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Original Research

In-Hospital Feeding Practices of Infants Born to Mothers With Gestational Diabetes Mellitus or Type 2 Diabetes Mellitus: Evaluating Policy Implementation Effectiveness

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Key Messages

- The number of infants receiving breast milk at discharge did not significantly differ pre- and postintroduction of a hospital supplemental feeding policy.
- There was no significant difference in the number of infants receiving breast milk exclusively in hospital between pre- and postpolicy groups.
- As part of a larger integrative knowledge translation initiative, this research highlighted a need for further policy development and fidelity assessment.

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ABSTRACT

Objectives: Women with diabetes in pregnancy may experience unique breastfeeding challenges. Few studies have examined the effectiveness of hospital policy to support breastfeeding in this patient population. This study aimed 1) to describe infant feeding practices of mother-infant pairs with gestational diabetes mellitus (GDM) or type 2 diabetes in pregnancy before and after introduction of an in-hospital policy and, 2) to compare feeding practices before and after policy introduction.
Methods: A retrospective chart audit of mother-infant pairs (n=120) was performed: 60 at 1 year before and 60 after policy introduction. The primary outcome was provision of breast milk at discharge; a chi-square test was completed to compare pre- and postpolicy groups. Secondary outcomes included participant and infant feeding characteristics.
Results: There was no significant difference in the number of infants receiving breast milk at discharge between pre- (58% [35 of 60]) and postpolicy (58% [35 of 60]) groups (p=0.64). The number of infants receiving breast milk exclusively throughout the hospital stay also did not differ by group (37% [22 of 60] before; and 43% [26 of 60] after; p=0.39). Information for each feed was infrequently recorded in charts for the method of feeding (34% [704 of 2,064]), infant state (96% [1,991 of 2,064]) and feeding description (96% [1,987 of 2,064]).
Conclusions: This practice-based research has highlighted a need for continuation of this work, examining an in-hospital policy to support breastfeeding in those with GDM or type 2 diabetes in pregnancy. Initially, feedback could be collected from health-care providers to understand perceived facilitators and barriers to policy application and the use of job aids (e.g. record keeping tools).

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RÉSUMÉ

Objectifs : Les femmes atteintes de diabète durant la grossesse peuvent éprouver des difficultés particulières à allaiter. Peu d'études ont porté sur l'efficacité des politiques hospitalières qui encouragent l'allaitement chez cette population de patientes. La présente étude visait : 1) à décrire les pratiques d'alimentation du nourrisson de paires mère-nourrisson ayant eu un diabète sucré gestationnel (DSG) ou un diabète de type 2 durant la grossesse avant et après l'introduction d'une politique hospitalière; 2) à comparer les pratiques d'alimentation avant et après l'introduction de la politique.

Méthodes : Une vérification rétrospective de dossiers de paires mère-nourrisson (n = 120) a été réalisée : 60 paires 1 an avant l'introduction de la politique et 60 paires après. Le critère d'évaluation principal était l'apport en lait maternel à la sortie de l'hôpital; un test du chi carré a été rempli pour faire la comparaison entre les groupes avant et après l'introduction de la politique. Les critères d'évaluation secondaires étaient les caractéristiques des participantes et des nourrissons.

Résultats : Il n'y avait aucune différence significative dans le nombre de nourrissons qui recevaient du lait maternel à la sortie de l'hôpital entre les groupes avant l'introduction de la politique (58 % [35 sur 60]) et les groupes après l'introduction de la politique (58 % [35 sur 60]) (p = 0,64). Le nombre de nourrissons qui recevaient exclusivement du lait maternel durant tout le séjour à l'hôpital ne différait également pas entre les groupes (37 % [22 sur 60] avant; 43 % [26 sur 60] après; p =0,39). Les renseignements sur la méthode d'alimentation (34 % [704 sur 2064]), l'état du nourrisson (96 % [1991 sur 2064]) et la description de l'alimentation (96 % [1987 sur 2064]) à chacune des tétées étaient rarement notés dans les dossiers.

