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# Prevalence and Characteristics Associated with Breastfeeding Initiation Among Canadian Inuit from the 2007–2008 Nunavut Inuit Child Health Survey

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**Abstract** We aimed to determine the prevalence of, and factors associated with, breastfeeding initiation in Canadian Inuit. We used data from the Nunavut Inuit Child Health Survey, a population-based, cross-sectional survey conducted in the Canadian territory of Nunavut. Inuit children aged 3–5 years in 2007 or 2008 were randomly selected for the survey. Select household, maternal, infant and community characteristics were collected from the child's primary caregiver and entered into logistic regression models as potential predictors of breastfeeding initiation. Analyses were repeated in a subgroup of caregiver reports from biological mothers. The reported prevalence of breastfeeding initiation was 67.6 % (95 % CI 62.4–72.8) overall and 85.1 % (95 % CI 80.2–90.1) in a subgroup of caregiver reports from biological mothers. Adjusted prevalence odds ratios (pOR) indicate the primary caregiver was an important determinant of breastfeeding (adopted parent vs. biological mother: pOR = 0.03, 95 % CI 0.01–0.07; other vs. biological mother: pOR = 0.33, 95 % CI 0.14–0.74). Maternal smoking during pregnancy and having access to a community birthing facility were also potentially important, but not statistically significant ( $p > 0.05$ ). In conclusion, data from the Nunavut Inuit Child Health Survey indicate breastfeeding is initiated

for more than two-thirds of children, but rates are below the national average and this may be one of several pathways to poor health outcomes documented in many Inuit communities. Considered in the particular context of birthing facilities utilization and postnatal care arrangements in Inuit communities, these results suggest that increasing breastfeeding initiation will require health interventions that effectively engage all types of primary caregivers.

**Keywords** Breastfeeding · Inuit · Aboriginal · Epidemiology

## Introduction

Breastfeeding is the optimal infant feeding practice, conferring many short and long term benefits to the infant and mother [1]. A recent national survey found that 89 % of Canadian mothers initiated breastfeeding in 2011–2012 [2] as recommended by Health Canada and their partners, the Infant Feeding Joint Working Group [3], but also that large variations exist between provinces, socioeconomic, and age groups [2].

Canadian Inuit are one of three indigenous populations in Canada—First Nations and Métis are the other two. Canadian Inuit are also one group that appear to initiate breastfeeding less frequently than other Canadians (66 %), comparing Inuit-specific rates to Canadian specific rates [2, 4]. One concern is that, despite some recent reductions, disparities between Inuit and other Canadians in infant health indicators remain substantial [5]. Protecting, promoting and supporting breastfeeding may be one way to reduce the health disparities that Inuit children disproportionately experience.

No population-based research exists in Canada on the determinants of breastfeeding initiation in an Inuit-specific

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context, and much of the community based research that does exist is more than 20 years dated [6, 7]. Internationally, breastfeeding research in Inuit populations is also limited by smaller, community-based samples [8]. The determinants of breastfeeding practices have been more recently examined in the general Canadian population, but these results may not be directly generalizable to Inuit Canadians. Given that substantial changes have happened in Canada's Inuit inhabited areas in more recent years—including the creation of the self-governing territory Nunavut—more recent estimates are needed. Furthermore, existing research does not evaluate the impact of several potentially important factors that are more unique or common in Inuit populations (e.g. household food insecurity, traditional adoption, practice of relocating (i.e. evacuating) the majority of pregnant women to hospitals in southern regions of Canada to give birth) on infant feeding practices [6, 9, 10].

Identifying the determinants of breastfeeding may help inform interventions to increase breastfeeding in Canada's North. The aim of the present research is to provide a more recent estimate of the prevalence of breastfeeding initiation and identify factors associated with breastfeeding initiation in a sample of Inuit families living in Nunavut.

## Methods

We used data from the Nunavut Inuit Child Health Survey (NICHHS), a cross-sectional, population-based survey conducted in the Canadian territory of Nunavut in the fall months of 2007 and 2008 (August to November), during the International Polar Year (IPY). The survey was designed to measure key aspects of health among Inuit children aged 3–5 years and included measures of several health indicators, including infant feeding practices. Research on a variety of these (e.g. food security, iron deficiency) have been published elsewhere [11–13]. The Institutional Review Board of the McGill University Faculty of Medicine approved the NICHHS and the University of Toronto's Health Sciences Research Ethics Board approved these secondary data analyses.

