Original Article

Obese women experience multiple challenges with breastfeeding that are either unique or exacerbated by their obesity: discoveries from a longitudinal, qualitative study

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Abstract

Obese women are at risk for shorter breastfeeding duration, but little is known about how obese women experience breastfeeding. The aim of this study was to understand obese women's breastfeeding experiences. We enrolled pregnant women in upstate New York, who were either obese [$n = 13$; body mass index (BMI) $\geq 30 \text{ kg/m}^2$] or normal weight ($n = 9$; BMI $18.5\text{--}24.9 \text{ kg/m}^2$) before conception and intended to breastfeed. A longitudinal, qualitative study was conducted from February 2013 through August 2014 with semi-structured interviews during pregnancy and at specific times post-partum through 3 months. Interviews were audio recorded, transcribed and analyzed using content analysis. Themes that emerged in analysis were compared between obese and normal-weight women. Differences were identified and described. Prenatally, obese women expressed less confidence about breastfeeding than normal-weight women. Post-partum, obese women and their infants had more health issues that affected breastfeeding, such as low infant blood glucose. Compared with normal-weight women, they also experienced more challenges with latching and positioning their infants. Breastfeeding required more time, props and pillows, which limited where obese women could breastfeed. Obese women also experienced more difficulty finding nursing bras and required more tangible social support than normal-weight women. In conclusion, obese women experienced more challenges than women of normal weight; some challenges were similar to those of normal-weight women but were experienced to a greater degree or a longer duration. Other challenges were unique. Obese women could benefit from targeted care prenatally and during the hospital stay as well as continued support post-partum to improve breastfeeding outcomes. © 2016 John Wiley & Sons Ltd

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Introduction

Maternal obesity, the condition of having excessive weight during pregnancy, is associated with adverse outcomes for both mothers and their infants (Weiss *et al.* 2004; American College of Obstetricians and Gynecologists (ACOG) 2013), including poorer breastfeeding outcomes (Amir & Donath 2007; Rasmussen 2007; Wojcicki 2011). High prepregnancy body mass index (BMI; defined as kg/m^2) has been

consistently associated with shorter duration of exclusive or full (Baker *et al.* 2007; Mok *et al.* 2008; Hauff *et al.* 2014) and any (Oddy *et al.* 2006) breastfeeding, except among African American women (Kugyelka *et al.* 2004; Liu *et al.* 2010). Furthermore, the risk of early breastfeeding cessation increases as BMI rises (Baker *et al.* 2007). Obesity has been associated with poor breastfeeding outcomes in several countries, including the United States (US) (Li *et al.* 2003), Australia (Oddy *et al.* 2006), Denmark (Baker *et al.* 2007), France (Mok

et al. 2008) and the United Kingdom (Sebire *et al.* 2001). Importantly, this association persisted after adjusting for potential confounders such as socioeconomic status (SES), education and parity (Amir & Donath 2007). Poorer breastfeeding outcomes among obese women are a concern because obesity now affects more than a third of US women of reproductive age (Flegal *et al.* 2012) and because breastfeeding provides a unique opportunity to improve and protect the health of the obese mother and her infant (Dieterich *et al.* 2013).

Biological factors may partially explain the links between maternal obesity and poor breastfeeding outcomes. Obese women have delayed copious milk secretion (Dewey *et al.* 2003; Hilson *et al.* 2004; Nommsen-Rivers *et al.* 2010) and a blunted prolactin response to suckling early post-partum (Rasmussen & Kjolhede 2004). Furthermore, women who are obese may have larger breasts or flat nipples, which have been identified as problematic for proper latching (Jevitt *et al.* 2007; Katz *et al.* 2010). Previous interventions that aimed to address these biological and physical factors by providing extra support from lactation consultants (BIBS 1) or pumping (BIBS 2) failed to improve obese women's breastfeeding outcomes (Rasmussen *et al.* 2011). These were small pilot interventions (sample size of 40 in BIBS 1 and 34 in BIBS 2); however, it is notable that breastfeeding duration tended to be shorter in the groups receiving the interventions, a trend that was opposite of that which was expected. A larger and more intensive intervention that provided specialized peer counselling support to obese women also had no effect on exclusive breastfeeding duration at 1, 3 or 6 months (Chapman *et al.* 2013). The failure of these

interventions suggests that obese women experience barriers that have not yet been fully understood or addressed.