Conclusions : Cette recherche axée sur les pratiques a fait valoir la nécessité de poursuivre ces travaux par l'examen des politiques hospitalières qui encouragent l'allaitement chez les femmes atteintes du DSG ou du diabète de type 2 durant la grossesse. Initialement, on pourrait recueillir les commentaires des prestataires de soins de santé pour comprendre les facilitateurs et les obstacles perçus dans l'application des politiques et l'utilisation des outils de travail (p. ex. des outils sur la tenue des dossiers).

Introduction

Breast milk can provide optimal nutrition to support healthy childhood growth and development during the first 6 months of life (1,2). The World Health Organization (in 2002), Health Canada (in 2015), Canadian Paediatric Society (in 2015), Dietitians of Canada (in 2015) and Breastfeeding Committee for Canada (in 2015) recommend that infants are exclusively breastfed for the first 6 months of life, with the subsequent introduction of complimentary foods and continued breastfeeding for up to 2 years and beyond (1,2). For mothers, breastfeeding may have a protective effect against developing type 2 diabetes, breast and ovarian cancers and postpartum depression. For infants, breastfeeding is associated with a reduced risk of certain infections, atopic dermatitis, sudden infant death syndrome, necrotizing enterocolitis, childhood asthma, childhood leukemia, obesity, type 1 diabetes and type 2 diabetes (3).

When a mother cannot or chooses not to breastfeed, commercial infant formula is recommended (1,2). Formula is nutritionally complete and formulated to meet the nutritional requirements of healthy infants (2,4). Alternative formulas are available for specific pediatric populations requiring medical nutrition therapy. For instance, extensively hydrolyzed formulas are recommended over common formulas with intact or partially hydrolyzed cow's milk proteins for infants with food allergies and malabsorptive conditions (2). Specialized formulas higher in protein, iron, docosahexaenoic acid and arachidonic acid have been formulated for preterm infants (2,4). Soy-based formulas are also available and suitable for infants diagnosed with galactosemia or who cannot consume dairy products (2).

Breastfeeding rates in Canada are low in comparison with these recommendations. In 2017, although 90% of Canadian mothers initiated breastfeeding, only 32% exclusively breastfed at 6 months (5). Nova Scotian rates are comparable with national statistics; in 2017, 89% of mothers initiated breastfeeding and 31% exclusively breastfed at 6 months (6). Evidence suggests that for women with diabetes in pregnancy, breastfeeding initiation and duration rates are lower than the general obstetric population (7–12). For instance, in a study of women delivering at 4 Ontario hospitals, women with pregestational diabetes (n=159) were least likely to breastfeed in hospital (adjusted odds ratio [aOR], 0.45; 95% confidence interval [CI], 0.30 to 0.65), followed by women with gestational diabetes mellitus (GDM) (n=1,259; aOR, 0.77; 95% CI, 0.68 to 0.87), compared with women without diabetes (n=23,291) (8).

Mother-infant pairs, with recent diabetes in pregnancy, may encounter breastfeeding challenges. For example, diabetes in pregnancy is associated with increased risk of delayed onset of lactogenesis II, typically defined as milk secretion occurring after 72 h postpartum (13). Infants born to mothers with diabetes are also at greater risk of experiencing hypoglycemia because of elevated maternal blood glucose exposure later in pregnancy (14). A recent qualitative study from the United States exploring early breastfeeding experiences in 27 women with GDM found that these women frequently encountered challenges with infant latch, positioning and delayed onset of lactogenesis II (15). Participants also reported that they felt the focus of care was centred around infant health, for example hypoglycemia and weight loss, with less time directed to breastfeeding support. Participants noted that monitoring and treatment of complications frequently led to mother-infant separation and formula supplementation (15).