Nunavut is located in the north east corner of Canada. The 2006 census found that, of the 50,475 Canadians self-identifying as Inuit, 49 % (n = 24,635) live in Nunavut [14]. Moreover, 84 % of the total population of Nunavut (n = 29,325), self-identify as Inuit [14]. There are 25 communities in the territory, and all of them are remote or isolated.

The NICHHS was restricted to 16 out of these 25 candidate communities. Nine communities were excluded because of the small numbers of eligible participants or for logistical reasons fully described elsewhere [11]. Within each community, approximately 20 % of eligible children were invited to participate. At the study's onset, eligible

children of caregivers who were randomly selected to participate in the concurrent IPY Inuit Health Survey (i.e. an adult survey of Inuit) were recruited. More detailed descriptions of participant selection for the IPY Inuit Health Survey are published elsewhere [15]. This approach yielded only one-third of the desired sample. The remaining two-thirds of children were randomly selected from medical records maintained at the community health centre. Because health centres are the sole source of entry into the health care system in Northern communities, these records are expected to include the names of all eligible children: sampling coverage will be close to, if not, 100 %.

After children were selected, a member of the research team contacted the primary caregivers to obtain informed consent. Up to three contact attempts were made by door to door visits, telephone calls or mailings; the method of contact varied depending on the community or family resources, but at least two approaches were used. Caregivers consenting to participate were invited to a community site to complete an interviewer-administered questionnaire within approximately 2 weeks. The questionnaire was administered in either English or Inuktitut.

Breastfeeding initiation was measured with the closed-ended question “was your child ever breastfed or fed breast milk?” According to a review of 11 studies from a variety of populations around the world, maternal recall of breastfeeding initiation as far as 14–15 years earlier agrees well with medical records (85 %) [16]. The average age of children in the NICHHS was 4.4 years—a much shorter time to recall breastfeeding initiation [11]. This suggests limited bias with respect to maternal recall of breastfeeding initiation. While a substantial proportion of surveys were completed by the biological mothers, other caregivers were also surveyed and the validity of their responses with regards to breastfeeding initiation is uncertain.

We selected several factors potentially associated with breastfeeding initiation based on a review of the literature including: infant birth weight [17], maternal drinking and smoking during pregnancy [18], place of residence [19], and socioeconomic status [20]. We also explored potential social determinants of breastfeeding initiation that may be of particular interest to Canadian Inuit such as access to health care, household overcrowding, engagement with traditional knowledge, food security, and the primary caregiver's relationship to the infant (e.g. adopted parent). Measures for most of these factors were abstracted directly from the NICHHS and were based on the caregivers' self-report. Information on maternal age and education, while likely important, were not collected in the NICHHS.

Primary language spoken at home was used as an indicator of traditional knowledge [21]. Receiving income support and living in a house in need of repairs was used as an indicator of household socioeconomic status. Both of

these indicators were based on caregivers' self-report to closed-ended questions.

Food security was measured using a version of the national 18-item Household Food Security Survey module as modified by Aboriginal Affairs and Northern Development Canada [22, 23]. Food security was categorized as either secure or insecure using classifications described elsewhere [11]. Household crowding was defined as more than two persons per bedroom in the household [24]. The primary caregiver was defined according to response patterns to two questions: "(what is the) respondent relationship to the child?" and "(what is the) respondent gender". Those indicating they were a biological parent and female were classified as the biological mother; those indicating they were an adoptive parent were classified as an adoptive parent; all other types of caregivers were classified as "other". The other category included primarily biological fathers, grandparents and siblings. We acknowledge that the 'other' category collapses together heterogeneous populations, but we did not have a large enough sample to consider each group separately.

We were also interested in different aspects of community conditions. Living in a community with a birthing facility and living in a community participating in the Canadian Prenatal Nutrition Program (CPNP) were used to indicate health care access. A shortage of skilled health care providers in the North and the lack of local capacity has resulted in the almost universal evacuation of most Inuit women for childbirth since the 1970's [10]. At the time of the survey, only women living in one of two communities had access to a birth facility (Iqaluit, Rankin Inlet). All community records corresponded to the year the child was born (i.e. 2002–2005) with one exception: we were unable to obtain records of community participation in the CPNP from 2002 and used values from 2003 instead.

