

Original Article

Predictors of breastfeeding exclusivity among migrant and Canadian-born women: results from a multi-centre study

Cindy-Lee Dennis*, Anita Gagnon[†], Andrea Van Hulst[‡] and Geoff Dougherty[§]

*Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, Ontario, Canada, [†]School of Nursing and Department of Obstetrics and Gynecology, McGill University, Montreal, Quebec, Canada, [‡]School of Nursing, McGill University, Montreal, Quebec, Canada, and [§]Faculty of Medicine, McGill University, Montreal, Quebec, Canada

Abstract

The objective of this study was to examine and compare predictors of breastfeeding exclusivity among migrant and Canadian-born women. As part of a longitudinal study, a sample of 1184 mothers were recruited from 12 hospitals in Canada and completed questionnaires at 1 and 16 weeks post-partum that included diverse questions from the following domains: demographic, social, migration, obstetrical, breastfeeding and maternal mood. After bivariate analysis, multivariate logistic regression analysis was completed to examine and compare predictors of exclusive breastfeeding at 16 weeks post-partum. Among migrant women, factors predictive of breastfeeding exclusivity included non-refugee immigrant or asylum-seeking status, residence in Toronto or Vancouver, maternal age of ≥ 35 years, feels most comfortable in the country of origin or nowhere and higher Gender-related Development Index of the country of origin. Factors predictive of not exclusively breastfeeding included maternal age of < 20 years, not planning to exclusively breastfeed, not making the decision to breastfeed before pregnancy and not exclusively breastfeeding at 1 week post-partum. Among Canadian-born women, factors predictive of a lower likelihood of breastfeeding exclusivity included not living with father of infant, infant neonatal intensive care unit admission, planned duration of exclusive breastfeeding for < 6 months, not exclusively breastfeeding at 1 week post-partum and Edinburgh Postnatal Depression Scale score of ≥ 10 . The only similar risk factor predicting a lower likelihood of breastfeeding exclusivity between migrant and Canadian-born women was not exclusively breastfeeding at 1 week post-partum; all other risk factors were dissimilar, suggesting that these groups might benefit from different strategies to optimise breastfeeding outcomes.

Keywords: breastfeeding, exclusivity, migrant, Canadian-born, risk factors, breastfeeding support.

Correspondence: Dr Cindy-Lee Dennis, Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, 155 College Street, Toronto, ON, Canada M5T1P8. E-mail: cindylee.dennis@utoronto.ca

Introduction

Leading health authorities such as the World Health Organization (WHO) (2001), Canadian Paediatric Society (2009) and the American Academy of Pediatrics (2005) all encourage breastfeeding as the optimal method of infant feeding. Specifically, infants should be breastfed exclusively for the first 6 months of life and then, once other foods have been introduced,

continue to be breastfed until 2 years and beyond. These recommendations are based on a body of literature that provides compelling evidence that breastfeeding offers many health benefits for both infants and mothers (Lawrence 2000; Labbok 2001; Chen & Rogan 2004; Grummer-Strawn & Mei 2004; American Academy of Pediatrics 2005; Horta *et al.* 2007; Ip *et al.* 2007). These benefits include decreased incidence of childhood infections; lower sudden

infant death syndrome and post-neonatal mortality rates; reduced incidence of childhood obesity, diabetes and certain childhood cancers; and enhanced cognitive development (American Academy of Pediatrics 2005). The maternal health benefits include decreased post-partum bleeding and lower risks of breast and ovarian cancers (American Academy of Pediatrics 2005). Other important benefits in the United States include a potential annual savings of \$3.6 billion in health care costs (American Academy of Pediatrics 2005).

Despite these individual and societal benefits and a breastfeeding initiation rate of 90% in Canada, there is a sudden decline in exclusive breastfeeding in the early post-partum period: by 3 months, only 54% of Canadian mothers are exclusively breastfeeding (Public Health Agency of Canada 2009). Similarly, 75% of women in the United States initiate breastfeeding, but only 35% are exclusively breastfeeding through 3 months (Centers for Disease Control 2011). According to the Organization for Economic Co-operation and Development (OECD 2011), this is consistent with other developed countries, in which the exclusive breastfeeding rates are low. In the 24 countries for which 3-, 4- and 6-month exclusive breastfeeding rates were reported, the rates ranged from 13% to 96% at 3 months, from 7% to 63% at 4 months and from 3% to 44% at 6 months (OECD 2011). Given that breastfeeding has a dose-response effect, with increased benefits being proportionate to the extent of exclusive breastfeeding and duration of breastfeeding (Raisler *et al.* 1999; Kramer & Kakuma 2002; Kramer *et al.* 2003), these suboptimal breastfeeding rates indicate that mothers and their infants are not receiving the maximum health benefits breastfeeding provides. Although initiation rates have

increased, there is sizable gap between actual rates of exclusive breastfeeding and current recommendations.

In the majority of cases, exclusive breastfeeding is discontinued early, with Canadian rates indicating 21% of infants are supplemented in the first week, while 25.5% of infants are supplemented in the second week post-partum (Chalmers *et al.* 2009; Public Health Agency of Canada 2009). Similarly, 25% of US infants are supplemented with infant formula before 2 days of age and 37% are supplemented with infant formula before 12 weeks of age (Centers for Disease Control 2010). Additionally, discontinuation of any breastfeeding often occurs within the first weeks. Sheehan *et al.* (2001, 2006) conducted a two-phase study, in which post-partum women in Ontario were surveyed at 4 weeks post-discharge. In the first phase, at 4 weeks, 18.5% (13–24%) of women had switched to formula and the majority of them had done so in the first 7 days. The reasons for discontinuation included breastfeeding factors such as perceived insufficient milk supply, difficulty with technique and sore nipples. This is consistent with other studies, which have found that a large percentage of early discontinuation occurs in the 1–2 weeks post-partum and is related to breastfeeding difficulties and perceived inadequate milk supply at these time points (Matthews *et al.* 1998; Ertem *et al.* 2001; Hall *et al.* 2002; Cooke *et al.* 2003).

Other risk factors related to early cessation or supplementation of breastfeeding have been examined in various studies, with results suggesting a multifactorial aetiology (Dennis 2002; Thuiler & Mercer 2009; Meedya *et al.* 2010). Demographic factors include maternal age, marital status, educational level, household income, employment activity and smoking

Key messages

- Migrant women were less likely to be exclusively breastfeeding at 16 weeks post-partum in comparison to Canadian-born women.
- Exclusive breastfeeding status at 1 week post-partum was the only similar protective factor of later exclusive breastfeeding among women in both groups.
- Future interventions to improve breastfeeding exclusivity could specifically target migrant women.

status. Obstetrical variables such as parity have influenced breastfeeding outcomes in addition to maternal attitudes, intentions, behaviours and confidence. Hospital policies and support from professionals, partners, family and peers can further impact whether a woman breastfeeds (Dennis 2002; Kehler *et al.* 2009; Thuiler & Mercer 2009; Meedya *et al.* 2010). Although factors that influence the initiation and duration of breastfeeding have been broadly researched, previous studies have rarely examined factors associated with exclusive breastfeeding (Scott & Binns 1999; Kristiansen *et al.* 2010). Furthermore, although these preceding risk factors may also affect immigrant women, an inadequate focus has been placed on this unique maternal population (Byrd *et al.* 2001; Celi *et al.* 2005; Gibson-Davis & Brooks-Gunn 2006). This is a significant limitation given the changing demographics of North America.

The immigrant population in the United States and Canada has grown considerably in the past three decades. In 2003, there were 33.5 million immigrants living in the United States (12% of the total US population), an increase of 23.9 million immigrants since 1970 (Larsen 2003; Singh *et al.* 2007); and in 2006, there were 6.2 million immigrants living in Canada (19.8% of the total Canadian population) (Statistics Canada 2007). The increase in the proportion of children born to immigrant families in the United States has also substantially increased; between 1990 and 2007, the number of US children in immigrant families nearly doubled, while the number of children in US-born families increased by only 3% (Mather 2009). Given such a rapid increase in the immigrant population, it is important to know how breastfeeding patterns for immigrant women differ from those of host populations.