Previous research indicates that breast milk may assist with glycemic control and reduce the risk of hypoglycemia in infants born to mothers with GDM (16). For women with GDM, lactation has been associated with improved short-term glycemic control and reduced risk of developing metabolic syndrome and type 2 diabetes compared with no lactation (17–19). Despite these benefits, previous research has found that women with GDM (n=34) are more likely to have formula introduced in the first 2 days after delivery than women without diabetes in pregnancy (n=398; 79.4%

vs 53.8%, respectively; p<0.01; aOR, 3.48; 95% CI, 1.47 to 8.26) (20). Nonmedically indicated formula supplementation may inadvertently be provided in hospital to prevent or manage complications (15,21,22). For instance, supplementation with formula may be provided because of maternal and health-care provider perceptions of low milk supply (15,21). Also, providers have cited maternal fatigue, infant behaviour, breastfeeding problems and the belief formula will prevent hypoglycemia as reasons for supplementing with formula (21,22). Inappropriate supplementation can result in decreased milk supply and interfere with breastfeeding duration (23,24). Other postnatal practices among infants born to mothers with diabetes, including routine admission to special care units, overfeeding, delayed skin-to-skin contact, delayed first feed and premature blood glucose monitoring may also interfere with establishing breastfeeding (25). These practices can be problematic for mothers intending to breastfeed their infants.

Establishing early breastfeeding, notably for the first feed, has been associated with greater likelihood of breastfeeding in the long term for women with diabetes in pregnancy (26). Consequently, the early in-hospital period after birth has been identified as an important period for breastfeeding support (26). There has been a call for research that examines the impact and efficiency of hospital policies that aim to support breastfeeding for women with GDM and type 2 diabetes in pregnancy (7). The knowledge-to-action (KTA) process was used as a conceptual framework for this work (Figure 1). The KTA process describes the relationship between knowledge creation and application (27). This work was exploratory in nature and the first part of a larger clinician- and clinical trainee-led policy development effort, aimed at monitoring policy adoption and evaluating policy effectiveness (27). The aim of this study was 2-fold: 1) to describe in-hospital feeding practices of infants born to mothers with GDM or type 2 diabetes, and 2) to evaluate the effectiveness of a policy in facilitating breastfeeding from birth to hospital discharge at a large urban teaching hospital, using clinically relevant metrics (e.g. markers of exclusivity, data comparisons between GDM and type 2 diabetes). This work was also developed to catalyze thoughtful and collaborative program development and evaluation related to this policy.

Methods

Policy

The evidence-informed policy was developed by 2 clinical nurse specialists of the study hospital. The policy was reviewed by several clinical and content expert individuals and groups during its development and upon final review. As described in the policy, the goal for supplementation of breastfeeding children is to “provide medically indicated nutrition while optimizing the maternal milk supply, breastfeeding exclusivity and duration” (28). The policy applies to hospital staff and physicians providing care for breastfeeding children and families. Content was developed in accordance with current best evidence and standards, including the World Health Organization, the Breastfeeding Committee for Canada and published research and clinical publications, including the Academy of Breastfeeding Medicine protocol on breastfeeding supplementation (29–32). The policy protocol is referred to in Figure 1, and the complete document is available online (28). The policy was approved October 18, 2016, and effective November 29, 2016.

Design

The design involved a retrospective chart audit of mothers with GDM and mothers with type 2 diabetes in pregnancy, and their infants (n=120). Data were collected from 60 mother-infant pairs in the period before and after policy introduction. Infants in the prepolicy group were born between January 5, 2016 and November 16, 2016, and infants in the postpolicy group were born between December 8, 2016, and November 24, 2017.

Sample

Inclusion criteria for the sample were as follows: 1) women attending the pregnancy and diabetes clinic, 2) women diagnosed with either GDM or type 2 diabetes and 3) women delivering a live singleton. The setting was an urban teaching hospital serving

