



RESEARCH ARTICLE

Factors Associated with Breastfeeding Duration and Satisfaction after Gestational Diabetes among Women Living in Northwest Ohio

Kerri Lynn Knippen, PhD, RDN, LD, BC-ADM¹; Natalie Walkup, MPAS, PA-C²; Cameron Burmeister, MD, MS³; Joseph Dake, PhD, MPH⁴; Kent Bishop, MD²

¹Department of Public and Allied Health, Bowling Green State University, Bowling Green, OH

²ProMedica, Toledo, OH

³College of Medicine and Life Sciences, The University of Toledo, Toledo, OH

⁴School of Population Health, The University of Toledo, Toledo, OH

Corresponding Author: Kerri Lynn Knippen, 122 Health and Human Services Building, Bowling Green, OH 43403, (419) 372-8316, kknippe@bgsu.edu

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ABSTRACT

Background: Given the potential for type 2 diabetes and the protective benefits of breastfeeding after gestational diabetes mellitus (GDM), there is a need to promote and support breastfeeding; however, delayed lactogenesis and postpartum experiences may challenge breastfeeding success. We aimed to describe factors that influence breastfeeding duration and satisfaction after GDM.

Methods: A cross-sectional survey, informed by an elicitation phase and subject matter expert review, was conducted to evaluate factors associated with breastfeeding satisfaction and duration after GDM. The study included women (n = 50) from Northwest Ohio who delivered a living child from a singleton pregnancy at greater than or equal to 34 weeks gestation, who intended to breastfeed after GDM. Spearman correlation and Mann-Whitney U test were calculated to evaluate factors associated with breastfeeding duration and satisfaction.

Results: Women described a lack of breastfeeding support, and there appeared to be a lack of awareness on the benefits of breastfeeding after GDM. Attitudes were associated with breastfeeding duration and satisfaction. Negative experiences in the child's first week of life were associated with shorter duration and lower level of satisfaction. Delayed lactogenesis, barriers after delivery, and negative normative influences were significantly associated with a lower level of breastfeeding satisfaction.

Conclusion: More work is needed to deliver breastfeeding education and support after GDM. Interventions tailored for GDM are recommended to promote positive breastfeeding beliefs and realistic breastfeeding expectations. Ongoing support to address early experiences and barriers after GDM is recommended. Further work should examine these factors in a larger, more diverse sample.

Keywords: Gestational diabetes mellitus; Lactation; Lactogenesis; Breastfeeding

INTRODUCTION

Approximately 7% to 12.5% of pregnancies in Ohio from 2009 through 2014 were impacted by gestational diabetes mellitus (GDM),¹ a condition characterized by high blood glucose in pregnancy that is not because of type 1 or type 2 diabetes.² Women with a history of GDM are at high risk for developing type 2 diabetes.³ Taking this risk into consideration, there is a need to encourage modifiable health behavior that can reduce diabetes risk; one such behavior is breastfeeding.⁴

Breastfeeding can reduce maternal fat stores, improve weight loss, and lower the risk for diabetes after GDM.⁵⁻⁸ The American Acade-

my of Pediatrics recommends sustained breastfeeding for 6 months exclusively, with a total duration of at least 1 year.⁹ Breastfeeding for a long-term duration (>10 months) can improve insulin sensitivity and glucose control after GDM;⁶ however, even 1 month⁸ to 3 months⁴ of breastfeeding can reduce maternal diabetes risk. Data from the 2009-2010 Pregnancy Risk Assessment Monitoring System (PRAMS) illustrates that Ohio women with GDM were less likely to initiate breastfeeding compared to women without GDM (69.4% versus 74.2%), and a lower proportion of women with GDM were breastfeeding at 2 weeks post partum.¹ These differences require further attention, considering the benefits of breastfeeding after GDM.



There are many factors that may influence breastfeeding duration. Milk supply is a common reason for discontinued breastfeeding.^{10,11} One concern that can compromise milk supply is delayed lactogenesis, defined as onset of milk production occurring beyond 72 hours post partum.^{12,13} Existing work has demonstrated that breastfeeding self-efficacy is negatively influenced by delayed lactogenesis.¹⁴ Without regard to GDM, women with delayed lactogenesis are more likely to discontinue breastfeeding.^{15,16} For a variety of reasons, women with GDM are at risk for delayed lactogenesis.^{17,18} While delayed lactogenesis has been cited qualitatively as a barrier to breastfeeding in the early postpartum period after GDM,¹⁸ more work is needed to understand how lactogenesis influences long-term breastfeeding outcomes after GDM.

Although duration is an important outcome to consider, there is also a need to explore factors that influence maternal satisfaction.^{19,20} In fact, breastfeeding duration and satisfaction, while related, are not the same¹⁹ and both should be prioritized.²⁰ In studies not focused on GDM, early experiences (ie, skin-to-skin contact) are associated with duration of breastfeeding,²¹ and the early use of mother's milk is correlated with maternal satisfaction.²² Unfortunately, women with GDM have earlier initiation of pumping, opposed to feeding at the breast, and formula use.²³ It is unclear how these early experiences impact breastfeeding after GDM, especially with regard to duration and maternal satisfaction.