While several studies suggest that immigrant women are more likely to initiate breastfeeding and breastfeed for longer periods than native-born women (Bonuck *et al.* 2005; Millar & Maclean 2005; Gibson-Davis & Brooks-Gunn 2006; Singh *et al.* 2007; Lee *et al.* 2009; Zuppa *et al.* 2010; Chen *et al.* 2011), other studies have found lower rates of breastfeeding among immigrant women (Meftuh *et al.* 1991; Tuttle & Dewey 1994; Thomas & DeSantis 1995; Roville-Sausse 2005; Groleau *et al.* 2006; Harley *et al.* 2007;

Sussner *et al.* 2008). For example, a US study found that among 4207 women, 91% of Mexican, 89% of non-Mexican and 85% of non-Hispanic immigrant mothers breastfed, whereas for US-born mothers, the corresponding rates were 53%, 47% and 53%, respectively (Gibson-Davis & Brooks-Gunn 2006). In a Canadian study of 7266 mothers, immigrant women were more likely to initiate breastfeeding than non-immigrant women (92% vs. 83%, respectively) (Millar & Maclean 2005). Conversely, in a study of 120 infants in France, those born to immigrant Chinese mothers were less likely to be breastfed in comparison to infants who were born to native French mothers (10% vs. 55%, respectively) (Roville-Sausse 2005). There is some evidence that immigration status and acculturation variables are important factors in explaining variations in breastfeeding rates among immigrant women. For example, a recent longitudinal study of 490 Mexican immigrant women living in California found that increased time in the United States was negatively associated with breastfeeding initiation, duration and exclusivity (Harley *et al.* 2007). These studies highlight the complex interplay of factors that may affect breastfeeding among immigrant women, many of whom face multiple layers of challenges owing to their migration status, race/ethnicity, socio-economic and cultural differences.

Given the substantial health benefits and low rates of exclusive breastfeeding in North America, health professionals have an important role to play to promote and support breastfeeding exclusivity. To identify women at risk for prematurely discontinuing exclusive breastfeeding, a better understanding of the key factors that predict breastfeeding exclusivity in different populations is required. The aim of this study was to examine and compare predictors of exclusive breastfeeding at 16 weeks post-partum among migrant and Canadian-born women.

Methods

Sample

This study is part of a larger multi-site, prospective cohort study (Gagnon *et al.* 2006) that aimed to (1) examine whether refugee or asylum-seeking women

and their infants experience a greater number or a different distribution of harmful health events during pregnancy, at birth and during the post-partum period than non-refugee immigrant or Canadian-born women; and (2) determine whether harmful health events experienced post-partum by asylum-seeking women and their infants are addressed less often (compared with refugee, non-refugee immigrant and Canadian-born women) by the Canadian health care system as delivered in each of the three major receiving cities for newcomers.

Hence, between February 2006 and May 2009, a cohort of women and their infants were recruited on the post-partum units of 12 hospitals serving the highest percentage of asylum-seekers in cities receiving the greatest number of refugees to Canada (Toronto, 32.8%; Montreal, 21%; Vancouver, 7.7%) (Citizenship and Immigration Canada 2007). Women were placed into one of four groups based on their status in Canada: refugees, asylum-seekers, immigrants and Canadian-born. As more immigrant and Canadian-born women were available for study, we alternated recruitment of these women based on the closest date and time of birth to each refugee and asylum-seeking woman recruited. Following the collection of data in hospital via medical records and interviewer-administered questionnaires, all women received home visits at 1 and 16 weeks post-partum.

For women to be included in the study, they must met the following criteria: (1) planned to remain in the study city to 16 weeks post-partum; (2) were able to speak any of the study languages [Arabic, Dari/Persian, English, French, Mandarin/Cantonese (oral; 'simplified' and 'complex' Chinese written), Punjabi, Russian, Serbo-Croatian, Somali, Spanish, Tamil and Urdu]; (3) lived within a 45-min drive of the hospital; (4) were discharged from hospital by post-partum day 4 for vaginal or day 7 for caesarean births; and (5) met the criteria for one of the following study subgroup samples. 'Refugee' is defined as a woman who met the United Nations definition of refugee within the last five years, 'owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership in a particular social group, or political opinion, is outside the country of his nationality, and is unable to or, owing to such fear, is unwilling to avail

himself of the protection of that country' (UNHCR 2000). 'Asylum-seeker' is defined as a woman who applied for refugee status in Canada within the last five years and those with no known immigration status (i.e. whose claim for refugee status has not yet been definitely evaluated). 'Non-refugee immigrant' is defined as a woman who immigrated within the last five years with non-refugee histories.

Canadian-born

Non-Aboriginal women born and living in Canada for the majority of their lives. Women were excluded if they (1) had a major mental illness (schizophrenia, other psychoses or profound previously existing depression) or cognitive impairment that precluded informed consent; (2) were temporary residents (e.g. visitors, students); (3) had given the infant up for adoption; or (4) had a stillbirth delivery or an infant death.

Procedures

An information sheet describing the study and offering the opportunity to decline a visit from research staff was provided to all women upon admission to the post-partum unit or posted in the hospital room. Research assistants contacted all eligible women who agreed to hear a detailed study explanation. Research assistants spoke a range of languages, used translated forms and communicated through family or friends as necessary. In the rare case that interpreters were required, they explained the study via telephone using a translated standardised information sheet and the research assistant obtained consent and baseline data via the interpreter. Prior to recruitment, ethical approval was obtained from all participating hospitals and from the ethics review boards at McMaster University, McGill University and the University of British Columbia.

Data related to obstetrical history were obtained from medical records, while data related to demographic characteristics were obtained from interviewer-assisted questionnaires administered on the post-partum unit. Migration history, social support, breastfeeding characteristics and maternal

mood were assessed at 1 week post-partum during a home visit by a nurse (with interpreters when needed). Breastfeeding exclusivity was measured at 16 weeks post-partum during a second home visit by the same nurse. Questionnaires were translated and validated across the 13 study languages using stringent procedures (Ruppenthal *et al.* 2005; Strochschein *et al.* 2010). Data verification protocols were developed for each of the 12 sites. Rates of missing data did not differ by group and not more than 20 women were missing data for any given variable.

Measurements

The dependent variable was breastfeeding exclusivity, defined as breastfeeding only without the provision of additional formula, cereals, juice or other supplements except for water. Women were categorised as exclusively breastfeeding at 16 weeks if they had given no supplements since birth; other women were categorised as not exclusively breastfeeding. Based on previous breastfeeding risk factor research, variables were selected and categorised into the following six domains: demographic characteristics, migration history, social characteristics, obstetrical history, breastfeeding characteristics and maternal mood (Table 1). *Demographic characteristics* included migration group, UN World Region from where emigrated, Canadian city of residence, maternal age, educational level, annual household income (Canadian dollars) and smoking status. *Migration history* (for the migrant group only) included time since migration to Canada, language-speaking preference and country in which the mother reported feeling most comfortable. The Gender-related Development Index (GDI) of the country of origin was also included. It was developed by the United Nations and is used as one of five indicators by the United Nations Development Programme in their annual Human Development Report (United Nations 2010). The GDI highlights inequalities in the areas of a long and healthy life, knowledge and a decent standard of living between men and women, with scores ranging from 0 (lowest) to 1 (highest). *Social characteristics* included level of social support as measured using the Personal Resources Questionnaire (PRQ) (Weinert & Brandt 1987) at 1

week post-partum. The PRQ is a 25-item self-report instrument where items are rated on a 7-point Likert-type scale to produce a total score ranging from 25 to 175, with higher scores indicating higher levels of social support. Other social variables included maternal residence with the infant's father and the provision of breastfeeding support from husband, maternal mother and/or peers. *Obstetrical history* included parity, mode of delivery and infant neonatal intensive care unit (NICU) admission. *Breastfeeding characteristics* included planned infant feeding method, timing of decision to breastfeed, planned duration of exclusive breastfeeding, previous breastfeeding experience and breastfeeding duration of peers. It also included breast engorgement, nipple pain and exclusive breastfeeding status at 1 week post-partum. Finally, *maternal mood* was measured using the Edinburgh Postnatal Depression Scale (EPDS) (Cox *et al.* 1987) at 1 week post-partum. The EPDS is a 10-item self-report instrument where items are rated on a 4-point scale to produce a total score ranging from 0 to 30, with higher scores indicating higher levels of depressive symptomatology. All predictors were measured prior to 16 weeks post-partum, either via medical records or questionnaires administered at birth or at the 1 week post-partum home visit.