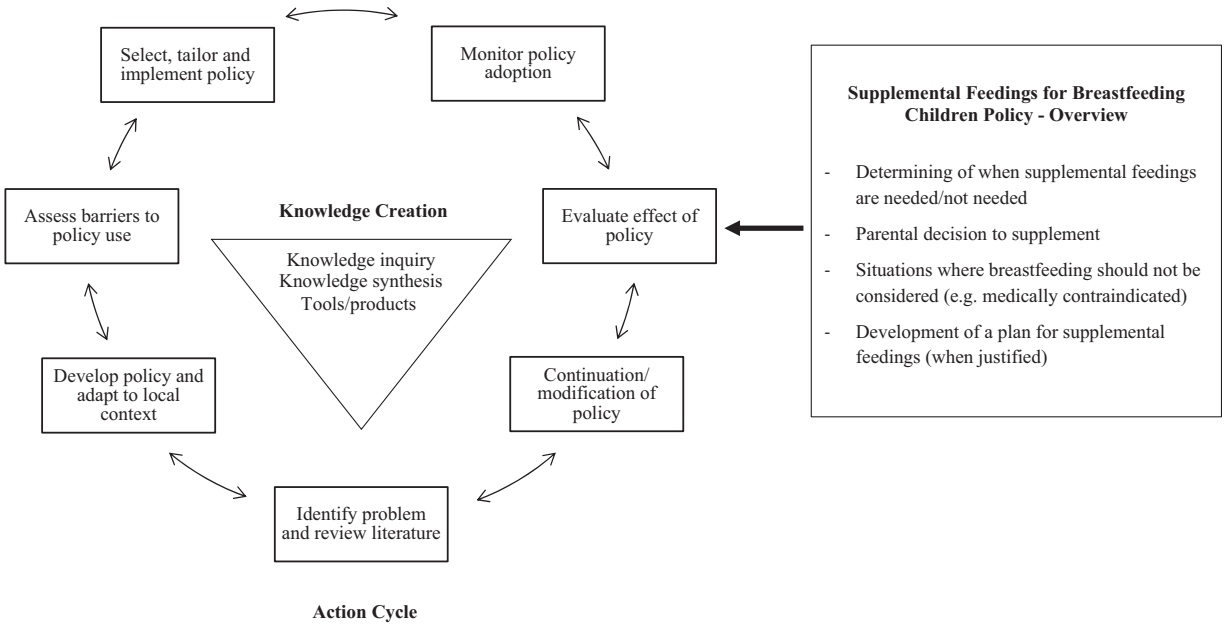

Figure 1. The knowledge-to-action process was used as a conceptual framework for policy review. The original policy (supplemental feedings for breastfeeding children policy) was developed and implemented (in 2016) to address a practice- and research-based problem identified (i.e. unjustified infant supplementation) and to support existing tools and products (that support breastfeeding). Evidence-informed metrics (e.g. markers of exclusivity) were used, in the context of a chart audit, to monitor and evaluate the effectiveness of the policy. Continued prospective review of the policy is justified. Adapted with permission from Graham et al (27).

women, children and youth from Nova Scotia, New Brunswick and Prince Edward Island (33). Women diagnosed with type 1 diabetes were excluded from this study because the risk factors and etiology of disease differ compared with GDM and type 2 diabetes (34,35). This study was reviewed and approved by the IWK Health Centre Research Ethics Board and Mount Saint Vincent University Research Ethics Board.

A power analysis calculation was performed to estimate the required sample size to observe whether there was a significant difference in the provision of exclusive breast milk at discharge (a common marker of effectiveness), before and after policy introduction. Based on results from 2 previous studies with similar designs to this study, it was determined that a sample of 56 mother-infant pairs was required to achieve a 5% significance level and 90% power (36–38). A sample of 120 participants was selected as a conservative sample size to detect a significant difference in exclusive breast milk at discharge.

Data collection

Two trainees screened maternal fetal assessment records for women meeting inclusion criteria using the MEDITECH magic software system (Version 5.67; MEDITECH, Westwood, Massachusetts, United States). Each mother-infant pair was added to the study target list and deidentified by assigning a participant identification. Data for each feed were gathered from newborn nutrition/elimination records and neonatal intensive care unit 24-h summary intakes and recorded as a new row in data collection spreadsheets. All data were double-checked by trained research team members. Infant feeding information was documented in charts by health-care providers, parents and caregivers. Data missing from charts were recorded as not available.

Data on the following outcomes were gathered and recorded: 1) participant characteristics, including maternal diabetes type (GDM or type 2 diabetes), unit at discharge (family newborn unit or neonatal intensive care unit), length of hospital stay (days) and infant birth weight (grams); and 2) feeding characteristics, including type of infant feed (breast milk, formula, intravenous [IV] fluid or combinations thereof), method of infant feed (breast, bottle, finger/syringe, cup, IV route or combinations thereof), feeding description (subjective measure of how well the infant was fed: good, fair or poor) and infant state (infant behaviour during the feed: awake/quiet, crying, fussy or sleeping).