Theoretical frameworks are commonly used to evaluate volitional health behavior,²⁴ including breastfeeding.^{25,26} An integrated behavioral model was selected for this study, as it incorporates constructs from a variety of theories, including the health belief model and the theory of planned behavior. These models have been used to understand breastfeeding duration^{27,28} and satisfaction^{29,30} in non-GDM studies. Integrated behavioral model describes the importance of reducing environmental constraints and barriers while addressing instrumental attitudes (beliefs about the behavior), experiential attitudes (feelings about the behavior and expectations), normative influences, and self-efficacy beliefs, as well as knowledge about the behavior, and prior experiences.^{24,31}

Although knowledge,²⁷ positive beliefs,²⁸ self-efficacy beliefs,²⁹ and meeting breastfeeding expectations³⁰ have shown importance to understanding breastfeeding duration and satisfaction in non-GDM women, these factors are not well-described in women with GDM. A qualitative study of Vietnamese women with a history of GDM revealed a "fear of transmitting diabetes" to the infant from breastfeeding,³² which represents a lack of knowledge. While it is not clear if women in the United States have similar beliefs, a qualitative study of low-income Ohio women with prior GDM identified gaps in knowledge related to breastfeeding after GDM.³³ Women were uncertain of the impact of glucose-lowering medications while breastfeeding.³³ Some women reported that had they known the benefits of breastfeeding after GDM, their decision to initiate or continue breastfeeding might have been different.³³ To that end, given the benefits of breastfeeding after GDM and the potential

challenges identified, a better understanding of how breastfeeding duration and satisfaction are influenced is needed to inform future studies and breastfeeding interventions for GDM.

This study aimed to expand existing work on breastfeeding experience after GDM by exploring the impact of attitudes, self-efficacy beliefs, normative influences, early experiences, and barriers on breastfeeding satisfaction and duration. The study also aimed to determine whether breastfeeding satisfaction and duration are associated with delayed lactogenesis. We hypothesized that early experiences, delayed lactogenesis, and barriers to breastfeeding would be negatively associated with breastfeeding duration and satisfaction. We also hypothesized that attitudes would be positively associated with duration and satisfaction, while lower levels of self-efficacy, support, and knowledge would have a negative impact on breastfeeding duration and satisfaction.

METHODS

Setting and Design

A cross-sectional study was conducted to examine factors associated with breastfeeding duration and satisfaction after GDM among women who delivered in a Northwest Ohio urban hospital. The study included an elicitation phase to identify relevant themes that were used to inform a cross-sectional survey.

Participants

Women were eligible if they were 19 years of age or older, intended to breastfeed, and delivered a living child from a singleton pregnancy at greater than or equal to 34 weeks gestation. A partial waiver of authorization for use of protected health information was approved by the institutional review board to screen billing and medical record data to identify an eligible sampling frame. Written informed consent was obtained for the elicitation phase, and a consent information sheet was provided to those who participated in the cross-sectional survey.

Procedures

The study was approved by ProMedica Toledo Hospital's institutional review board. A summary of the procedures used in this study is provided in **Figure 1**. A retrospective query of the obstetrical unit's billing record was completed to identify a purposive sample of women who had a delivery admission (within the time period of September 1, 2015, to August 31, 2016) and a diagnosis of GDM using the appropriate International Classification of Diseases (ICD) diagnosis codes (ICD-9, 648.80, 648.83 or ICD-10, O24.410, O24.411, O24.414). Although the conversion to ICD-10 occurred in 2015, both ICD-9 and ICD-10 codes were used to reduce the potential for missing eligible women given this transitional period. We identified 468 medical records with diagnosis of GDM.

Screening of the medical records occurred in late spring of 2017. A primary screening identified records where all inclusion and ex-

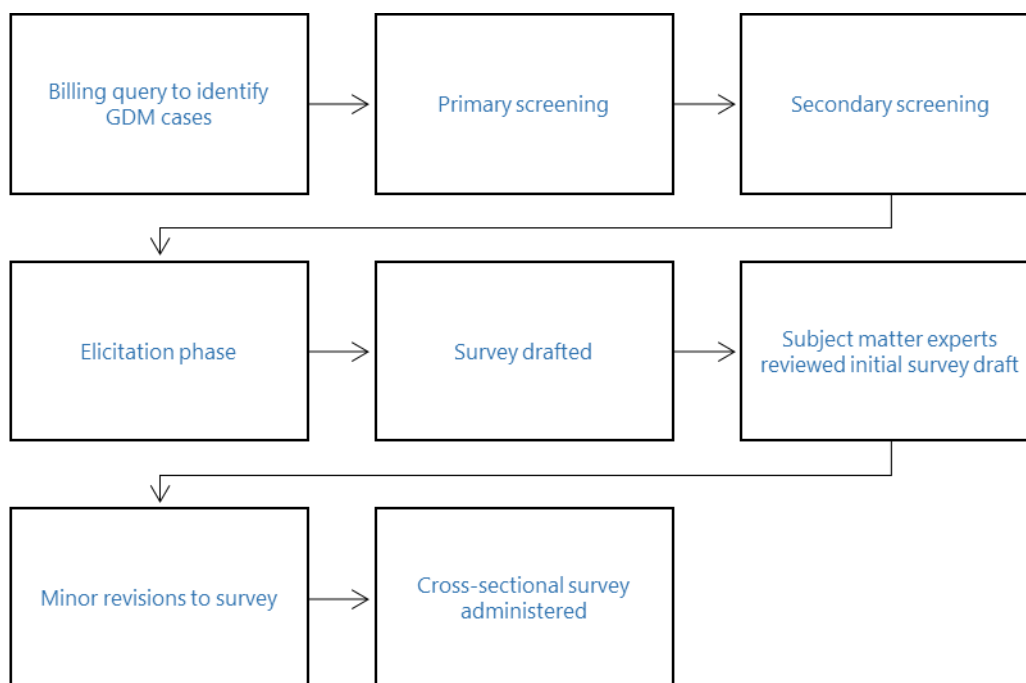


Figure 1. Overview of Study Procedures to Evaluate Breastfeeding Duration and Satisfaction among Northwest Ohio Women who Intended to Breastfeed after GDM

clusion criteria were documented, and the secondary screening identified records that met inclusion criteria. In the case of any discrepancy or uncertainty of medical notation, consensus was obtained from 2 members of the research team who conducted the screening.