Statistical analysis

In order to examine differences in risk factors, all analyses were completed using two different samples: (1) migrant only (sample combined the refugee, asylum-seeker and non-refugee immigrant subgroups) and (2) Canadian-born only. Chi-square tests were used to compare proportions of breastfeeding predictors by breastfeeding exclusivity at 16 weeks post-partum. Logistic regression was performed using the following five steps: (1) six separate logistic regression models were completed to examine the impact of each set of predictor variables from each domain on breastfeeding exclusivity; (2) predictors from each domain that were significantly associated with breastfeeding exclusivity were then included in an overall model; (3) predictors that were no longer statistically significant in the overall model were removed one by one until all remaining predictors

Table 1. Factors associated with breastfeeding exclusivity at 16 weeks post-partum among migrant and Canadian-born women

	Migrant women			Canadian-born women		
	Exclusively breastfeeding at 16 weeks (<i>n</i> = 810)		χ^2 <i>P</i> -value	Exclusively breastfeeding at 16 weeks (<i>n</i> = 374)		χ^2 <i>P</i> -value
	Yes (<i>n</i> = 411)	No (<i>n</i> = 399)		Yes (<i>n</i> = 265)	No (<i>n</i> = 109)	
Demographic characteristics						
Migration group			<0.001			N/A
Refugee	34.6 (44)	65.4 (83)		–	–	
Asylum-seeker	52.4 (151)	47.6 (137)		–	–	
Non-refugee immigrant	54.7 (216)	45.3 (179)		–	–	
UN world region			<0.001			N/A
North America	90.9 (10)	9.1 (1)		–	–	
Africa	43.8 (74)	56.2 (95)		–	–	
Asia/Oceania	50.2 (147)	49.8 (146)		–	–	
Europe	72.6 (45)	27.4 (17)		–	–	
Latin America	49.1 (135)	50.9 (140)		–	–	
Residential city			<0.001			0.255
Montreal	43.3 (157)	56.7 (206)		64.7 (66)	35.3 (36)	
Toronto	55.4 (155)	44.6 (125)		74.7 (68)	25.3 (23)	
Vancouver	59.3 (99)	40.7 (68)		72.4 (131)	27.6 (53)	
Maternal age			0.161			0.793
<20 years	42.9 (6)	57.1 (8)		50.0 (1)	50.0 (1)	
20–34 years	49.2 (308)	50.8 (318)		71.4 (157)	28.6 (63)	
≥35 years	57.1 (97)	42.9 (73)		70.4 (107)	29.6 (45)	
Educational level			0.657			0.220
≤12 years	49.8 (158)	50.2 (159)		62.2 (23)	37.8 (14)	
>12 years	51.6 (249)	48.4 (234)		71.8 (242)	28.2 (95)	
Annual household income			0.029			0.003
<\$30 000	46.9 (226)	53.1 (256)		46.4 (13)	53.6 (15)	
≥\$30 000	55.7 (128)	44.3 (102)		72.7 (240)	27.3 (90)	
Smoking status			0.478			0.956
Yes	42.9 (9)	57.1 (12)		71.4 (10)	28.6 (4)	
Migration history						
Time since migration			0.407			N/A
<2 years	52.4 (204)	47.6 (185)		–	–	
≥2 years	49.5 (206)	50.5 (210)		–	–	
Gender-related Development Index			<0.001			N/A
Low	40.2 (102)	59.8 (152)		–	–	
Middle	55.2 (132)	44.8 (107)		–	–	
High	60.7 (147)	39.3 (95)		–	–	
Language most comfortable speaking			0.916			N/A
English or French	50.9 (293)	49.1 (283)		–	–	
Other	50.5 (112)	49.5 (110)		–	–	
Country most comfortable living in			0.018			N/A
Canada or equally in Canada and country of origin	48.2 (293)	51.8 (316)		–	–	
Country of origin or nowhere	57.9 (114)	42.1 (83)		–	–	
Social characteristics						
Social support			0.206*			0.144*
Score on PRQ, mean (SD)	5.74 (0.81)	5.67 (0.79)		6.42 (0.46)	6.33 (0.53)	
Residence with infant's father			0.426			<0.001
Yes	51.3 (334)	48.7 (317)		73.5 (253)	26.5 (91)	

Table 1. Continued

	Migrant women			Canadian-born women		
	Exclusively breastfeeding at 16 weeks (<i>n</i> = 810)			Exclusively breastfeeding at 16 weeks (<i>n</i> = 374)		
	Yes (<i>n</i> = 411)	No (<i>n</i> = 399)	χ^2 <i>P</i> -value	Yes (<i>n</i> = 265)	No (<i>n</i> = 109)	χ^2 <i>P</i> -value
Breastfeeding support from father			0.374			<0.001
Yes	51.4 (357)	48.6 (338)		72.2 (262)	27.8 (101)	
Breastfeeding support from mother			0.017			0.534
Yes	53.0 (340)	47.0 (302)		71.3 (236)	28.7 (95)	
Breastfeeding support from peers			0.082			0.283
Yes	52.4 (332)	47.6 (302)		71.5 (248)	28.5 (99)	
Obstetrical history						
Parity			0.156			0.530
1	53.1 (206)	46.9 (182)		73.2 (153)	26.8 (56)	
2	51.1 (143)	48.9 (137)		67.8 (82)	32.2 (39)	
3 or more	43.7 (62)	56.3 (80)		68.2 (30)	31.8 (14)	
Mode of delivery			0.469			0.877
Vaginal birth	51.8 (277)	48.2 (258)		71.1 (170)	28.9 (69)	
Caesarean section	49.1 (134)	50.9 (139)		70.4 (95)	29.6 (40)	
Infant admission to NICU			0.102			0.014
Yes	40.7 (24)	59.3 (35)		28.6 (2)	71.4 (5)	
Breastfeeding characteristics						
Infant feeding plan			<0.001			0.012
Breastfeed only	57.5 (342)	42.5 (253)		72.5 (251)	27.5 (95)	
Other	32.1 (69)	67.9 (146)		50.0 (14)	50.0 (14)	
Previous breastfeeding experience			0.297			0.455
Yes	48.8 (191)	51.2 (200)		68.8 (108)	31.2 (49)	
Peer breastfeeding duration			0.774			0.180
No breastfeeding or do not know	50.5 (55)	49.5 (54)		69.6 (39)	30.4 (17)	
Most breastfeed <6 months	55.4 (31)	44.6 (25)		57.6 (19)	42.4 (14)	
Most breastfeed \geq 6 months	50.4 (323)	49.6 (318)		72.9 (207)	27.1 (77)	
Timing of decision to breastfeed			0.001			0.806
Before pregnancy	54.1 (322)	45.9 (273)		71.1 (216)	28.9 (88)	
During pregnancy or at birth	41.2 (87)	58.8 (124)		69.6 (48)	30.4 (21)	
Planned duration of exclusive breastfeeding			<0.001			0.001
No exclusive breastfeeding	31.9 (61)	68.1 (130)		46.2 (12)	53.8 (14)	
<6 months	48.7 (57)	51.3 (60)		57.1 (28)	42.9 (21)	
\geq 6 months	57.2 (259)	42.8 (194)		74.8 (208)	25.2 (70)	
Had engorgement pain at 1 week			0.153			0.351
Yes	46.8 (111)	53.2 (126)		67.5 (77)	32.5 (37)	
Had nipple pain at 1 week			0.805			0.641
Yes	51.3 (159)	48.7 (151)		69.6 (117)	30.4 (51)	
Was exclusively breastfeeding at 1 week			<0.001			<0.001
Yes	59.6 (335)	40.4 (227)		75.8 (241)	24.2 (77)	
Maternal mood						
EPDS at 1 week			0.440			0.023
Score <10	51.6 (320)	48.4 (300)		72.9 (237)	27.1 (88)	
Score \geq 10	48.4 (90)	51.6 (96)		57.1 (28)	42.9 (21)	

EPDS, Edinburgh Postnatal Depression Scale; PRQ, Personal Resources Questionnaire. Note: Data are presented as % (*n*). **t*-Test *P*-value.

were statistically significant; (4) predictors that were not included in the overall model were then re-introduced into the model to examine whether they were associated with breastfeeding exclusivity when combined with other variables; and (5) the final model included the predictors significantly associated with breastfeeding exclusivity at the end of steps 3 and 4. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for the association between predictors and breastfeeding exclusivity status at 16 weeks are presented. These steps were repeated for each sample (i.e. migrants only, Canadian-born only). Analyses were conducted using SPSS version 16.0 (SPSS 2009).

The formula presented by Tabachnick & Fidell (2001) was used to calculate a proposed sample size. With a type I error of 0.05 and a type II error of 0.20, the sample size (N) needed to evaluate (m) independent predictors was: $N = 104 + m$. In our study with 28 independent predictors, we had well over the required size ($104 + 28 = 132$). Furthermore, the formula used for multivariate analysis was: $N = 50 + 8m$. Because we never used more than 10 predictors in a multivariate analysis at one time, again we had a sufficient sample size.

Results

Sample characteristics

A cohort of 1875 women was recruited into the following four groups: refugees ($n = 219$), asylum-seekers ($n = 454$), non-refugee immigrants ($n = 588$) and Canadian-born ($n = 614$). Of these women, 1539 completed the 16-week assessment for an 82.1% participation rate. Thirty-four women were excluded from the study due to not initiating breastfeeding, 319 were excluded because they were no longer breastfeeding at 16 weeks and two had missing data on breastfeeding status at 16 weeks, resulting in a final sample of 1184 women included in the analysis (810 in the migrant group and 374 in the Canadian-born group).