Breast milk at discharge, defined as the final recorded feed prior to discharge, with binary outcomes of yes or no, was the primary outcome. This measure was selected for the purposes of estimating the sample size. The predominant type of feed an infant received throughout the entire hospital stay was also calculated. The categories for in-hospital feeding type included exclusive breast milk (100% of feeds breast milk), mostly breast milk (>75% of feeds breast milk), mixed feeding (25% to 75% of feeds breast milk), mostly formula or IV fluid (>75% of feeds formula or IV fluid) and exclusive formula or IV fluid (100% of feeds formula or IV fluid). Mixed feeding was defined as the provision of breast milk and formula or IV fluid during the same feed.

Data analysis

Descriptive and inferential analyses were completed using IBM SPSS Software (version 25; IBM Corp, Armonk, New York, United States). Descriptive analyses were computed for pre- and postpolicy participant and feeding characteristics data as number of patients (%). Inferential statistics were performed to evaluate whether there were any differences in outcomes between pre- and postpolicy groups. A chi-square test with 2-sided significance was performed for maternal diabetes type, provision of breast milk at discharge, in-hospital feeding type, total type of feeding and method of feeding. To meet minimum expected cell counts for chi-square analysis, the category "not available" was excluded from analysis for the primary outcome (prepolicy: n=1 [2%]; postpolicy: n=7 [12%]) and the categories "mostly formula or IV fluid" and "exclusive formula or IV fluid" were combined for in-hospital type of feeding. An additional analysis for in-hospital type of feeding was performed to evaluate whether there was a significant difference between infants receiving exclusive breast milk and those not receiving exclusive breast milk. For outcomes where a significant chi-square test ($p<0.05$) was found, *z* scores (standardized residuals) were calculated. Data for unit at discharge were analyzed using a Fisher exact test with 2-sided significance. Inferential analysis was not performed for infant state and feeding description because cell frequencies did not meet assumptions for chi-square analysis. Independent *t* tests were performed to evaluate potential differences between groups in the length of hospital stay and infant birth weight.

Results

The target sample size of 120 mother-infant pairs was reached, and a total of 2,064 feeds were recorded from charts.

Participant characteristics

There were no significant differences in maternal diabetes type (p=0.39), unit at discharge (p>0.99), length of hospital stay (p=0.09) and infant birth weight (p=0.08) between pre- and postpolicy groups (Table 1). Approximately three-quarters of women were diagnosed with GDM (92 of 120) and one-quarter with type 2 diabetes (28 of 120). Most infants were discharged from the family newborn unit (114 of 120) and stayed approximately 2 to 3 days in hospital (prepolicy: 3.1±4.0 days; postpolicy: 2.1±1.1 days). Mean infant birth weight was 3,495±536 g for the prepolicy group and 3,312±576 g for the postpolicy group.

Infant feeding characteristics

As shown in Table 2, 58% (35 of 60) of infants in both the pre- and postpolicy groups received breast milk as the final feed before discharge; there was no significant difference between study groups ($\chi^2_1=0.54$, p=0.46). Throughout the hospital stay, more infants received breast milk exclusively compared with other feeding types (prepolicy: 37% [22 of 60], postpolicy: 43% [26 of 60]); the difference between categories of in-hospital feeding type was not statistically significant between groups ($\chi^2_3=3.02$, p=0.39) (Table 2). Additionally, the number of infants who received breast milk exclusively vs nonexclusively throughout the hospital stay was

Table 1
Participant characteristics by policy group

Characteristic	Prepolicy (n=60)	Postpolicy (n=60)	p value
Maternal diabetes type			
GDM	48 (80)	44 (73)	0.39*
Type 2 diabetes	12 (20)	16 (27)	
Unit at discharge			
Family newborn unit	57 (95)	57 (95)	>0.99†
NICU	3 (5)	3 (5)	
Length of hospital stay, days	3.1±4.0	2.1±1.1‡	0.09§
Infant birth weight, g	3,495±536	3,312±576	0.08§

GDM, gestational diabetes mellitus; *NICU,* neonatal intensive care unit.
Note: Values are mean ± SD, n (%) or as otherwise indicated.
* Derived by chi-square analysis.
† Derived by Fisher exact test analysis.
‡ Data not available from charts for 1 participant.
§ Derived by independent *t* test analysis.