#### Statistical Analysis

We conducted all statistical analyses in SAS v.9.4. To estimate the prevalence and determinants of breastfeeding initiation in Nunavut (the target population), sampling weights were assigned. Weights were driven by the sampling strategy [25]; it was assumed that within each community (strata), children were selected by simple random sample from medical centre lists. Accordingly, the numerator for the weights was the number of eligible children in the community and the denominator was the number of eligible children sampled. All children within a community were assigned the same weight. We used complex survey methodology procedures in SAS (surveylogistic, surveyfreq, surveymeans) for estimation [26]. These procedures are designed to statistically analyze sample survey data, incorporating sampling methodology and weights.

Such procedures are useful when probability-based samples are used to make estimations about a larger population.

The prevalence of breastfeeding initiation was estimated in two samples: (1) in all respondents and; (2) in a subgroup of those surveys completed by the biological mother. All caregivers who responded to the breastfeeding initiation question were included in these estimates. Crude and multivariable logistic regression models were fit to determine the predictors of breastfeeding initiation in all Inuit infants as well as the subgroup of infants whose biological mother identified as the child's primary caregiver. Only those caregivers with complete information on all potential determinants of interest were included in these analyses. As such, there were fewer participants in the predictive models than in the breastfeeding initiation prevalence estimates.

Weighted crude prevalence odds ratios and 95 % confidence limits were calculated. To identify factors for our multivariable model, we used a forwards logistic regression model building strategy wherein all variables exhibiting a crude association of  $p < 0.20$  were considered candidates for these models. The forwards selection procedure can be a useful approach when the sample size is small, adding variables one at a time, minimizing the risk of overfitting. Model building strategies were consistent with published recommendations for prediction models [27]. Specifically, the most significant factor meeting the entry criteria ( $p < 0.20$ ) was first entered into the model. Factors were added in order of statistical significance [27]. Only factors that were independently significant at the  $p < 0.25$  level in multivariable models were retained (exit criteria).

#### Results

There were 644 children randomly sampled to participate in the NICHS: 537 of these were successfully contacted (83.3 %) and 388 (60.4 %) participated. Of the 149 who were successfully contacted but did not participate, 74 gave verbal consent but either cancelled or failed to attend their scheduled appointment; the remaining 75 refused outright. The three most common reasons for refusals were competing commitments (40 %), illness (15 %), or lack of interest (15 %). Most of those who did participate completed the question on breastfeeding initiation and were retained for our prevalence estimates ( $n = 371$ ). There were 311 surveys that had complete data for all potential determinants of interest and these reports were retained for predictive models. In the subgroup analysis of surveys completed by a biological mother, information from 232 and 214 mothers was retained for prevalence estimates and predictive models, respectively.

Table 1 details the characteristics of study respondents. Although the majority of surveys were completed by the biological mother (62.5 %) a substantial proportion were completed by an adoptive parent (19.4 %) or another type of caregiver (18.1 %). Many of the characteristics of interest were similar in the population of all infants and infants whose biological mothers completed the NICHHS. Missing value patterns are also presented in Table 1.

Among 371 caregivers, 252 (67.6 %) report their infant began breastfeeding. Among 232 biological mothers, 196 (84.5 %) report their infant began breastfeeding. Weighted prevalence estimates were similar to unweighted estimates –67.6 % overall (95 % CI 62.4–72.8) and 85.1 % among biological mothers (95 % CI 80.2–90.1).

Table 2 shows the crude and adjusted associations between select characteristics of interest and breastfeeding initiation in the population. The strongest determinant of breastfeeding initiation was the primary caregiver. In unadjusted models, children whose primary caregiver was an adoptive parent (pOR = 0.04, 95 % CI 0.02–0.09) or another type of caregiver (e.g. biological father, grandparent) (pOR = 0.34, 95 % CI 0.16–0.75) were less likely

to have begun breastfeeding compared to children whose primary caregiver was the biological mother. Other factors that were eligible for our multivariable model but were not statistically significant included: having a biological mother who smoked during pregnancy (pOR = 0.62, 95 % CI 0.29–1.31), being a low birth weight infant (pOR = 0.55, 95 % CI 0.22–1.38) and living in a community with a birthing centre (pOR = 1.82, 95 % CI 0.95, 3.33).