The hospital system had transitioned to a new electronic system during the screening period. This presented challenges to locating eligibility criteria for cases within 2015. In addition, the initial billing query and access to the data screening system took longer than expected. As a result, a decision was made to exclude 206 records, retaining records after January 15, 2016. After the secondary screening, 160 eligible records remained. An additional 6 records were excluded due to undeliverable mail, email, or disconnected phone number.

To inform the questionnaire development, women were invited to participate in focus groups to elicit discussion about their experience. Elicitation, the use of open-ended questions to identify important issues that may facilitate or act as a barrier for a behavior, is a common practice to apply health behavioral theories in research.²⁴ A systematic random sampling approach was used to recruit 30 women, inviting every fifth eligible case. A standard phone script was used to invite women; 19 women were reached via telephone, 8 women indicated interest, and 2 focus groups were scheduled. Interested women were emailed additional details including a cover letter, consent information, and information on parking, time, and location. An email reminder was provided 48

hours in advance of the scheduled session. Women were given the opportunity to review the consent form and ask questions prior to deciding to participate. Written informed consent was obtained in person on the scheduled day. Light appetizers and refreshments were provided as an incentive for attending.

In total, 3 women consented to participate. The first session was limited to 1 participant, and she was interviewed individually. The second session was limited to 2 participants, and the women were interviewed together. Women were prompted to discuss their experience with breastfeeding using a theory-based elicitation interview guide (**Table 1**). A brief summary and debriefing were provided at the end of each session to clarify any questions or concerns identified in the discussion. A member of the research team recorded notes, and responses were audio recorded. The notes were compared to the audio record to ensure accuracy. A combination of inductive and deductive coding of the notes was completed by 2 members of the research team to identify themes relevant to breastfeeding satisfaction and duration.

Based on the information obtained from the elicitation phase and existing literature, an initial questionnaire, grounded by constructs from an integrated behavioral model, was drafted. We made minor revisions after obtaining feedback for content validity from subject matter experts ($n=4$) with expertise in maternal health, gestational diabetes, breastfeeding, and questionnaire development. The final questionnaire included 47 items.


Table 1. List of Questions Used in the Elicitation Phase

1.	How many children do you have and what are their ages?
2.	Tell us about the interaction or experience you had feeding your baby during your first 72 hours (3 days) after delivery.
3.	How would you describe your breastfeeding experience in comparison to the expectations you had about breastfeeding during your pregnancy?
4.	What motivated you to try (or consider) breastfeeding?
5.	What did you find easy about breastfeeding? What did you find challenging?
6.	Describe your support system that you had prior to delivery? How about after delivery?
7.	How do you think breastfeeding did (or would have) impacted you? And your baby?
8.	What is one thing that would have, or did, help you be more successful with breastfeeding?

Excluding the subsample of women ($n = 3$) who participated in the elicitation phase, the remainder of eligible women ($N = 151$) were then invited to participate in the survey. Mixed-mode contact was used to optimize the response rate. Initial contact was made with email and postcard notification to inform women of the upcoming opportunity to participate in a survey about their breastfeeding experience after GDM. Following the initial contact, an online invitation was delivered via email. This invitation included a unique study identification code (ID) and a link to the online consent information and Qualtrics survey. Proceeding with the survey indicated consent to participate.

Nonresponders were emailed an initial reminder within 1 week of the study invitation which was followed by a mailed postcard reminder. The postcard contained the unique study ID, the URL for the survey, and a QR code for smartphone access. During the third week, nonresponders were emailed an additional time, and a study packet containing a hard copy of the cover letter, consent information sheet, survey, and a prepaid return envelope was mailed with a due date for return within 2 weeks.

Measures

The outcome variables assessed on the cross-sectional survey included breastfeeding duration and satisfaction. The questionnaire included items related to demographics, medical and reproductive histories, prior breastfeeding experiences, breastfeeding intentions after GDM diagnosis, experiences within the child's first week of life, maternal postpartum experiences (ie, feelings of worry, shame, postpartum blues), breastfeeding complications, knowledge about breastfeeding and GDM, initial cues to action, negative normative influences (pressure from others to breastfeed), and factors that encouraged or acted as a barrier to the achievement of breastfeeding goals since delivery. The remaining psychological items assessed instrumental attitudes (4 items related to beliefs about breastfeeding [ie. importance and health benefits]), experiential attitudes (7 items related to feelings about

breastfeeding or their personal experience, i.e. ease of breastfeeding, expectations, and effort required), self-efficacy beliefs (2 items), and feelings about satisfaction with breastfeeding support and education (3 items).