Table 2
Type of infant feeding by policy group

Type of infant feeding	Prepolicy (n=60)	Postpolicy (n=60)	p value
Provision of breast milk at discharge*			
Yes	35 (58)	35 (58)	0.46†,‡
No	24 (40)	18 (30)	
In-hospital feeding type§			
Exclusive breast milk¶	22 (37)	26 (43)	0.39‡,**
Mostly breast milk	12 (20)	10 (17)	
Mixed feeding‖	18 (30)	21 (35)	
Mostly formula or IV fluid	3 (5)	2 (3)	
Exclusive formula or IV fluid	5 (8)	1 (2)	

IV, intravenous.
Note: Values are n (%) or as otherwise indicated.
* Provision of breast milk at discharge is defined as the provision of solely breast milk for the final recorded feed prior to discharge.
† "Not available" was excluded from analysis; therefore, a total of 59 patients were included for the prepolicy group and 53 patients were included for the postpolicy group.
‡ Derived by chi-square analysis.
§ In-hospital feeding type refers to the predominant type of feed an infant received throughout the entire hospital stay. Categories are defined as follows: exclusive breast milk (100% of feeds breast milk), mostly breast milk (>75% of feeds breast milk), mixed feeding (25% to 75% of feeds breast milk), mostly formula or IV fluid (>75% of feeds formula or IV fluid) and exclusive formula or IV fluid (100% of feeds formula or IV fluid).
¶ p=0.46, exclusive breast milk compared with not exclusive breast milk between policy groups.
‖ Mixed feeding is defined as the provision of breast milk and formula or IV fluid during the same feed.
** Categories mostly formula or IV fluid and exclusive formula or IV fluid were combined for chi-square analysis.

not significant between policy groups (χ^2_1=0.556, p=0.46) (Table 2).

Of the total number of recorded feeds, breast milk accounted for approximately two-thirds (prepolicy: 60% [596 of 992]; postpolicy: 61% [651 of 1,072]); the difference was not statistically significant between groups (χ^2_3=6.49, p=0.09) (Table 3). In terms of the method of feeding, infants were most often fed at the breast (prepolicy: 42% [420 of 992]; postpolicy: 50% [539 of 1,072]); however, data were unavailable from charts for approximately one-third of feeds (Table 3). There was a significant difference in the overall model for the method of feeding (χ^2_3=106.71, p<0.001). After post hoc analysis, it was determined there was a significantly greater number of "other" feeds and lesser number of "breast and other" feeds for the postpolicy group compared with the prepolicy group. Subjective clinical measures of infant state and feeding description were not documented in charts for most feeds (>95%) (Table 3).

Table 3
Infant feeding characteristics for the total number of feeds between delivery and discharge, by policy group

Infant feeding characteristics	Prepolicy (n=992)	Postpolicy (n=1,072)	p value
Type of feeding			
Breast milk	596 (60)	651 (61)	0.09†
Mixed feeding*	161 (16)	207 (19)	
Formula or IV fluid	175 (18)	165 (15)	
Not available	60 (6)	49 (5)	
Method of feeding			
Breast	420 (42)	539 (50)	<0.001†
Breast and other‡	178§ (18)	60§ (6)	
Other‡	43§ (4)	120§ (11)	
Not available¶	351 (35)	353 (33)	
Infant state‖,**			
Awake/quiet	0 (0)	0 (0)	
Crying	0 (0)	0 (0)	
Fussy	4 (0)	5 (0)	
Sleeping	33 (3)	31 (3)	
Not available	955 (96)	1,036 (97)	
Feeding description‖,††			
Good	36 (4)	34 (3)	
Fair	1 (0)	3 (0)	
Poor	1 (0)	2 (0)	
Not available	954 (96)	1,033 (96)	