In the final predictive model (Table 2), the association between the child's primary caregiver and breastfeeding initiation history remained strong - primary caregivers other than the biological mother were less likely to report their child initiated breastfeeding (adoptive parent, pOR = 0.03, 95 % CI 0.01–0.07); other caregiver (pOR = 0.33, 95 % CI 0.014, 0.74). We retained maternal smoking during pregnancy as a potential determinant of breastfeeding initiation, but this was not statistically significant at  $p < 0.05$  (pOR = 0.34, 95 % CI 0.12–1.01).

Table 3 shows the results of our subgroup analyses that included only surveys completed by a biological mother. No characteristics were significantly associated with

**Table 1** Characteristics of study respondents, Nunavut Inuit Child Health Survey

Characteristic of interest	Reports from all caregivers (N = 371)		Reports from biological mothers (N = 232)	
	Unweighted n <sup>b</sup> /N <sup>c</sup> (%)	Weighted <sup>a</sup> Prevalence (95 % CI) <sup>d</sup>	Unweighted n <sup>b</sup> /N <sup>c</sup> (%)	Weighted <sup>a</sup> Prevalence (95 % CI) <sup>d</sup>
Breastfeeding initiation	252/371 (67.6)	67.6 (62.4, 72.8)	196/232 (84.5)	85.1 (80.2–90.1)
<i>Respondent characteristics</i>				
Biological mother	232/371 (62.5)	60.7 (55.3, 66.2)	–	–
Adoptive parent	72/371 (19.4)	21.4 (16.8, 26.2)	–	–
Other	67/371 (18.1)	17.8 (13.6, 22.0)	–	–
<i>Household characteristics</i>				
Speaks Inuit dialect at home	203/371 (54.7)	56.3 (52.2, 60.4)	118/232 (51.1)	52.1 (47.0, 57.1)
Household crowding	131/352 (37.2)	37.3 (31.9, 42.7)	87/220 (37.5)	40.6 (33.6, 47.6)
Receives income support	162/358 (45.2)	43.1 (37.8, 48.4)	102/223 (45.7)	42.8 (36.2, 49.5)
Household food insecurity	254/371 (68.5)	68.3 (63.2, 73.3)	152/231 (66.0)	64.6 (58.1, 71.0)
House in need of repairs	162/371 (43.7)	44.6 (39.2, 50.0)	104/232 (44.8)	45.4 (38.4, 52.4)
<i>Maternal characteristics</i>				
Mother drank during pregnancy	80/338 (23.7)	23.3 (18.6, 28.1)	47/231 (20.4)	19.7 (14.3, 25.1)
Mother smoked during pregnancy	305/366 (83.3)	82.1 (77.8, 86.4)	196/232 (84.5)	83.0 (77.6, 88.3)
<i>Infant characteristics</i>				
Infant birth weight <2,500 g	32/358 (8.9)	8.8 (5.6, 12.0)	14/229 (6.0)	6.5 (3.0, 10.0)
<i>Community characteristics</i>				
Canadian prenatal nutrition program	211 (56.7)	44.5 (na) <sup>e</sup>	133 (57.1)	47.2 (na) <sup>e</sup>
Birthing centre	63 (17)	23.1 (na) <sup>e</sup>	34 (14.7)	19.7 (na) <sup>e</sup>

<sup>a</sup> Weights were based on probability of selection, participation

<sup>b</sup> The number of affirmative responses (e.g. 131 participants reported household crowding)

<sup>c</sup> The total number of respondents completing the question of interest

<sup>d</sup> 95 % CI 95 % confidence limits; estimated using the Wald method

<sup>e</sup> na, not applicable: these characteristics were measured at the community level and are without error

**Table 2** Crude and adjusted associations between characteristics of interest and breastfeeding initiation, all primary caregivers reporting: Nunavut Inuit Child Health Survey (n = 311)