Duration of breastfeeding was measured as a continuous variable (days, weeks, months of breastfeeding). Most other items included a close-ended response option, using either a dichotomous (yes/no) response option or a 4-point, balanced, bipolar, Likert scale (1 = strongly disagree to 4 = strongly agree); this method was selected to encourage a thoughtful response and avoid misinterpretation of a neutral midpoint. Reverse coding was used for negatively worded items (ie, "*Breastfeeding takes a lot of effort*"). Text entry was allowed for several responses.

Statistical Analysis

Survey data were reviewed and recoded to develop analysis variables. Lactogenesis was coded as normal (≤ 3 days post partum) or delayed (> 3 days post partum). An aggregate score was calculated for the number of cues to action, encouraging cues and barriers since delivery, and number of correct knowledge items. A dichotomous variable was created for negative normative influence, based on whether a woman indicated that she had felt pressure from family, friends, or a health care provider to breastfeed. A composite score was calculated for remaining psychological subscales and Cronbach α was used to assess internal reliability. Descriptive statistics and bivariate analyses were conducted using SPSS, Version 24.0.³⁴ Based on the Kolmogorov-Smirnov test ($P < .001$), Mann-Whitney U test (U) was used to assess the difference between breastfeeding duration and satisfaction based on whether a woman experienced delayed lactogenesis. Spearman correlation (r_s) was calculated to assess the impact of knowledge, cues, attitudes, early experiences, self-efficacy, satisfaction with support, normative influence, and barriers regarding breastfeeding duration and satisfaction.



RESULTS

Elicitation Results

Common themes about the breastfeeding experiences of women who participated in the elicitation phase are summarized in **Table 2**. Early experiences in the first week of life were particularly important. When comparing experience with expectations, a woman stated, *"GDM didn't make it more challenging, just a rough start."* Early use of formula, neonatal hypoglycemia, latching difficulty, and concern over milk supply was described as having an impact on their breastfeeding attitudes and perceptions. While we anticipated that early experiences would be important, women stressed their fears regarding the infant's blood glucose. Women also expressed concerns related to finding a "balance" after GDM and uncertainties about milk supply, blood glucose, and losing weight.

Barriers included transitioning to work, stigma, and family's influence. Women specifically highlighted excessive pressure from others and feelings of shame when milk production was not sufficient. Women also described the lack of support and resources in the hospital and after discharge. Women cited maternal and infant benefits of breastfeeding; however, there was a lack of awareness regarding the benefits of breastfeeding after GDM.

As a result of these findings, 2 items related to negative normative influence (pressure to breastfeed) were incorporated into the questionnaire. Items related to the infant's blood glucose and concerns about their own blood glucose were incorporated in the survey. In addition, we included items regarding a woman's support before delivery, in the hospital, and after the hospital, as well as a woman's satisfaction with the support she received for breastfeeding from her health care providers. As a result of the elicitation phase, we were interested in the self-efficacy of women to

access breastfeeding support. Given the overall lack of awareness regarding breastfeeding after GDM, we included questions to assess whether women had received counseling on postpartum risk reduction, and if that included breastfeeding.

Survey Results

A total of 50 surveys were returned for a 33% response rate. Among nonresponders, the average time that had passed since delivery admission until survey invitation was 69 weeks, whereas 58 weeks (range 44-77 weeks) had passed for responders. These differences may correspond with nonresponders having a lack of interest, given the longer recall period. Most responders (**Table 3**) were non-Hispanic, white women, most were married or in a committed relationship, and the mean age was 33 years (SD = 5.20). Most had a prior viable pregnancy, prior breastfeeding attempt, yet no history of GDM. Women delivered on average at 38.5 weeks gestation, and the average birth weight was 3370 grams (SD = 394).

Regarding the outcome variables, 33% of women reported delayed lactogenesis, and 68% reported that they were satisfied with their breastfeeding experience after GDM. The duration of breastfeeding ranged from 1 week to 64 weeks (Median = 14 weeks). Collectively, 36% reported breastfeeding for 6 weeks or less, and 50% breastfed less than or equal to 12 weeks. Among those who set a duration goal, 59% did not meet their goal; 82% of those who did not meet their goal were dissatisfied with their experience. Delayed onset was not associated with duration of breastfeeding ($U = -0.49, P = 0.64$); however, it was associated with a lower level of breastfeeding satisfaction ($U = -3.01, P = 0.007$). Among women with delayed lactogenesis, 46% were dissatisfied with their breastfeeding experience.

Table 2. Themes and Sample Quotes from Women with Attempted Breastfeeding after GDM

Theme	Sample quotes
Early experiences, attitudes, and perceptions	<p>"The first few days were rough time, I wanted to nurse, but baby could not latch, she was on me a lot because she was not getting enough milk."</p> <p>"Scariest thing, blood sugar test immediately was a blood sugar of 20, scared living day lights out of me...someone came in and brought 'Formula' right away."</p> <p>"Not knowing how much they are getting."</p>
Normative influence and lack of support as barrier to breastfeeding	<p>"Nurses seemed to not know I had GDM...never met with dietitian or maternal fetal medicine provider after delivery, had to advocate for self."</p> <p>"Family grabbed bottle because I was not around and disrupted cycle...done fighting everyone."</p> <p>"I did feel really pressured. 'Why aren't you still nursing?' "</p>
Perceived benefits	<p>"Breast is best, right...I nursed all my children, helps with immune system, reduce obesity, a lot of things."</p> <p>"Wanted the bond and feel closer to my daughter."</p>