IV, intravenous.
Note: Values are n (%) or as otherwise indicated.
* Mixed feeding is defined as the provision of breast milk and formula or IV fluid during the same feed.
† Derived by chi-square analysis.
‡ Other includes bottle, finger or syringe, cup and IV route.
§ p<0.001, *z* scores for standardized residuals of individual cells.
¶ Not available refers to data that were missing from records.
‖ Analysis not completed because cell frequencies did not meet assumptions for chi-square analysis.
** Infant state is defined as the infant behaviour during the feed.
†† Feeding description is defined as the subjective measure of how well the infant was fed.

Discussion

This study described feeding practices of infants born to mothers with GDM or type 2 diabetes pre- and postpolicy and identified potential next steps for policy development and evaluation. In this study, infants born to mothers with diabetes in pregnancy were less likely to receive breast milk exclusively from birth to hospital discharge compared with the general newborn population (39). This finding is consistent with previous literature and highlights the opportunity to explore health-care providers' understanding of the unique experiences of this patient population that may influence feeding practices (8,9,11). The number of infants receiving breast milk exclusively did not differ between pre- and postpolicy groups. This finding indicates that the introduction of the hospital policy did not support breastfeeding for this group of mother-infant pairs; however, study findings highlight an opportunity for further policy development and fidelity assessment.

In this study, most infants (95% [114 of 120]) born to mothers with GDM or type 2 diabetes received some breast milk in hospital, for at least one feed; however, comparatively, few infants received breast milk exclusively (Table 2). In 2013, in Nova Scotia, approximately 62% of mothers exclusively breastfed from birth to hospital discharge, whereas in our study, 40% (48 of 120) of infants received breast milk exclusively throughout the hospital stay (39). Results from previous studies have come to similar conclusions. Rates of any breastfeeding have been found to be comparable for women with GDM, women without diabetes during pregnancy and population-based rates (9,40). However, there is evidence that women with GDM or pre-GDM are less likely to exclusively breastfeed at discharge compared with women without diabetes during pregnancy (8,9,11). This finding presents opportunities for future work to explore health-care providers' understanding of the unique breastfeeding challenges this patient population faces in the early postpartum period.

Findings from this study indicate that the policy did not have an impact on the provision of exclusive breast milk at discharge for infants born to mothers with GDM or type 2 diabetes after policy introduction. An association was found between policy group and method of feeding; however, the method does not necessarily reflect the type of feed an infant received. For example, infants fed by bottle may have received expressed breast milk. It is also important to consider that the nonsignificant results may be related to other factors, and not necessarily be indicative of the policy itself. Research often reveals gaps between evidence and practice because behaviour change in health care can be particularly complex, with barriers and facilitators to change existing at multiple levels (individual, social and organizational) (27,41). Achieving successful practice change is not a one-time implementation, a one-size fits all approach, and targeted implementation strategies may be required to overcome these barriers (27,41). One possible explanation for the lower observed exclusive breastfeeding rates and possible lack of

effect of the policy may be routine formula supplementation in hospital (25). Given the unique challenges and experiences of this patient population, they may be more likely to receive nonmedically indicated formula supplementation in hospital.

During literature review and study development, routine formula supplementation in hospital and associated provider behaviour were contextualized using the theory of planned behaviour. Health-care provider attitudes and subjective norms are explored in this framework (42). Providers have a generally positive attitude and are supportive of breastfeeding (43,44). The literature supports that providers recognize health benefits associated with breastfeeding and the importance of establishing breastfeeding shortly after birth (43,44). Nurses also acknowledge their role of providing support and assistance in hospital for breastfeeding mothers (43,44). In terms of subjective norms, relationships between providers may influence practice behaviour in a manner that either supports or conflicts with breastfeeding (45). For instance, evidence suggests that workplace cultures and routines may result in feelings of pressure to conform to practices that conflict with evidence (45,46). As previously noted, common reasons for supplementing with formula include breastfeeding problems, infant behaviour and maternal fatigue (21). Providing formula during the overnight hours may also be a common practice in some centres (21,22). Perceived behavioural control (another concept explored by the theory of planned behaviour) may also influence formula supplementation practices. Organizational constraints, including scheduling and working demands, have been cited as limitations to delivering optimal breastfeeding support (21,45). Also, additional formal training may increase provider confidence with breastfeeding assistance. There is evidence that providers may rely on personal experiences and learnings from on-the-job training to guide instruction for breastfeeding mothers (44). Although these findings may not be generalizable to the studied sample, they offer insight into potential factors shaping health-care provider formula supplementation practices. In subsequent work, we aim to explore site-specific factors, represented by the assess barriers to policy use phase of the KTA process (Figure 1) (27).