Characteristics	Estimated population (N = 1,217) <sup>a</sup>	Estimated initiated breastfeeding (n = 857) <sup>a</sup> n, %	Bivariable prevalence odds ratios (pOR, 95 % CI) <sup>b</sup>	Multivariable <sup>c</sup> prevalence odds ratios (pOR, 95 % CI) <sup>b</sup>
<i>Caregiver characteristics</i>				
Biological mother	815	695 (85.3)	<b>1.00***</b>	<b>1.00***</b>
Adoptive parent	221	41 (18.4)	<b>0.04 (0.02, 0.09)</b>	<b>0.03 (0.01, 0.07)</b>
Other	181	120 (66.7)	<b>0.34 (0.16, 0.75)</b>	<b>0.33 (0.14, 0.74)</b>
<i>Household characteristics</i>				
Primary language spoken at home				
Inuktitut or Inuinnaqtun	650	453 (69.6)	1.00	–
Other	566	404 (71.3)	1.09 (0.64, 1.86)	–
Household overcrowding				
No	742	519 (70.0)	1.00	–
Yes	475	337 (70.9)	1.04 (0.60, 1.79)	–
Receives income support				
No	704	505 (71.7)	1.00	–
Yes	513	352 (68.6)	0.86 (0.50, 1.48)	–
Household food security				
Food secure	395	290 (73.5)	1.00	–
Food insecure	822	566 (68.9)	0.80 (0.44, 1.47)	–
House mold or in need of repair				
No	692	498 (72.0)	1.00	–
Yes	525	358 (68.2)	0.84 (0.49, 1.43)	–
<i>Maternal pregnancy behaviour</i>				
Drinking during pregnancy				
No	916	641 (70.0)	1.00	–
Yes	300	215 (71.6)	1.08 (0.58, 1.98)	–
Smoking during pregnancy				
No	223	174 (78.0)	1.00*	1.00**
Yes	994	682 (68.7)	0.62 (0.29, 1.31)	0.34 (0.12, 1.01)
<i>Infant characteristics</i>				
Infant birth weight				
≥2,500 g	1,124	803 (71.4)	1.00*	–
<2,500 g	93	54 (57.9)	0.55 (0.22, 1.38)	–
<i>Community characteristics</i>				
Canadian prenatal nutrition program				
No	677	465 (68.8)	1.00	–
Yes	540	391 (72.4)	1.20 (0.70, 2.03)	–
Community hospital or birthing center				
No	306	185 (60.8)	1.00**	–
Yes	911	671 (73.6)	1.82 (0.95, 3.33)	–

Bold values are statistically significant at  $p < 0.05$

\*\*\*  $p < 0.01$ , \*\*  $p < 0.10$ , \*  $p < 0.20$

<sup>a</sup> Column totals are weighted prevalence estimates. Weighted population sizes may not always add to column totals due to rounding

<sup>b</sup> 95 % CI: 95 % confidence limits; estimated using the Wald method

<sup>c</sup> Models include only those variables listed

**Table 3** Crude and adjusted associations between characteristics of interest and breastfeeding initiation, biological mothers reporting: Nunavut Inuit Child Health Survey (n = 214)