**Table 3. Demographic and Health Characteristics of Northwest Ohio Women (n = 50) who Intended to Breastfeed after GDM**

Variable	n (%) ^a
Ethnicity	
Hispanic	6 (12)
Non-Hispanic	44 (88)
Race	
Black or African American	1 (2)
White	48 (96)
Multiracial	1 (2)
Married/Committed relationship	47 (94)
Household income	
Less than \$20 000	2 (4)
\$20 000 – \$49 999	7 (14)
\$50 000 – \$99 999	22 (44)
\$100 000 or more	17 (34)
Not sure	2 (4)
WIC participation	7 (14)
Delivery type	
Vaginal delivery	31 (62)
Cesarean delivery, scheduled	11 (22)
Cesarean delivery, emergency	7 (15)
Parity (delivered where at least 5 months pregnant)	
0	2 (4)
1	15 (30)
2	26 (52)
3	5 (10)
4	2 (4)
Prior GDM	14 (28)
Prior breastfeeding attempt	36 (72)
Lactogenesis	
Normal (\leq 3 days post partum)	29 (67.4)
Delayed ($>$ 3 days post partum)	14 (32.6)
Management of GDM	
Diet	50 (100)
Monitoring of glucose	50 (100)
Physical activity	39 (78)
Oral medications	18 (36)
Insulin	11 (22)

^a % based on valid percentage

Internal reliability was calculated using Cronbach α for each psychosocial scale; results ranging from 0.69 to 0.88 were considered acceptable for continued analyses. The results of the bivariate analyses are summarized in **Table 4**. Experiential attitudes, the feelings about breastfeeding and a woman's experience, correlated with duration and satisfaction. Satisfaction with prior breastfeeding experience was positively associated with current breastfeeding duration and satisfaction. Instrumental attitudes,

beliefs about the benefits and importance of breastfeeding, also correlated with duration and satisfaction.

A higher number of negative experiences in the child's first week of life (ie, introduction of formula, breathing problems, jaundice, neonatal intensive care unit (NICU) admission) was negatively associated with duration of breastfeeding and satisfaction (**Table 4**). Maternal postpartum experience (ie, postpartum blues, worry



and feelings of shame regarding milk supply) was also negatively associated with duration and satisfaction.

A higher level of encouraging cues after delivery was correlated with a higher level of satisfaction, while a higher number of barriers after delivery was negatively associated with duration and satisfaction (Table 4). Self-efficacy was positively associated with duration and satisfaction, whereas negative normative influence (pressure from others to breastfeed since delivery) was correlated with a lower level of satisfaction.

DISCUSSION

This study aimed to identify factors associated with breastfeeding duration and satisfaction. Attitudes were associated with breastfeeding duration and satisfaction, while early experiences correlated with a shorter duration and a lower level of satisfaction. The use of constructs from an integrated behavioral framework appears relevant in the context of understanding breastfeeding satisfaction and duration after GDM. Although the findings on positive beliefs are consistent with existing research,^{28,35} this study highlights the impact of experiential attitudes and unavoidable challenges associated with breastfeeding after GDM. Proactive and ongoing support is needed to help women navigate the distinct challenges of breastfeeding after GDM, including delayed lactogenesis.

Consistent with past research on delayed lactogenesis after GDM,^{17,18} one-third of women reported delayed lactogenesis, and 40% reported that milk supply was a barrier to reaching breastfeeding goals. While delayed lactogenesis was not related to dura-

tion of breastfeeding, it was associated with a lower level of breastfeeding satisfaction. There is currently a lack of best practices or interventions to address delayed lactogenesis; however, assessment of lactogenesis and proactive recognition of delayed lactogenesis may help coordinate a woman's postpartum breastfeeding plan after GDM.

Instrumental (beliefs about breastfeeding) and experiential attitudes (expectations and feelings about the experience) were correlated with satisfaction and duration. The finding related to experiential attitudes and satisfaction is an important contribution from this study. Forty-six percent of women reported that breastfeeding was uneasy or not easy at all compared to their expectations. It is possible that negative early experiences, including those in the child's first week of life challenged breastfeeding expectations. Women should be informed of the potential challenges related to breastfeeding after GDM (ie, delivery type, delayed lactogenesis, and infant complications). Although these challenges may not be always avoided, interventions may be enhanced by improving beliefs about the perceived benefits of breastfeeding after GDM while also addressing self-efficacy and expectations over the course of the breastfeeding experience.

Most survey respondents had prior experience with breastfeeding, and prior breastfeeding satisfaction was associated with current satisfaction and duration. Yet, among those with prior experience, 60% reported that breastfeeding after GDM was somewhat uneasy or not easy at all, and 32% of the overall sample did not feel confident to breastfeed future children. Given the relationships between prior experience and current satisfaction and duration, it

Table 4. Impact of Variables from an Integrated Behavioral Model on Breastfeeding Duration and Satisfaction among a Sample of Northwest Ohio Women with History GDM (n = 50) who Intended to Breastfeed

	Duration r_s	P	Satisfaction r_s	P
Prior breastfeeding satisfaction	.70	<.001	.72	<.001
Initial cues to action	-.09	.62	.27	.06
Knowledge	-.06	.72	.16	.26
Negative first week experiences	-.36	.03	-.32	.03
Maternal postpartum experience	-.42	.01	-.47	.001
Experiential attitudes	.67	<.001	.75	<.001
Instrumental attitudes	.35	.04	.43	.002
Negative normative influence	-.25	.14	-.43	.002
Self-efficacy beliefs	.37	.03	.52	<.001
Satisfaction with support	.05	.79	.41	.003
Encouraging cues after delivery	.35	.04	.59	<.001
Barriers after delivery	-.44	.008	-.69	<.001



may be important to investigate how challenging experiences after GDM may influence future breastfeeding intentions and expectations, especially for first-time mothers or those without prior breastfeeding experience. Health care providers should assess for prior negative experiences, as these women may benefit from additional support and counseling to encourage breastfeeding success.