Overall, the majority (72%) of women in the sample were between 20 and 34 years ($n = 846$). Thirty per cent ($n = 354$) of women had 12 years of edu-

cation or less and 48% ($n = 510$) had an annual household income less than \$30 000 CDN. Eighty-four per cent ($n = 995$) indicated that they were living with the infant's father. Fifty per cent ($n = 597$) of the women were primiparous, 65% ($n = 774$) delivered vaginally and 66% ($n = 731$) planned to exclusively breastfeed for 6 months or more. Among women in the migrant group, 16% ($n = 127$) were refugees, 36% ($n = 288$) were asylum-seekers and 49% ($n = 395$) were non-refugee immigrants. Thirty-six per cent ($n = 293$) emigrated from Asia/Oceania, 34% ($n = 275$) emigrated from Latin America and 21% ($n = 169$) emigrated from Africa. Forty-eight per cent ($n = 389$) of migrant women had been in Canada for less than 2 years.

In total, 676 women (57.1%) were breastfeeding exclusively at 16 weeks, 411 (50.7%) were migrant women and 265 (70.9%) were Canadian-born women. In the migrant group, 44 (35%) refugee, 151 (52%) asylum-seeking and 216 (55%) non-refugee immigrant women were breastfeeding exclusively at 16 weeks. Women in the migrant subgroups were significantly less likely to be breastfeeding exclusively at 16 weeks post-partum in comparison to those in the Canadian-born group: refugee (OR = 0.22, 95% CI = 0.14–0.34), asylum-seeker (OR = 0.45, 95% CI = 0.33–0.63) and non-refugee immigrant (OR = 0.50, 95% CI = 0.37–0.67) (data not shown).

Variables associated with breastfeeding exclusivity

Bivariate analysis (Table 1) revealed significant differences in factors related to breastfeeding exclusivity at 16 weeks post-partum among migrant and Canadian-born women. Among demographic factors, annual household income was the only factor associated with breastfeeding exclusivity for both migrant women and Canadian-born women (migrant: $P = 0.029$; Canadian-born: $P = 0.003$). Among migrant women, a number of other demographic variables were significantly associated with breastfeeding exclusivity at 16 weeks and included migration group ($P < 0.001$), UN World Region from which emigrated ($P < 0.001$) and Canadian city of residence ($P < 0.001$). GDI score of the country of origin

($P < 0.001$) and country most comfortable living in ($P = 0.018$) was significantly associated with breastfeeding exclusivity among migration history variables. Among social variables, only breastfeeding support from mother ($P = 0.017$) was significantly associated with breastfeeding exclusivity. Conversely, residing with infant's father ($P < 0.001$) and the provision of breastfeeding support from husband ($P < 0.001$) were significantly associated with breastfeeding exclusivity among Canadian-born women. Unlike the migrant group, where no obstetric variables were associated with breastfeeding exclusivity, Canadian-born women were significantly less likely to be breastfeeding exclusively if their infant was admitted to the NICU ($P = 0.014$). Despite these group variations, breastfeeding exclusivity was significantly associated with several breastfeeding characteristics for women in both groups: maternal infant feeding plan (migrant: $P < 0.001$; Canadian-born: $P = 0.012$), planned duration of exclusive breastfeeding (migrant: $P < 0.001$; Canadian-born: $P = 0.001$) and exclusive breastfeeding status at 1 week post-partum (migrant: $P < 0.001$; Canadian-born: $P < 0.001$). The only difference was that timing of decision to breastfeed ($P = 0.001$) was significantly associated with breastfeeding exclusivity among migrant women. Another difference was that EPDS score was significantly associated with breastfeeding exclusivity among Canadian-born women ($P = 0.023$).

Variables predictive of breastfeeding exclusivity

Migrant women

Logistic regression was performed to determine the prediction of membership in each of the two categories: exclusively breastfeeding vs. not exclusively breastfeeding at 16 weeks post-partum. $OR > 1$ indicates greater likelihood of breastfeeding exclusivity, while $OR < 1$ indicates lower likelihood of breastfeeding exclusivity at 16 weeks post-partum. Among migrant women, non-refugee immigrant status ($OR = 1.75$, 95% $CI = 1.06-2.87$), asylum-seeker status ($OR = 1.98$, 95% $CI = 1.19-3.31$), residence in Toronto ($OR = 1.99$, 95% $CI = 1.36-2.92$) and residence in Vancouver ($OR = 1.54$, 95% $CI = 0.96-2.48$)

were significant predictors of breastfeeding exclusivity and remained in the final model among demographic factors (Table 2). Maternal age also remained in the final model showing a higher likelihood of breastfeeding exclusivity for ≥ 35 years ($OR = 1.58$, 95% $CI = 1.05-2.38$) and a lower likelihood of breastfeeding exclusivity for < 20 years ($OR = 0.90$, 95% $CI = 0.26-3.14$). Breastfeeding support from mother was significant in the bivariate model but did not remain predictive with the inclusion of other covariates. Among migration history variables, feeling most comfortable in the country of origin or nowhere ($OR = 1.58$, 95% $CI = 1.07-2.32$) and a higher GDI score of the country of origin ($OR = 1.80$, 95% $CI = 1.19-2.70$ for 'high' and $OR = 1.69$, 95% $CI = 1.12-2.55$ for 'middle' compared with 'low') were predictive of breastfeeding exclusivity. Among breastfeeding variables, not planning to breastfeed exclusively ($OR = 0.43$, 95% $CI = 0.29-0.63$), not making the decision to breastfeed before pregnancy ($OR = 0.63$, 95% $CI = 0.43-0.92$) and not exclusively breastfeeding at 1 week post-partum ($OR = 0.26$, 95% $CI = 0.18-0.38$) were predictive of a lower likelihood of breastfeeding exclusivity. Planned duration of exclusive breastfeeding did not remain significant in the model with the addition of other covariates. A test of the full model with all 12 predictors against a constant-only model was statistically reliable [χ^2 (12, $n = 726$) = 140.92, $P < 0.001$], indicating that the predictors as a set, reliably distinguished between migrant women who were exclusively breastfeeding with those who were not exclusively breastfeeding.

Canadian-born women

Among Canadian-born women, annual household income did not remain predictive of breastfeeding exclusivity in the final model among demographic factors. Not residing with the father of the infant was predictive of not exclusively breastfeeding among social variables ($OR = 0.27$, 95% $CI = 0.12-0.63$), while breastfeeding support from husband did not remain significant in the model with the addition of other covariates. Among obstetric variables, newborn admission to the NICU was predictive of a lower likelihood of breastfeeding exclusivity ($OR = 0.14$,

Table 2. Predictors of breastfeeding exclusivity at 16-weeks post-partum among migrant and Canadian-born women*

Risk factor	Migrant women (<i>n</i> = 726)		Canadian-born women (<i>n</i> = 348)	
	Odds ratio	95% CI	Odds ratio	95% CI
Demographic characteristics				
Migrant group				
Refugee (reference)	1.0		–	–
Asylum-seeker	1.98	1.19–3.31	–	–
Non-refugee immigrant	1.75	1.06–2.87	–	–
City of residence				
Montreal (reference)	1.0		–	–
Toronto	1.99	1.36–2.92	–	–
Vancouver	1.54	0.96–2.48	–	–
Maternal age				
20–34 years (reference)	1.0		–	–
<20 years	0.90	0.26–3.14	–	–
≥35 years	1.58	1.05–2.38	–	–
Migration history				
Feels most comfortable in country of origin or nowhere	1.58	1.07–2.32	–	–
Gender-related Development Index				
Low (reference)	1.0		–	–
Middle	1.69	1.12–2.55	–	–
High	1.80	1.19–2.70	–	–
Social characteristics				
Was not living with father of infant	–	–	0.27	0.12–0.63
Obstetrical history				
Infant was admitted to NICU	–	–	0.14	0.02–0.80
Breastfeeding characteristics				
Did not plan to breastfeed only	0.43	0.29–0.63	–	–
Decision to breastfeed was not made before pregnancy	0.63	0.43–0.92	–	–
Planned duration of exclusive breastfeeding				
No exclusive breastfeeding	–	–	0.28	0.12–0.68
<6 months	–	–	0.51	0.26–1.00
≥6 months (reference)	–	–	1.0	
Was not exclusively breastfeeding at 1 week	0.26	0.18–0.38	0.26	0.13–0.50
Maternal mood				
EPDS ≥ 10	–	–	0.43	0.22–0.86

CI, confidence interval; EPDS, Edinburgh Postnatal Depression Scale; NICU, neonatal intensive care unit. *Adjusted for other covariates in the model.