Characteristics	Estimated population (N = 815) <sup>a</sup>	Estimated initiated breastfeeding (n = 695) <sup>a</sup> n, %	Bivariable prevalence odds ratios (pOR, 95 % CI) <sup>b</sup>	Multivariable <sup>c</sup> prevalence odds ratios (pOR, 95 % CI <sup>b</sup> )
<b>Household characteristics</b>				
Primary language spoken at home				
Inuktitut or Inuinnaqtun	407	349 (85.6)	1.00	–
Other	408	347 (85.0)	0.96 (0.42, 2.18)	–
Household overcrowding				
No	467	403 (86.4)	1.00	–
Yes	348	292 (83.8)	0.82 (0.34, 1.88)	–
Receives income support				
No	469	402 (85.8)	1.00	–
Yes	346	293 (84.7)	0.92 (0.40, 2.11)	–
Household food security				
Food secure	279	242 (86.6)	1.00	–
Food insecure	536	453 (84.6)	0.85 (0.35, 2.07)	–
House mold or in need of repair				
No	457	400 (87.5)	1.00	–
Yes	358	296 (82.6)	0.68 (0.30, 1.52)	–
<b>Maternal pregnancy behaviour</b>				
Drinking during pregnancy				
No	643	548 (85.2)	1.00	–
Yes	171	147 (85.6)	1.03 (0.40, 2.65)	–
Smoking during pregnancy				
No	136	128 (93.8)	1.00	1.00*
Yes	679	568 (83.6)	0.34 (0.07, 1.52)	0.37 (0.08, 1.69)
<b>Infant characteristics</b>				
Infant birth weight				
≥2,500 g	764	659 (86.2)	1.00	–
<2,500 g	51	36 (71.4)	0.40 (0.10, 1.61)	–
<b>Community characteristics</b>				
Canadian prenatal nutrition program				
No	447	382 (85.2)	1.00	–
Yes	367	314 (85.4)	1.02 (0.46, 2.27)	–
Community hospital or birthing center				
No	643	534 (83.0)	1.00	1.00*
Yes	172	131 (93.9)	3.16 (0.64, 15.5)	2.95 (0.59, 14.70)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.10$ , \*  $p < 0.20$

<sup>a</sup> Column totals are weighted prevalence estimates. Weighted population sizes may not always add to column totals due to rounding

<sup>b</sup> 95 % CI: 95 % confidence limits; estimated using the Wald method

<sup>c</sup> Models include only those variables listed

breastfeeding initiation at traditional significance levels (i.e.  $p < 0.05$ ) in either crude or adjusted models. We retained three different factors for our multivariable models because they met our inclusion criteria ( $p < 0.20$ ): having a biological mother who smoked during pregnancy

(pOR = 0.34, 95 % CI 0.07–1.52); being a low birth weight infant (pOR = 0.40, 95 % CI 0.10–1.61); and living in a community with a birthing facility (pOR = 3.16, 95 % CI 0.64, 15.50). In the final predictive model, maternal smoking during pregnancy (pOR = 0.37, 95 % CI



0.08, 1.69) and living in a community with a birthing centre (pOR = 2.95 95 % CI 0.59, 14.70) were retained, although neither were significant at  $p < 0.05$ .

## Discussion

We estimate 67.6 % of Inuit children ages 3–5 years living in Nunavut during 2007 and 2008 began breastfeeding as infants. This is consistent with Inuit-specific estimates from the ACS (2006) (66 %) and the Aboriginal Peoples' Survey (APS) (2001) (67 %) [4, 28]. The close similarity in breastfeeding initiation rates between the APS, which reported breastfeeding histories of children up to 15 years of age in 2001 (i.e. born between 1986 and 2001), the ACS (2006), which reported breastfeeding histories of children up to 6 years of age, and our data, suggest that breastfeeding initiation has remained fairly stable over time in the Inuit [4].

Yet, breastfeeding initiation in this and other surveys is measured in a population of caregivers that may include adopted parents, grandparents and aunts, in addition to biological mothers. While maternal recall of breastfeeding initiation is high, recall of other caregivers is unclear [16]. The majority of Inuit women give birth away from their communities and if a mother began breastfeeding at the hospital but stopped before discharge, other caregivers may not be able to accurately speak to this history [10]. If true, breastfeeding initiation rates may be higher than reported herein.

To reduce such measurement error, we conducted two analyses: (1) one in the larger population and (2) one restricted to reports from only the biological mother. Published reports indicate anywhere from 17 to 42 % of Inuit infants are adopted and most of these adoptions occur shortly after birth and may be within the same family and household [29–31]. Failing to include all caregiver reports would likely exclude a substantially large proportion of Inuit infants and not provide information on determinants of breastfeeding in the larger population. Moreover, we felt adoption could be an important determinant of breastfeeding. In the absence of direct measures, it is plausible that there may be more barriers to beginning breastfeeding if an infant's primary caregiver is not their biological mother, even if the biological mother is in frequent and continued contact with the infant, which is not uncommon in Inuit traditional adoptions. Indeed, previous community based research in Inuit populations supports a lower prevalence of breastfeeding in adopted infants compared to other infants [6, 29]. The present findings are consistent with the possibility that the child's primary caregiver may have a significant influence on whether breastfeeding was initiated. However, the observational nature of the present

study does not allow us to make any conclusions about causality. A particular concern in cross-sectional research is the unclear temporal sequence; in our study, adoption decisions likely follow from particular family circumstances that may themselves have influenced the likelihood that new mothers initiate breastfeeding.