Although the overall knowledge score was not significantly related to the outcome variables, 62% of the sample erroneously believed that *"If a mother's blood sugar is high, excess sugar could pass into the breastmilk."* Qualitative findings demonstrated that women were generally unaware of the benefits of breastfeeding specific to GDM. While most women (72%) reported some form of postpartum education to reduce risk for diabetes, this did not address breastfeeding after GDM for most women (74%). Early use of formula, lack of provider support, and mixed messages were cited in the qualitative interviews. Similarly, data from the Infant Feeding Practices Study II suggest that women with GDM were less likely to report that breastfeeding was ideal, and women with GDM were 3 times as likely to report that their health care provider preferred the use of formula.³⁶ There appears to be a need for consistent breastfeeding messaging that is tailored to address the specific benefits of breastfeeding after GDM. These efforts could be feasibly incorporated into postpartum care planning, starting in pregnancy.

Initial breastfeeding cues to action (before delivery) was not significantly related to breastfeeding duration or satisfaction. It is possible that cues to action may have contributed to breastfeeding attitudes; however, this was not a focus of this study. Encouraging cues after delivery were associated with breastfeeding duration and satisfaction. In contrast, negative maternal postpartum experiences and pressure from others to breastfeed correlated with a lower level of breastfeeding satisfaction. This suggests the importance of support that is positively framed. Efforts to educate family members and health care providers may be warranted to help women feel supported, rather than feeling ashamed about her breastfeeding experience or milk supply.

Most women (74%) were satisfied with breastfeeding education received during pregnancy; however, a higher proportion were dissatisfied with postdelivery education and support. Several women indicated no support, while others reported that social media and the internet were their primary sources of education and support after delivery. These findings are important, given the impact of barriers and self-efficacy. Women who participated in the elicitation phase cited an interest in having support from other women who have experienced GDM or low milk supply; this is in alignment with the US Preventive Services Task Force's recommendation for peer support.³⁷ Future programs should consider ways to assess a woman's self-efficacy and incorporate ongoing support, including the support of peers.

Identification of all eligible cases was not possible due to insufficient information in the screening record, and this may have led to sampling bias. It is also possible that nonresponders had a more challenging experience, which influenced their decision to not participate. The lack of diversity in the sample further limits the external validity. As a result, these factors limited the elicitation sample size, the potential for saturation, and the capture of a range of experiences to inform the survey. While common themes were identified and incorporated into the questionnaire, it is possible that other experiences not described in the elicitation phase have importance to breastfeeding after GDM. Phone interviews may be practical to use in future studies, given the challenges women are balancing in the first year post partum.

Some scales in the survey instrument were limited to a few items which may limit the understanding of the construct. This study is also limited by the potential for social desirability bias. Another significant limitation is that retrospective recall was required, which may increase reporting error. It is possible that women misreported the onset of lactogenesis. It is also conceivable that women who had a more challenging experience may have been able to recall a greater number of challenges or exaggerated their experience, whereas those who had a positive experience may have underestimated barriers or the positive impact of support.

Given that this was a small study with a limited sample size, descriptive statistics and bivariate tests were used to describe potential relationships of interest to breastfeeding satisfaction and breastfeeding duration. Future work including a larger, diverse sample and the use of multivariate analyses that control for confounders may improve understanding of these relationships. Despite these limitations, the exploratory study does provide insight into the possible facilitators and challenges to breastfeeding satisfaction and duration after GDM.

PUBLIC HEALTH IMPLICATIONS

From a public health standpoint, our study identified gaps in care, support, and the need to enhance early experiences with breastfeeding after GDM. While the findings are exploratory and have limited external validity, the information was shared with the hospital's women's services and maternal fetal medicine administration to initiate efforts to improve breastfeeding after GDM. Since this study, the hospital has explored opportunities to address postpartum health in general and efforts are continuing.

The findings suggest a need for health communication interventions that start in pregnancy to optimize attitudes about the importance of breastfeeding after GDM. Given that expectations will change over time with experience, it is important that interventions continue in the postpartum period to address negative experiential feelings. Community resources to provide ongoing support after GDM are recommended. While programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) are available in the community, not all women will



qualify for this program. Peer support programs focused on the woman with GDM should be explored by community breastfeeding programs and hospital outreach efforts.

Early experiences may also be influenced by improved hospital practices and postdelivery support. The Baby-Friendly Hospital Initiative (BFHI) encourages breastfeeding by improving hospital practices including, but not limited to, counseling mothers, providing mothers with support, and encouraging positive early experiences such as skin-to-skin contact and rooming in.³⁸ This initiative also ensures that staff have adequate knowledge and skills to support breastfeeding. The hospital where women were recruited is not BFHI-certified; however, it participates in Ohio's First Steps for Healthy Babies³⁹ program, which is modeled after BFHI.⁴⁰ While BFHI does not address GDM specifically, the broad clinical practice goals in combination with specific training and resources for GDM and breastfeeding could be explored. Collectively, this study provides a better understanding of the factors that have importance to breastfeeding outcomes after having GDM, but more work is needed.