95% CI = 0.02–0.80). Among breastfeeding variables, planned duration of exclusive breastfeeding (OR = 0.51, 95% CI = 0.26–1.00 for '<6 months' and OR = 0.28, 95% CI = 0.12–0.68 for 'no exclusive breastfeeding' compared with '≥6 months') and not exclusively breastfeeding at 1 week post-partum (OR = 0.26, 95% CI = 0.13–0.50) were predictive of a lower likelihood of breastfeeding exclusivity. Maternal infant feeding intentions did not remain significant in the model with the addition of other covariates. Maternal mood was also predictive of a lower likelihood of breastfeeding exclusivity at 16

weeks (OR = 0.43, 95% CI = 0.22–0.86). A test of the full model with all six predictors against a constant-only model was statistically reliable [χ^2 (6, *n* = 348) = 50.59, *P* < 0.001], indicating that the predictors as a set, reliably distinguished between Canadian-born women who were exclusively breastfeeding with those who were not exclusively breastfeeding.

In secondary analysis, we combined data for migrant and Canadian-born women to test for interactions between migration group (migrant vs. Canadian-born) and risk factors presented in Table 2, which were measured in both groups. We found that

the interaction between 'not living with father of infant' was statistically significant (not living with the father of the infant was associated with a greater likelihood of not exclusively breastfeeding among the migrant group only, $P = 0.002$). All other interactions were not statistically significant.

Discussion

This is one of the first and largest studies to specifically examine and compare predictors of breastfeeding exclusivity among ethnically diverse migrant and Canadian-born women who breastfed through the first 16 weeks post-partum. Women in the migrant subgroups were significantly less likely to be breastfeeding exclusively at 16 weeks post-partum in comparison to women in the Canadian-born group. Among migrant women, refugee women had the lowest exclusive breastfeeding rates, which were approximately 20% lower than asylum-seekers and non-refugee immigrant women. Those who emigrated from the UN World Region of Africa had the lowest breastfeeding exclusivity rates, which were approximately 7% lower than those who emigrated from Asia/Oceania and Latin America. Multivariate analyses suggest that exclusive breastfeeding status at 1 week post-partum was the only similar protective factor for later exclusive breastfeeding among women in both groups. Among migrant women, factors predictive of breastfeeding exclusivity included asylum-seeker status, non-refugee immigrant status, residence in Toronto, residence in Vancouver, maternal age of ≥ 35 years, feeling most comfortable in the country of origin or nowhere and a higher GDI score of the country of origin. Factors predictive of not exclusively breastfeeding included maternal age of < 20 years, not planning to breastfeed exclusively, not making the decision to breastfeed before pregnancy and not exclusively breastfeeding at 1 week post-partum. Among Canadian-born women, factors predictive of not exclusively breastfeeding included not living with the father of the infant, infant NICU admission, planned duration of exclusive breastfeeding for < 6 months, not exclusively breastfeeding at 1 week post-partum and lower maternal mood.

Previous studies on breastfeeding have demonstrated that different demographic factors influence the initiation and duration of breastfeeding (Dennis 2002; Thuiler & Mercer 2009; Meedya *et al.* 2010). Among these variables, maternal age has consistently been associated with breastfeeding initiation, duration and exclusivity (Scott & Binns 1999; Dennis 2002; Ludvigsson & Ludvigsson 2005; Thuiler & Mercer 2009). For example, in a study of 500 Malaysian women, Chye *et al.* (1997) found that mothers older than 27 years were 1.48 times more likely to be exclusively breastfeeding at 6 weeks post-partum than were younger mothers. Similar to previous studies (Lande *et al.* 2003; Ludvigsson & Ludvigsson 2005), maternal age was a significant predictor of breastfeeding exclusivity among migrant women. However, maternal age was not predictive of breastfeeding exclusivity among Canadian-born women. In a review, Scott & Binns (1999) found that the association between breastfeeding and maternal age in general is strong and consistent, although not all studies find an association. In our study, the significance of maternal age may reflect the likelihood that older women have had more experience breastfeeding previous children or that they have higher levels of education, another demographic variable known to influence breastfeeding outcomes (Michaelsen *et al.* 1994; Scott & Binns 1999; Susin *et al.* 1999; Yngve & Sjostrom 2001; Lanting *et al.* 2005; Ludvigsson & Ludvigsson 2005; Thuiler & Mercer 2009). In our study, we did not observe a significant association between breastfeeding exclusivity and education. However, in bivariate analysis, annual household income was significantly associated with breastfeeding exclusivity at 16 weeks for both groups but did not remain significant in multivariate analysis with the inclusion of other variables.

Research has consistently demonstrated the importance of social support in the continuation of breastfeeding. Arora *et al.* (2000) surveyed 123 women in the United States and found that formula-feeding mothers reported that they may have breastfed with more support from family members such as their partner and mother. A few studies have evaluated the effect of partner support on breastfeeding outcomes (Scott *et al.* 2001; Rempel & Rempel 2004; Swanson &

Power 2005). In all of these studies, women who received support from their partners had better breastfeeding outcomes, including longer breastfeeding duration (Scott *et al.* 2001; Swanson & Power 2005) and increased exclusivity (Rempel & Rempel 2004). A Cochrane systematic review evaluating breastfeeding support interventions found the provision of peer support significantly decreased the risk to prematurely discontinue breastfeeding [relative risk (RR) = 0.86, 95% CI = 0.76–0.98] and to not exclusively breastfeed (RR = 0.72, 95% CI = 0.57–0.90) (Britton *et al.* 2007). In contrast to previous studies, the provision of social support from partner, mother or peers was not a significant predictor of breastfeeding exclusivity in multivariate analysis. However, Lande *et al.* (2003) found that marital status/cohabitation was a significant predictor of exclusive breastfeeding at 4 months post-partum. This finding is consistent with our study where Canadian-born women who were not living with the father of the infant were at higher risk to discontinue exclusive breastfeeding by 16 weeks. Other studies have shown that married women breastfeed for longer periods of time (Evers *et al.* 1998; Kuan *et al.* 1999; Li *et al.* 2002). In a review that compared the differences in the incidence and duration of breastfeeding across several countries (Callen & Pinelli 2004), married women consistently had better breastfeeding outcomes. The positive effects of being married or living with the father of the infant is likely the result of having a partner available for encouragement, although it is unclear why this would not be a significant predictor of breastfeeding exclusivity among migrant women.

A negative association between acculturation and breastfeeding initiation and duration among immigrant women has been reported in a range of studies (Gibson-Davis & Brooks-Gunn 2006; Harley *et al.* 2007; Sussner *et al.* 2008). For example, a US study found that each additional year of residence in the United States decreased the odds of breastfeeding at 6 months post-partum by 4% among Mexican and Hispanic immigrant women (Gibson-Davis & Brooks-Gunn 2006). In another US longitudinal study of 679 predominantly Latina women, immigrant mothers who exclusively used their native language had close to three times the odds of breastfeeding for

6 months or longer in comparison to immigrant mothers with non-exclusive use (mixed or English only). Furthermore, women with foreign-born parents had two times the odds of breastfeeding for 6 months or longer compared with those who had parents born in the United States (Sussner *et al.* 2008). This research may help explain our finding that migrant women who felt most comfortable in their country of origin or nowhere were significantly more likely to be exclusively breastfeeding at 16 weeks post-partum as compared with women who felt most comfortable in Canada. This finding suggests that less acculturation may have had a positive effect on exclusive breastfeeding among migrant women. However, we also found that a higher GDI score of the country of origin was a significant predictor of breastfeeding exclusivity at 16 weeks. This may be a reflection of the effects of acculturation or it may be explained by the fact that high GDI is often associated with higher socio-economic status for women. In this case, women from these countries may have the resources to access breastfeeding information positing the benefits of exclusive breastfeeding as well as policies and programmes designed to support mothers who choose to breastfeed. Clearly, the association between breastfeeding and GDI should be explored in future studies.

Maternal infant feeding attitudes have reliably been shown to influence breastfeeding outcomes (Scott *et al.* 2004, 2006; Shaker *et al.* 2004). For example, in a recent cohort study of 587 women in Australia, a longer duration of exclusive breastfeeding was significantly associated with positive maternal attitudes towards breastfeeding (Scott *et al.* 2006). This research is consistent with our findings where deciding to breastfeed before pregnancy and planning to breastfeed exclusively were positively associated with breastfeeding exclusivity at 16 weeks among migrant women. These variables are proxy measures for maternal infant feeding attitudes. Previous research has also shown maternal infant feeding attitudes to be a stronger predictor of breastfeeding behaviours than socio-demographic variables (Scott *et al.* 2004, 2006).