An additional finding of interest in this study is the infrequent chart documentation for specific outcomes. We found that information was often missing for the method of feeding, infant state and feeding description (Table 3). As stated in the policy, the supplemental feeding plan is to be documented in the child's health record. There may be an opportunity to gather feedback from health-care providers on the utility of current record keeping procedures and documents. Such feedback may lead to record keeping improvement.

This work has a number of strengths and limitations. A major strength is the application of a participatory approach to research and collaboration between researchers and decision-makers at the study hospital. This involved knowledge exchange throughout the planning and data collection phases of research. In terms of limitations, results from this study are specific to mothers delivering at the study hospital and may not be generalizable to other health-care centres or regions across Canada. Data collectors were not blinded to participant group (pre- or postpolicy), and data available from charts were also limited by the accuracy and completeness of records. Moreover, site record keeping procedures encourage parents and caregivers to participate in chart documentation. Although not a limitation of the study per se, this likely impacted these data. Parents and caregivers have little or no training with documentation or performing breastfeeding assessments. The impact of other hospital policies introduced during the study period should also be considered. For instance, guidelines for neonatal glucose monitoring were introduced on June 1, 2016, at the study hospital, overlapping with the prepolicy time frame.

Collecting data during a time frame immediately after policy enactment may have provided an insufficient buffer period for staff to become comfortable with the change. Moreover, staff training and education took place over the spring of 2017, overlapping the time frame for inclusion of mother-infant pairs. It is possible that staff and providers were unaware of the policy and/or had not yet received training on the policy. Future studies may also evaluate policy uptake and impact over time by applying time series evaluation methods. Such analysis could indicate whether there were lags in policy adoption. Further research may also explore feeding practices in the broader postpartum period and understand provider or caregiver reasons for supplementation. Additionally, research may consider examining demographic data (e.g. socioeconomic status, ethnicity) and data on maternal pharmacologic therapy, all of which have potential to influence feeding practices.

Conclusions

This retrospective chart audit of infant feeding practices of mother-infant pairs diagnosed with GDM or type 2 diabetes found no significant difference in the number of infants receiving breast milk at discharge between pre- and postpolicy groups. The number of infants receiving breast milk exclusively throughout the hospital stay also did not differ before and after policy introduction. Our findings indicate that the policy was not effective in facilitating breast milk provision and limiting nonmedically indicated formula supplementation in-hospital among this sample of mother-infant pairs; however, additional intervention fidelity assessment is warranted. Data on several outcomes, including feeding method, infant state and feeding description, were infrequently documented in charts for each feed. Results from this study represent an early stage of a larger integrative knowledge translation initiative. Initial steps may include collecting feedback from providers to better understand perceived facilitators and barriers to policy application, the use of job aids (e.g. record keeping tools) and practice change. Future research may also explore the health-care team's understanding of the unique experiences and needs of this patient population.

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Author Disclosures

Conflicts of interest: None.

Author Contributions

E.C. (research coordinator) contributed to study design, data collection and analysis and preparation and review of final manuscript. S.G. and G.C. contributed to study design, supervision of data collection, analysis and interpretation and preparation and review of final manuscript. J.M., K.C.W. and K.H. contributed to study design and preparation and review of final manuscript. T.R.

(research in medicine trainee) contributed to study design, data collection and preparation and review of final manuscript.

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