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REFERENCES

- Conrey EJ, Shellhaas C, Wapner A, Oza-Frank R, Michael D. Gestational diabetes in Ohio: 2009-2014. Ohio Department of Health. Published November 2016. Accessed October 16, 2019. <https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/gestational-diabetes/collaborative/>
- American Diabetes Association. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2020. *Diabetes Care*. 2020; 43(Supplement 1): S14-S31. doi:10.2337/dc20-S002
- American Diabetes Association. Management of Diabetes in Pregnancy: Standards of Medical Care in Diabetes—2020. *Diabetes Care*. 2020; 43 (Supplement 1): S182-S192. doi:10.2337/dc20-S014
- Ziegler AG, Wallner M, Kaiser I, et al. Long-term protective effect of lactation on the development of type 2 diabetes in women with recent gestational diabetes mellitus. *Diabetes*. 2012; 61(12):3167-3171. doi:10.2337/db12-0393
- Gunderson, EP, Hurston, SR, Ning, X, et al. Lactation and progression to type 2 diabetes mellitus after gestational diabetes: a prospective cohort study. *Ann Intern Med*. 2015; 163(12):889-898. doi:10.7326/M15-0807
- Chouinard-Castonguay S, Weisnagel SJ, Tchernof A, Robitaille J. Relationship between lactation duration and insulin and glucose response among women with prior gestational diabetes. *Eur J Endocrinol*. 2013; 168(4):515-523. doi:10.1530/EJE-12-0939
- Dieterich CM, Felice JP, O'Sullivan E, Rasmussen KM. Breastfeeding and health outcomes for the mother-infant dyad. *Pediatr Clin North Am*. 2013 Feb; 60(1):31-48. doi:10.1016%2Fj.pcl.2012.09.010
- Schwarz EB, Nothnagle M. The maternal health benefits of breastfeeding. *Am Fam Physician*. 2015 May; 91(9):602-604.
- American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. *Pediatr*. 2012; 129(3):e827-e841. doi:10.1542/peds.2011-3552
- Rozga MR, Kerver JM, Olson BH. Self-reported reasons for breastfeeding cessation among low-income women enrolled in a peer counseling breastfeeding support program. *J Hum Lact*. 2015; 31(1):129-137. doi:10.1177/0890334414548070
- Hornsby PP, Gurka KK, Conaway MR, Kellams AL. Reasons for early cessation of breastfeeding among low income women. *Breastfeed Med*. 2019; 14(6):375-381. doi:10.1089/bfm.2018.0206
- Dewey KG, Nommsen-Rivers LA, Heinig MJ, Cohen RJ. Risk factors for suboptimal infant breastfeeding behavior, delayed onset of lactation, and excess neonatal weight loss. *Pediatrics*. 2003 Sep; 112(3pt1):607-619. doi:10.1542/peds.112.3.607
- Grajeda R, Pérez-Escamilla R. Stress during labor and delivery is associated with delayed onset of lactation among urban Guatemalan women. *J Nutr*. 2002 Oct; 132(30):3055-3060. doi:10.1093/jn/131.10.3055
- Chertok IR, Sherby E. Breastfeeding self-efficacy of women with and without gestational diabetes. *Am J Matern Child Nurs*. 2016 May-Jun; 41(3): 173-180. doi:10.1097/NMC.0000000000000233
- Nommsen-Rivers LA, Mastergeorge AM, Hansen RL, Cullum AS, Dewey KG. Doula care, early breastfeeding outcomes, and breastfeeding status at 6 weeks postpartum among low-income pima women. *J Obstet Gynecol Neonatal Nurs*. 2009 Mar-Apr; 38(2):157-173. doi:10.1111/j.1552-6909.2009.01005.x
- Brownell E, Howard CR, Lawrence RA, Dozier AM. Delayed onset lactogenesis II predicts the cessation of any or exclusive breastfeeding. *J Pediatr*. 2012 Oct; 161(4):608-614. doi:10.1016/j.jpeds.2012.03.035
- Matias SL, Dewey KG, Quesenberry CP Jr, Gunderson EP. Maternal prepregnancy obesity and insulin treatment during pregnancy are independently associated with delayed lactogenesis in women with recent gestational diabetes mellitus. *Am J Clin Nutr*. 2014 Jan; 99(1): 115-121. doi:10.3945/ajcn.113.073049
- Jagiello KP, Azulay Chertok IRA. Women's experiences with early breastfeeding after gestational diabetes. *J Obstet Gynecol Neonatal Nurs*. 6459 Jul-Aug; 44(4):500-509. doi:10.1111/1552-6909
- McBride-Henry K, White G, Benn C. Inherited understandings: The breast as object. *Nurs Inq*. 2009 Mar; 16(1):33-42. doi:10.1111/j.1440-1800.2009.00428.x
- Edwards R. An exploration of maternal satisfaction with breastfeeding as a clinically relevant measure of breastfeeding success. *J Hum Lact*. 2018 Feb; 34(1):93-96. doi:10.1177/0890334417722509
- Forster DA, Johns HM, McLachlan HL, Moorhead AM, McEgan KM, Amir LH. Feeding infants directly at the breast during the postpartum hospital stay is associated with increased breastfeeding at 6 months postpartum: a prospective cohort study. *BMJ Open*. 2015 May; 5(5):e007512. doi:10.1136%2Fbmjopen-2014-007512
- Fischer-Fumeaux CJ, Denis A, Prudon MB, et al. Early use of mother's own raw milk, maternal satisfaction, and breastfeeding continuation in hospitalised neonates: a prospective cohort study. *Neonatology*. 2018; 113(2):131-139. doi:10.1159/000480535
- Oza-Frank R, Moreland JJ, McNamara K, Geraghty SR, Keim SA. Early lactation and infant feeding practices differ by maternal gestational