It is largely unknown how obese women experience breastfeeding or what they perceive as barriers to and supports for breastfeeding. In our previous research, we (Garner *et al.* 2014) identified breastfeeding challenges perceived by health professionals among obese women. Only one previous study used qualitative methods to explore obese women's perceptions of their breastfeeding experiences by interviewing women after they stopped breastfeeding (Keely *et al.* 2015). Our aim was to understand obese women's experiences and perceptions longitudinally, with a normal-weight comparison group, beginning in late pregnancy and continuing through 3 months post-partum, to identify key experiences and barriers that are unique to or more common among obese women.

Methods

Pregnant women who intended to breastfeed were recruited in upstate New York using flyers and brochures in obstetrics, midwifery and family medicine practices, hospital maternity ward tours, birthing classes and prenatal care programmes as well as using chain referral. The recruitment materials advertised the study to 'pregnant women with a variety of body sizes' as a means to 'understand how moms experience breastfeeding in our society'. To avoid influencing how women described their experiences, materials did not indicate that obesity was a factor being investigated.

Key messages

- Obese women experienced breastfeeding challenges similar to normal-weight women, such as positioning difficulties, but to a greater degree or for a longer duration.
- Prenatal confidence about breastfeeding plans was lower among obese women, particularly those who were primiparous or lacked previous breastfeeding experience.
- Post-partum health concerns, such as post-caesarean health/healing and infant low blood glucose, were more common among obese mother–infant dyads and negatively affected breastfeeding.
- Obese mothers had greater need for tangible support post-partum.
- Interventions are needed to address obese women's concerns about and challenges with breastfeeding from pregnancy through the post-partum period.

Women interested in participating contacted the researchers and completed a screening questionnaire over the phone to provide demographic information. Eligible women were either obese ($\text{BMI} \geq 30 \text{ kg/m}^2$) or normal weight ($\text{BMI} 18.5\text{--}24.9 \text{ kg/m}^2$) based on self-reported pre-conception weight and height, and in their third trimester with a singleton fetus. They intended to breastfeed, had no history of breast surgery and were purposively selected to obtain a diverse sample. Women who delivered preterm (<37 weeks gestation) or had severe complications of delivery that resulted in prolonged separation from the infant were excluded. Informed consent was obtained from each participant before enrollment, and women received a \$20 gift card to their choice of a grocery or big-box store (such as Walmart or Target) upon completion of each interview. Enrollment ceased when data saturation – the point at which no new information was obtained with additional data collection – was reached. This study was approved by the institutional review boards at the University of Rochester (protocol RSRB00044666) and Cornell University (protocol 1211003416).

Semi-structured interviews were conducted by CDG with each participant: (1) during pregnancy and postpartum at (2) 7 to 10 days, (3) 6 weeks and (4) 3 months, with (5) an optional 6-month phone call. If a woman stopped breastfeeding before 3 months, a final interview was conducted after breastfeeding ceased. Each woman completed between two and five interviews between February 2013 and August 2014. Interviews took place in locations chosen by participants to facilitate private conversations, usually their homes. Interview guides (supplementary appendix) were tested with women who were similar to those we intended to recruit. Questions were developed based on previous research findings and current gaps in knowledge and were modified, added, removed or re-ordered based on analysis of audio recordings and feedback from practice participants. The revised interview guides were used to assist with data collection; however, interviews were largely participant-directed. The Interpersonal Support Evaluation Survey (ISEL-12) (Cohen *et al.* 1985), a validated questionnaire that measures three types of social support, was completed by participants at each interview.

