadian women: a national survey. BMC Pediatr. 2010 Apr 8;10:20.
23. Skafida V. The relative importance of social class and maternal education for breast-feeding initiation. Public Health Nutr. 2009 Dec;12(12):2285-2292.
24. Better Outcomes Registry Network. Perinatal Health Report 2008. Central East Ontario Public Health Region, May 2010. [cited March 2016].Available from: https://www.bornontario.ca/en/resources/reports/public-health-region-reports/
25. Simard I, O'Brien HT, Beaudoin A, Turcotte D, Damant D, et al. Factors influencing the initiation and duration of breastfeeding among low-income women followed by the Canada prenatal nutrition program in 4 regions of Quebec. J Hum Lact. 2005 Aug;21(3):327-37.
26. Alikaşifoğlu M, Erginoz E, Gur ET, Baltas Z, Beker B, Arvas A. Factors influencing the duration of exclusive breastfeeding in a group of Turkish women. J Hum Lact. 2001 Aug;17(3):220-226.
27. Forster DA, McLachlan HL, Lumley J. Factors associated with breastfeeding at six months postpartum in a group of Australian women. Int Breastfeed J. 2006 Oct 12;1:18.
28. Gray-Donald K, Kramer MS, Munday S, et al. Effect of formula supplementation in the hospital on the duration of breastfeeding: a controlled clinical trial. Pediatrics. 1985;75:514-518.
29. Bergevin Y, Dougherty C, Kramer MS. Do infant formula samples shorten the duration of breast-feeding? Lancet. 1983 May 21;1(8334):1148-1151.
30. Durham Region Planning Department. Durham Region Profile – Demographics and Socio-Economic Data. October 2015. [cited March 2016].Available from: http://www.durham.ca/departments/planed/planning/stats-n-facts/durhamprofile/DetailedReport.pdf
31. Yeon Bai, SE, Middlestadt CY, Peng J, Fly AD. Predictors of continuation of exclusive breastfeeding for the first six months of life. J Hum Lact. 2000;26(1):26-34.
32. Raisler J. Against the odds: Breastfeeding experiences of low income mothers. J Midwifery Women's Health. 2000;45(3):253-263.