- diabetes history. *J Hum Lact.* 2016 Nov; 32(4):658-665. doi:10.1177/0890334416663196
24. Montano DE, Kasprzyk D. Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model. In: Glanz K, Rimer BK, Viswanath, eds. *Health Behavior: Theory, Research, and Practice.* 5th ed. San Francisco, CA: Jossey-Bass; 2015:168-222.
 25. Park S, Lee JL, In Sun J, Kim Y. Knowledge and health beliefs about gestational diabetes and healthy pregnancy's breastfeeding intention. *J Clin Nurs.* 2018 Nov; 27(21-22):4058-4065. doi:10.1111/jocn.14539
 26. Lau CYK, Lok KYW, Tarrant M. Breastfeeding duration and the theory of planned behavior and breastfeeding self-efficacy framework: a systematic review of observational studies. *Matern Child Health J.* 2018 Mar; 22(3):327-342. doi:10.1007/s10995-018-2453-x
 27. Wallenborn JT, Ihongbe T, Rozario S, Masho SW. Knowledge of breastfeeding recommendations and breastfeeding duration: A survival analysis on Infant Feeding Practices II. *Breastfeed Med.* 2017 Apr; 12(3):156-162. doi:10.1089/bfm.2016.0170
 28. Schafer EJ, Campo S, Colaizy TT, Mulder PJ, Breheny P, Ashida S. First-time mothers' breastfeeding maintenance: role of experiences and changes in maternal perceptions. *Public Health Nutr.* 2017 Dec; 20(17):3099-3108. doi:10.1017/S136898001700221X
 29. Awaliyah SN, Rachmawati IN, Rahmah H. Breastfeeding self-efficacy as a dominant factor affecting maternal breastfeeding satisfaction. *BMC Nurs.* 2019 Aug 16; 18(1):30. doi:10.1186/s12912-019-0359-6
 30. Gregory EF, Butz AM, Ghazarian SR, Gross SM, Johnson SB. Met expectations and satisfaction with duration: a patient-centered evaluation of breastfeeding outcomes in the infant feeding practices study II. *J Hum Lact.* 2015 Aug; 31(3):444-451. doi:10.1177/0890334415579655
 31. Fishbein M, Yzer MC. Using theory to design effective health behavior interventions. *Commun Theory.* 2003 May; 13(2):164-183. doi:10.1111/j.1468-2885.2003.tb00287.x
 32. Hirst JE, Tran TS, Do MA, Rowena F, Morris JM, Jeffery HE. Women with gestational diabetes in Vietnam: a qualitative study to determine attitudes and health behaviors. *BMC Pregnancy Childbirth.* 2012; 12:81-91. doi:10.1186/1471-2393-12-81
 33. Oza-Frank R, Conrey E, Bouchard J, Shellhaas C, Weber MB. Healthcare experiences of low-income women with prior gestational diabetes. *MCHJ.* 2018 Jul; 22(7):1059-1066. doi:10.1007/s10995-018-2489-y
 34. IBM Corp. Released 2016. IBM SPSS Statistics for Mac, Version 24.0. Armonk, NY: IBM Corp.
 35. Wallenborn JT, Perera RA, Masho SW. Breastfeeding after gestational diabetes: does perceived benefits mediate the relationship? *J Pregnancy.* 2017 March 22. doi.org/10.1155/2017/9581796
 36. Doughty KN, Ronnenberg AG, Reeves KW, Qian J, Sibeko L. Barriers to exclusive breastfeeding among women with gestational diabetes mellitus in the United States. *J Obstet Gynecol Neonatal Nurs.* 2018 May; 47(3):301-315. doi:10.1016/j.jogn.2018.02.005
 37. Bibbins-Domingo, K, Grossman, DC, Curry, SJ, et al. Primary care interventions to support breastfeeding: US Preventive Services Task Force Recommendation Statement. *JAMA.* 2016 Oct 25; 316(16),1688-1693. doi:10.1001/jama.2016.14697
 38. Baby-Friendly USA. *Guidelines and Evaluation Criteria for Facilities Seeking Baby-Friendly Designation.* Albany, NY: Baby-Friendly USA, 2016.
 39. Ohio Hospital Association First Steps for Healthy Babies. Accessed March 1, 2020. <https://ohiohospitals.org/Patient-Safety-Quality/Statewide-Initiatives/Infant-Mortality-Initiatives/First-Steps>
 40. Highlighting improvements in breastfeeding outcomes across Ohio. Ohio Hospital Association and the Ohio Department of Public Health. Accessed May, 2020. <https://ohiohospitals.org/OHA/media/OHA-Media/Documents/News%20and%20Publications/Newsletters/First-Steps-BF-Month-flier-2019.pdf>

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