Early supplementation with infant formula has been associated previously with poorer breastfeeding outcomes (Blomquist *et al.* 1994; Michaelsen *et al.*

1994). These findings help explain why we found exclusive breastfeeding status in the early post-partum period to be significantly predictive of breastfeeding exclusivity at 16 weeks. It is noteworthy that a recent Australian study that included 587 women found a strong association between an infant's first feeding and admission to the Special Care Unit (Scott *et al.* 2006). In this study, 47.6% of the infants who were admitted to the Special Care Unit had received formula or glucose as their first feeding compared with only 11.9% of infants not admitted to the unit. This may help explain why among Canadian-born women we found a negative association between infant NICU admission and breastfeeding exclusivity. For women whose infants are in an NICU, lack of knowledge about the importance of breast milk, emotional distress, physical separation from their infants and the stress of the NICU environment can create multiple breastfeeding problems (Gonzalez *et al.* 2008).

The relationship between parity and breastfeeding is inconsistent (Scott & Binns 1999; Thuiler & Mercer 2009). Some studies have reported a longer duration of breastfeeding with increased parity (Simard *et al.* 2005), while others have not (Adams *et al.* 2001). In our study, we did not observe a significant association between exclusive breastfeeding and parity in either group. Conversely, the relationship between maternal mood and breastfeeding is becoming clearer (Henderson *et al.* 2003; Dennis & McQueen 2009). Several studies have demonstrated a negative association between early post-partum depressive symptomatology and breastfeeding exclusivity (Clifford *et al.* 2006; Thorne *et al.* 2006; McCarter-Spaulling & Horowitz 2007). In a study of 734 Icelandic mothers who completed self-administered questionnaires at 8–12 weeks post-partum, exclusively breastfeeding mothers had lower mean EPDS scores in comparison to those who were not exclusively breastfeeding (Thorne *et al.* 2006). In a Canadian study, 856 mothers were mailed questionnaires 1 and 24 weeks post-partum and results found depressive symptomatology at 1 week was negatively associated with exclusive breastfeeding at 1 week; a similar finding was found at 24 weeks (Clifford *et al.* 2006). An additional study evaluated 122 US women with an EPDS score of >9 at

2–4 weeks post-partum (McCarter-Spaulling & Horowitz 2007) and found higher levels of depressive symptomatology reduce the likelihood of exclusive breastfeeding. This research is consistent with our study where a higher EPDS score had a negative effect on breastfeeding exclusivity at 16 weeks post-partum among Canadian-born women. Depressive symptoms in the early post-partum period may negatively influence breastfeeding outcomes because of feelings of inadequacy and difficulty interpreting hunger and distress cues from the infant (Henderson *et al.* 2003). Breastfeeding difficulties that occur at this stage may also appear insurmountable to breastfeeding women who are depressed (Dennis & McQueen 2009).

Overall, this study has several strengths. Research assistants visited birthing centres daily to ensure potential study subjects were not missed for recruitment. Women were contacted up to three times by the project nurse to ensure they were not lost to follow-up at 16 weeks. Rigorous validation procedures were used for the questionnaires employed, thus maximising equivalency across all language groups. However, analytical bias could have resulted from distortion in our sample due to participant loss from consent to 16 weeks post-partum. Loss was similar between asylum-seeking, immigrant and Canadian-born women (17.8%, 14.2% and 15%, respectively) but loss was twice as high in refugee women (31.1%). However, even with the smaller group size, our results showed a statistically significant difference between them and Canadian-born women at 16 weeks in a separate analysis of the full sample in terms of breastfeeding exclusivity. Mothers in the migrant subgroups were significantly less likely to be exclusively breastfeeding at 16 weeks post-partum in comparison to mothers in the Canadian-born group. Although our results are based on migrants living within three large Canadian cities, we believe them to be generalisable to a much wider audience due to the size of the study and the recruitment method. Furthermore, the migrant population originates from a vast source of countries and these same countries are commonly sources for migrants to other receiving countries (UNHCR 2009). Our results are generalisable to other populations with breast-

feeding characteristics similar to our sample of migrant and host-country women. For example, this study is conducted on a very specific population (i.e. women who not only initiate breastfeeding but also are able or willing to breastfeed until at least 16 weeks post-partum). This population is different from those who did not initiate or discontinued breastfeeding during the first few weeks post-partum. While we were not able to analyse predictors of breastfeeding exclusivity among refugee, asylum-seeking and non-refugee immigrant women separately in comparison to Canadian-born women, analysis of migrant subgroups is important. In the larger study, all three migrant groups had greater rates of health concerns post-natally and greater rates of these concerns being unaddressed by the health care system (Gagnon *et al.* 2006). It is plausible that there are differences in health needs and behaviours as well as predictors in breastfeeding exclusivity among migrant women in different immigration classes. A final limitation of this study is that although the definition of exclusive breastfeeding specifies that no other liquids or solids except breast milk are given to the infant (WHO 1991), this study includes water feeding in the definition of exclusive breastfeeding.

Our findings have important implications and can assist health professionals to identify women who may be at risk to prematurely discontinue exclusive breastfeeding before the recommended minimum age of 6 months. The finding that migrant women had lower breastfeeding exclusivity rates has important implications and supports the need for additional support for immigrant women to minimise supplementation. While some studies have found that immigrant women are more likely to initiate breastfeeding and to breastfeed for longer durations than native-born women (Bonuck *et al.* 2005; Millar & Maclean 2005; Gibson-Davis & Brooks-Gunn 2006; Singh *et al.* 2007; Lee *et al.* 2009; Zuppa *et al.* 2010; Chen *et al.* 2011), other studies have found lower rates of breastfeeding among immigrant women (Meftuh *et al.* 1991; Tuttle & Dewey 1994; Thomas & DeSantis 1995; Roville-Sausse 2005; Groleau *et al.* 2006; Harley *et al.* 2007; Sussner *et al.* 2008). The results of these studies are inconsistent, which may be attributable to differences in the underlying study

populations and/or analytical methods. It is also plausible that these inconsistent findings are explained by the limited use of standardised definitions for breastfeeding initiation, duration, and exclusivity and diverse interpretations of what constitutes breastfeeding outcomes (Dennis 2002). Although we found not exclusively breastfeeding at 1 week post-partum to be a significant predictor of later breastfeeding exclusivity for both migrant and Canadian-born women, most risk factors were dissimilar, suggesting that these groups of women might benefit from different strategies to optimise breastfeeding outcomes. Our finding that depressive symptomatology negatively influenced breastfeeding exclusivity among Canadian-born women has important clinical implications and supports the need for early identification and treatment of breastfeeding women who are depressed. However, strategies to address help-seeking barriers such as women's inability to recognise the symptoms of depression or to disclose their feelings, often reinforced by family members and health professionals' reluctance to respond to the mother's emotional and practical needs, are needed if women are to receive appropriate and timely treatment and to improve breastfeeding outcomes in the early post-partum period (Dennis & Chung-Lee 2006).

In conclusion, this study examined and compared predictors of breastfeeding exclusivity among ethnically diverse migrant and Canadian-born women using both bivariate and multivariate analyses.

Our results suggest that not exclusively breastfeeding at 1 week post-partum was the only similar risk factor for not exclusively breastfeeding at 16 weeks among both migrant and Canadian-born women.

Among migrant women, factors predictive of breastfeeding exclusivity included non-refugee immigrant or asylum-seeking status, residence in Toronto or Vancouver, maternal age of ≥ 35 years, feels most comfortable in the country of origin or nowhere and higher GDI of the country of origin. Factors predictive of not exclusively breastfeeding included maternal age of < 20 years, not planning to breastfeed exclusively, not making the decision to breastfeed before pregnancy and not exclusively breastfeeding at 1 week post-partum. Among

Canadian-born women, factors predictive of a lower likelihood of breastfeeding exclusivity included not living with father of infant, infant NICU admission, planned duration of exclusive breastfeeding for <6 months, not exclusively breastfeeding at 1 week post-partum and EPDS score of ≥ 10 . Knowledge of these risk factors among migrant and Canadian-born women can help health professionals identify women at risk of prematurely discontinuing exclusive breastfeeding and implement targeted strategies to optimise breastfeeding outcomes. The risk factors are likely to be quite different in the two populations and this is worthy of further study. The role of immigration status and acculturation-related variables on breastfeeding exclusivity deserves exploration in future studies. Future research is also warranted to determine which specific cultural strategies can be implemented to effectively increase exclusive breastfeeding duration among migrant women. Additional research to determine effective interventions to support depressed breastfeeding women is also required.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

AG, GD and C-LD designed the study and wrote the protocol. C-LD managed the breastfeeding litera-

ture searches and analyses. AVH undertook the statistical analysis and C-LD wrote the first draft of the manuscript. All authors approved the final manuscript.