In our subgroup analyses, we found that estimates of breastfeeding initiation based on retrospective report by the biological mother (85.4 %) are closer to those reported among the general Canadian population over similar time periods (i.e. 84.9 %, 2003; 86.9 %, 2005) [32]. Yet, we cannot say with certainty that Inuit children raised by a biological mother were more likely to begin breastfeeding. The lower breastfeeding initiation as reported by other caregivers may reflect the influence of different family structure, conditions and processes. We did not have information on family structure: just because the biological mother did not complete the NICHHS does not mean she was not one of the child's primary caregivers. Being a primary caregiver but not completing the NICHHS could conceivably be related to infant feeding choices. For example, research indicates that mothers who return to work shortly after giving birth tend to initiate breastfeeding less frequently than other mothers [33]; this employment may also be related to why another primary caregiver (e.g. biological father) completed the NICHHS instead of the biological mother.

Our multivariable models suggest that maternal smoking during pregnancy may be an important determinant of failing to initiate breastfeeding; although this effect was not statistically significant, the magnitude of the effect was large. Similar findings have been reported in other populations [18, 34] and may be partially attributable to physiological differences in lactation production between smokers and non-smokers [35]. An alternative explanation is that associations are the result of residual confounding from other, important correlated factors (e.g. intentions to breastfeed [36], sociodemographic characteristics [37]). If true, promoting smoking cessation during pregnancy will have little impact on breastfeeding initiation without considering other, shared determinants. The high prevalence of maternal smoking during pregnancy (~84 %) is a public health concern in its own right—the harms of smoking extend beyond breastfeeding and include an increased risk of respiratory infection, otitis media and even infant death [38]. Promoting and supporting smoking cessation among Inuit women smokers should be a public health priority that could improve both maternal and infant health through multiple pathways, including the protection of healthy breastfeeding practices.

Although we did not detect a statistically significant association between living in a community with a birthing centre and initiating breastfeeding, the relative strength of

the association—particularly in reports from biological mothers—points to a potentially important clinical effect that is worth further exploration. New research should include individual level data about birth location, which is needed to further understand the role that birthing centres play in breastfeeding decisions. Data from the Rankin Inlet Birthing Centre indicate that approximately 50 % of pregnant community members deliver their newborns here [39]. Nevertheless, our finding could mean that returning birth to the community is an opportunity for new mothers to receive culturally appropriate lactation support from both family members and health care providers. Lack of instrumental and social support—a direct result of evacuation practices—has been described by some Inuit women as a barrier to initiating breastfeeding [40].

### Limitations

Several limitations should be considered when interpreting this research. First, previous research in western populations has consistently shown several factors associated with initiating breastfeeding (e.g. education, age, marital status) [20] that were not collected on the NICHHS. As such, we were not able to include these variables and our data may be affected by residual confounding. Second, many of the individual characteristics of interest (e.g. household crowding) reflect the status of participants at the time of the survey rather than during the prenatal and perinatal period most relevant to breastfeeding initiation. Third, not all of those who were recruited elected to participate and it is possible that breastfeeding initiation patterns were different in non-participants. A final limitation is sample size restrictions. We identified many characteristics that showed large effect sizes but were not statistically significant (e.g. maternal smoking, living in a community with a birthing centre).

### Conclusions

Beginning breastfeeding is the primary component of the recommendation to practice exclusive breastfeeding in the first 6 months of life and continue breastfeeding into the second year of life. Our research found that Inuit Canadians, on average, continue to initiate breastfeeding less frequently than other Canadians and that some of this difference may be related to structural differences in family composition. When looking only at surveys completed by the biological mother, breastfeeding initiation rates were comparable to other Canadians. This suggests that interventions to improve breastfeeding in Inuit populations should consider strategies to engage various types of caregivers, and to explore ways and means to protect,

promote and support breastfeeding of adopted infants. Future research should also consider further exploring the potentially positive impact of keeping birth in the community on breastfeeding initiation.

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