References

- Adams C., Beger R., Conning P., Cruikshank L. & Dore K. (2001) Breastfeeding trends at a community breastfeeding center: an evaluative survey. *Journal of Obstetric, Gynecologic, and Neonatal Nursing* **30**, 392–400.
- American Academy of Pediatrics (2005) Breastfeeding and the use of human milk. *Pediatrics* **115**, 496–506.
- Arora S., McJunkin C., Wehrer J. & Kuhn P. (2000) Major factors influencing breastfeeding rates: mother's perception of father's attitude and milk supply. *Pediatrics* **106**, e67–e71.
- Blomquist H.K., Jonsbo F., Serenius F. & Persson L.A. (1994) Supplementary feeding in the maternity ward shortens the duration of breast feeding. *Acta Paediatrica Scandinavica* **83**, 1122–1126.
- Bonuck K.A., Freeman K. & Trombley M. (2005) Country of origin and race/ethnicity: impact on breastfeeding intentions. *Journal of Human Lactation* **21**, 320–326.
- Britton C., McCormick F.M., Renfrew M.J., Wade A. & King S.E. (2007) Support for breastfeeding mothers. *Cochrane Database of Systematic Reviews* (1), CD001141.
- Byrd T.L., Balcazar H. & Hummer R.A. (2001) Acculturation and breastfeeding intention and practice in Hispanic women on the US-Mexico border. *Ethnicity and Disease* **11**, 72–79.
- Callen J. & Pinelli J. (2004) Incidence and duration of breastfeeding for term infants in Canada, United States, Europe, and Australia: a literature review. *Birth (Berkeley, Calif.)* **31**, 285–292.
- Canadian Paediatric Society (2009) Exclusive breastfeeding should continue to six months. *Paediatric Child Health* **10**, 148–149.
- Celi A.C., Rich-Edwards J.W., Richardson M.K., Kleinman K.P. & Gillman M.W. (2005) Immigration, race/ethnicity, and social and economic factors as predictors of breastfeeding initiation. *Archives of Pediatrics and Adolescent Medicine* **159**, 225–260.
- Centers for Disease Control (2010) *Breastfeeding among U.S. Children Born 1999–2007, CDC National Immunization Survey*. CDC: Atlanta.
- Centers for Disease Control (2011) *Breastfeeding among U.S. Children Born 2000–2008, CDC National Immunization Survey*. CDC: Atlanta GA.
- Chalmers B., Levitt C., Heaman M., O'Brien B., Sauve R. & Kaczorowski J. (2009) Breastfeeding rates and hospi-

- tal practices in Canada: a national survey of women. *Birth (Berkeley, Calif.)* **36**, 122–132.
- Chen A. & Rogan W.J. (2004) Breastfeeding and the risk of postneonatal death in the United States. *Pediatrics* **113**, e435–e439.
- Chen T.L., Tai C.J., Chu Y.R., Han K.C., Lin K.C. & Chien L.Y. (2011) Cultural factors and social support related to breastfeeding among immigrant mothers in Taipei City, Taiwan. *Journal of Human Lactation* **27**, 41–48.
- Chye J., Zain Z., Lim W. & Lim C. (1997) Breastfeeding at 6 weeks and predictive factors. *Journal of Tropical Pediatrics* **43**, 287–292.
- Citizenship and Immigration Canada (2007) *Facts and Figures 2006: Immigration Overview – Permanent and Temporary Residents*. Minister of Public Works and Government Services Canada: Ottawa.
- Clifford T.J., Campbell M.K., Speechley K.N. & Gorodzinsky F. (2006) Factors influencing full breastfeeding in a southwestern Ontario community: assessments at 1 week and at 6 months postpartum. *Journal of Human Lactation* **22**, 292–304.
- Cooke M., Sheehan A. & Schmied V. (2003) A description of the relationship between breastfeeding experiences, breastfeeding satisfaction, and weaning in the first 3 months after birth. *Journal of Human Lactation* **19**, 145–156.
- Cox J.L., Holden J.M. & Sagovsky R. (1987) Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. *The British Journal of Psychiatry* **150**, 782–786.
- Dennis C.-L. (2002) Breastfeeding initiation and duration: a 1990–2000 literature review. *Journal of Obstetric, Gynecologic, and Neonatal Nursing* **31**, 12–32.
- Dennis C.-L. & Chung-Lee L. (2006) Postpartum depression help-seeking barriers and maternal treatment preferences: a qualitative systematic review. *Birth (Berkeley, Calif.)* **33**, 323–331.
- Dennis C.-L. & McQueen K. (2009) The relationship between infant-feeding outcomes and postpartum depression: a qualitative systematic review. *Pediatrics* **123**, e736–e751.
- Ertem I.O., Votto N. & Leventhal J. (2001) The timing and predictors of the early termination of breastfeeding. *Pediatrics* **107**, 543–548.
- Evers S., Doran L. & Schellenberg K. (1998) Influences on breastfeeding rates in low-income communities in Ontario. *Canadian Journal of Public Health* **89**, 203–207.
- Gagnon A.J., Wahoush O., Dougherty G., Saucier J.-F., Dennis C.-L., Merry L. *et al.* (2006) The childbearing health and related service needs of newcomers (CHARSNN) study protocol. *BMC Pregnancy and Childbirth* **6**, 31.
- Gibson-Davis C.M. & Brooks-Gunn J. (2006) Couples' immigration status and ethnicity as determinants of breastfeeding. *American Journal of Public Health* **96**, 641–646.
- Gonzalez K.A., Meinzen-Derr J., Burke B.L., Hibler A.J., Kavinsky B. & Hess S. (2008) Evaluation of a lactation support service in a children's hospital neonatal intensive care unit. *Journal of Human Lactation* **19**, 286–292.
- Groleau D., Souliere M. & Kirmayer L.J. (2006) Breastfeeding and the cultural configuration of social space among Vietnamese immigrant women. *Health and Place* **12**, 516–526.
- Grummer-Strawn L.M. & Mei Z. (2004) Does breastfeeding protect against pediatric overweight? Analysis of longitudinal data from the Centers for Disease Control and Prevention Pediatric Nutrition Surveillance System. *Pediatrics* **113**, e81–e86.
- Hall R.T., Mercer A., Teasley S.L., McPherson D.M., Simon S.D., Santos S.R. *et al.* (2002) A breastfeeding assessment score to evaluate the risk for cessation of breast-feeding by 7–10 days of age. *The Journal of Pediatrics* **141**, 659–664.
- Harley K., Stamm N.L. & Eskenazi B. (2007) The effect of time in the U.S. on the duration of breastfeeding in women of Mexican descent. *Maternal and Child Health Journal* **11**, 119–125.
- Henderson J.J., Evans S.F., Straton J.A., Priest S.R. & Hagan R. (2003) Impact of postnatal depression on breastfeeding duration. *Birth (Berkeley, Calif.)* **30**, 175–180.
- Horta B.L., Bahl R., Martines J.C. & Victoria C.G. (2007) *Evidence on the Long-Term Effects of Breastfeeding: Systematic Reviews and Meta-Analyses*. World Health Organization: Geneva.
- Ip S., Chung M., Raman G., Chew P., Magula N., DeVine N. *et al.* (2007) Breastfeeding and maternal and infant health outcomes in developed countries. *Evidence Report/Technology Assessment (Full Report)* **153**, 1–186.
- Kehler H., Chaput K. & Tough S. (2009) Risk factors for cessation of breastfeeding prior to six months among a community sample of women in Calgary, Alberta. *Canadian Journal of Public Health* **100**, 376–380.
- Kramer M.S. & Kakuma R. (2002) Optimal duration of exclusive breastfeeding. *Cochrane Database of Systematic Reviews* (1), CD003517.
- Kramer M.S., Guo T., Platt R.W., Sevkovskaya Z., Dziko-vich I., Collett J.-P. *et al.* (2003) Infant growth and health outcomes associated with 3 compared with 6 mo of exclusive breastfeeding. *The American Journal of Clinical Nutrition* **78**, 291–295.
- Kristiansen A.L., Lande B., Overby N.C. & Andersen L.F. (2010) Factors associated with exclusive breast-feeding and breast-feeding in Norway. *Public Health Nutrition* **13**, 2087–2096.

- Kuan L.W., Britto M., Decolongon J., Schoettker P.J., Atherton H.D. & Kotagal U.R. (1999) Health system factors contributing to breastfeeding success. *Pediatrics* **104**, e28.
- Labbok M.H. (2001) Effects of breastfeeding on the mother. *Pediatric Clinics of North America* **48**, 143–158.
- Lande B., Anderson L.F., Baerug A., Trygg K.U., Lund-Larsen K., Veierod M.B. *et al.* (2003) Infant feeding practices and associated factors in the first six months of life: the Norwegian infant nutrition survey. *Acta Paediatrica* **92**, 152–161.
- Lanting C.I., van Wouwe J.P. & Reijneveld S.A. (2005) Infant milk feeding practices in the Netherlands and associated factors. *Acta Paediatrica* **84**, 935–942.
- Larsen L.J. (2003) *The foreign-born population in the United States: 2003. Population characteristics. Current population reports. P20-551*. US Census Bureau: Washington.
- Lawrence R.A. (2000) Breastfeeding: benefits, risks and alternatives. *Current Opinion in Obstetrics and Gynecology* **12**, 519–524.
- Lee H.J., Elo I.T., McCollum K.F. & Culhane J.F. (2009) Racial/ethnic differences in breastfeeding initiation and duration among low-income inner-city mothers. *Social Science Quarterly* **90**, 1251–1271.
- Li R., Odgen C., Ballew C., Gillespie C. & Grummer-Strawn L.M. (2002) Prevalence of exclusive breastfeeding among U.S. infants: the third national health and nutrition examination survey (Phase II, 1991–1994). *American Journal of Public Health* **92**, 1107–1110.
- Ludvigsson J.F. & Ludvigsson J. (2005) Socio-economic determinants, maternal smoking and coffee consumption and exclusive breastfeeding in 10 205 children. *Acta Paediatrica* **94**, 1310–1319.
- Mather M. (2009) *Reports on America: Children in Immigrant Families Chart New Path*. Population Reference Bureau: Washington.
- Matthews K., Webber K., McKim E., Banoub-Baddour S. & Laryea M. (1998) Maternal infant-feeding decisions: reasons and influences. *The Canadian Journal of Nursing Research* **30**, 117–198.
- McCarter-Spaulding D. & Horowitz J.A. (2007) How does postpartum depression affect breastfeeding. *MCN. The American Journal of Maternal Child Nursing* **32**, 10–17.
- Meedya S., Fahy K. & Kable A. (2010) Factors that positively influence breastfeeding duration to 6 months: a literature review. *Women and Birth* **23**, 135–145.
- Meftuh A.B., Tapsoba L.P. & Lamounier J.A. (1991) Breastfeeding practices in Ethiopian women in Southern California. *Indian Journal of Pediatrics* **58**, 349–356.
- Michaelsen K.F., Larsen P.S., Thomsen B.L. & Samuelson G. (1994) The Copenhagen cohort study on infant nutrition and growth: duration of breastfeeding and influencing factors. *Acta Paediatrica* **83**, 565–571.
- Millar W.J. & Maclean H. (2005) Breastfeeding practices. *Health Reports* **16**, 23–31.
- OECD (2011) *Breastfeeding Rates. OECD Family Database COI.5*. Social Policy Division, Directorate of Employment, Labour and Social Affairs, OECD: Paris.
- Public Health Agency of Canada (2009) *What Mothers Say: The Canadian Maternity Experiences Survey*. PHAC: Ottawa.
- Raisler J., Alexander C. & O'Campo P. (1999) Breastfeeding and infant illness: a dose-response relationship? *American Journal of Public Health* **89**, 25–30.
- Rempel L. & Rempel L. (2004) Partner influence on health behaviour decision-making: increasing breastfeeding duration. *Journal of Social and Personal Relationships* **21**, 92–111.
- Roville-Sausse F.N. (2005) Westernization of the nutritional pattern of Chinese children living in France. *Public Health* **119**, 726–733.
- Ruppenthal L., Tuck J. & Gagnon A. (2005) Enhancing nursing research with migrant women through focus groups. *Western Journal of Nursing Research* **27**, 735–754.
- Scott J.A. & Binns C.W. (1999) Factors associated with the initiation and duration of breastfeeding: a review of the literature. *Breastfeeding Review* **7**, 5–16.
- Scott J.A., Landers M., Hughes R. & Binns C.W. (2001) Factors associated with breastfeeding at discharge and duration of breastfeeding. *Journal of Paediatrics and Child Health* **37**, 254–261.
- Scott J.A., Shaker I. & Reid M. (2004) Parental attitudes toward breastfeeding: their association with feeding outcome at hospital discharge. *Birth (Berkeley, Calif)* **31**, 125–131.
- Scott J.A., Binns C.W., Oddy W.H. & Graham K.I. (2006) Predictors of breastfeeding duration: evidence from a cohort study. *Pediatrics* **117**, e646–e655.
- Shaker I., Scott J.A. & Reid M. (2004) Infant feeding attitudes of expectant parents: breastfeeding and formula feeding. *Journal of Advanced Nursing* **45**, 260–268.
- Sheehan D., Krueger P., Watt S., Sword W. & Bridle B. (2001) The Ontario Mother and Infant Survey: breastfeeding outcomes. *Journal of Human Lactation* **17**, 211–219.
- Sheehan D., Watt S., Krueger P. & Sword W. (2006) The impact of a new universal postpartum program on breastfeeding outcomes. *Journal of Human Lactation* **22**, 398–408.
- Simard I., O'Brien H.T., Beaudoin A., Turcotte D., Damant D., Ferland S. *et al.* (2005) Factors influencing the initiation and duration of breastfeeding among low-income women followed by the Canada prenatal nutrition program in 4 regions of Quebec. *Journal of Human Lactation* **21**, 327–337.

- Singh G.K., Kogan M.D. & Dee D.L. (2007) Nativity/immigrant status, race/ethnicity, and socioeconomic determinants of breastfeeding initiation and duration in the United States, 2003. *Pediatrics* **119**, S38–S46.
- SPSS (2009) *Statistical Package for the Social Sciences*. SPSS, Inc: Chicago.
- Statistics Canada (2007) *Immigration in Canada: A Portrait of the Foreign-Born Population, 2006 Census. Catalogue No. 97-557-XIE*. Statistics Canada: Ottawa.
- Strochschein F., Merry L., Thomas J. & Gagnon A.J. (2010) Strengthening data quality in studies of migrants not fluent in host languages: a Canadian example with reproductive health questionnaires. *Research in Nursing and Health* **33**, 369–379.
- Susin L.R., Giugliani E.R., Kummer S.C., Marciel M., Simon C. & Da Silveira L.C. (1999) Does parental breastfeeding knowledge increase breastfeeding rates? *Birth (Berkeley, Calif.)* **26**, 149–156.
- Sussner K.M., Lindsay A.C. & Peterson K.E. (2008) The influence of acculturation on breast-feeding initiation and duration in low-income women in the US. *Journal of Biosocial Science* **40**, 673–696.
- Swanson V. & Power K.G. (2005) Initiation and continuation of breastfeeding: theory of planned behaviour. *Journal of Advanced Nursing* **50**, 272–282.
- Tabachnick B. & Fidell L. (2001) *Using Multivariate Statistics*. Allyn & Bacon: Boston.
- Thomas J.T. & DeSantis L. (1995) Feeding and weaning practices of Cuban and Haitian immigrant mothers. *Journal of Transcultural Nursing* **6**, 34–42.
- Thorne M., Alder E.M. & Ramel A. (2006) A population-based study of exclusive breastfeeding in Icelandic women: is there a relationship with depressive symptoms and parenting stress? *International Journal of Nursing Studies* **43**, 11–20.
- Thuiler D. & Mercer J. (2009) Variables associated with breastfeeding duration. *Journal of Obstetric, Gynecologic, and Neonatal Nursing* **38**, 259–268.
- Tuttle C. & Dewey K. (1994) Determinants of infant feeding choices among Southeast Asian immigrants in Northern California. *Journal of the American Dietetic Association* **94**, 282–286.
- UNHCR (2000) *The State of the World's Refugees: Fifty Years of Humanitarian Action*. Oxford University Press: Geneva.
- UNHCR (2009) *Population Levels and Trends. Statistical Yearbook 2008*. UNHCR: Geneva.
- United Nations (2010) *The Real Wealth of Nations: Pathways to Human Development. Human Development Report 2010*. United Nations Development Programme: New York.
- Weinert C. & Brandt P. (1987) Measuring social support with the Personal Resource Questionnaire. *Western Journal of Nursing Research* **9**, 589–602.
- World Health Organization (1991) *Indicators for Assessing Breast-Feeding Practices*. World Health Organization: Geneva.
- World Health Organization (2001) *The Optimal Duration of Exclusive Breastfeeding: Report of an Expert Consultation*. WHO: Geneva.
- Yngve A. & Sjostrom M. (2001) Breastfeeding determinants and a suggested framework for action in Europe. *Public Health Nutrition* **4**, 729–739.
- Zuppa A.A., Orchi C., Calabrese V., Verrillo G., Perrone S., Pasqualini P. et al. (2010) Maternal and neonatal characteristics of an immigrant population in an Italian hospital. *The Journal of Maternal-Fetal and Neonatal Medicine* **23**, 627–632.