Interviews were audio recorded, transcribed, de-identified and checked for accuracy. Analysis of

transcripts was iterative and conducted with the assistance of ATLAS.ti 7 (Berlin, Germany) software and field notes that were recorded immediately after each interview. A team of four researchers (including CDG and SAM) used content analysis with a combination of predetermined and emergent codes (Hsieh & Shannon 2005). Predetermined codes were developed based on results of previous research. The team met weekly to discuss differences that emerged between obese and normal-weight women and to come to agreement on analysis. Themes that emerged were organized into subthemes and categories, and influential circumstances were identified that related to the themes. Social support codes emerged from the data both as support that women received and support of which women wanted more. These codes were categorized into advice/information, tangible and emotional support that was received or that was desired. The ISEL-12 results were used to triangulate (Greene & McClintock 1985) how social support was coded in transcripts but are not presented here. Pseudonyms were used to protect participants' identities.

Results

Participants

Twenty-six women were enrolled, and 22 women were followed longitudinally. The four women who were not followed longitudinally were excluded due to preterm birth ($n=1$), severe delivery complications with the mother ($n=1$), severe infant complications after birth ($n=1$) and infant death ($n=1$). Among those who remained in the study, 13 were obese, nine were normal weight and the two groups were similar in important social characteristics except that more obese women had low SES as determined by their participation in the Supplemental Nutrition Program for Women Infants and Children (WIC), a federal programme that provides supplemental foods and nutrition education to low-income pregnant and post-partum women and children (Table 1). Women gave birth in five different hospitals. All 22 women initiated breastfeeding, and 18 continued breastfeeding to some extent at 3 months. All four women who stopped breastfeeding before 3 months were obese. In the first 10 days, more than half of the

Table 1. Participant characteristics of obese and normal-weight women

Characteristics	Obese (<i>n</i> = 13)	Normal weight (<i>n</i> = 9)
BMI prepregnancy, kg/m ²		
Mean	39.5	21.6
Range	29.2–68.5	18.8–23.8
Age, <i>n</i>		
<30 years	5	3
≥30 years	8	6
Parity, <i>n</i>		
Nulliparous	8	6
Multiparous	5	3
Race, <i>n</i>		
White	9	8
Black	3	1
Other	1	0
Marital status, <i>n</i>		
Married	7	7
Partner, unmarried	5	1
Single	1	1
Education, <i>n</i>		
< College	7	4
≥ College	6	5
WIC participation, <i>n</i>	6	1
Delivery type, <i>n</i>		
Caesarean	6	2
Vaginal	7	7
Breastfeeding at 3 months, <i>n</i>		
Exclusive	5	7
Any	9	9

WIC, Women Infants and Children.

obese women (7 of 13) supplemented with formula, compared with two of the nine normal-weight women. In total, 90 interviews were conducted from pregnancy through 3 months, and 13 were conducted at 6 months.

Presentation of themes

Themes emerged in which obese and normal-weight women differed, including prenatal breastfeeding confidence, health issues for both mothers and infants that affected breastfeeding, difficulty or ease with which women positioned and latched their babies, challenges of finding nursing bras and social support (Table 2).

We illustrate these themes with individual women's stories. The experiences of two obese mothers, Allison and Jana, and one normal-weight mother, Natalie, are described in detail. The obese women were selected because, together, their experiences illustrate the major challenges identified among the obese women in our sample. The

normal-weight woman was selected because she had a caesarean delivery, which was more common among our obese women, yet she was otherwise quite similar to other normal-weight women. Thus, she provides a comparison to illustrate the uniqueness of breastfeeding challenges among the obese women. A comparison of cases and summary of findings in the full sample within each theme are provided after the cases.

Allison: from 'they kept taking her away from me' to 'we made it through'

Allison was 29 years old, pregnant with her first child, and reported a prepregnancy BMI of 32.8 kg/m². She was White, married, had a graduate degree and planned to return to work full time around 2 months post-partum. To avoid disappointment, Allison did not plan how long she would breastfeed:

So I figure if I kind of leave it as open-ended, we're going to see what happens, I won't be as stressed about it and I won't be upset if something goes wrong. [Allison, pregnancy]

Breastfeeding was the norm in her own and her husband's families, and her mother and sister were her major sources of breastfeeding information.

Allison's labour lasted 3 days, leaving her exhausted. Eventually, she had a caesarean delivery. She first breastfed her daughter, Jacey, in the recovery room. Allison was amazed at how well Jacey found the breast and latched on, but Jacey had low blood sugar:

And then I got really bummed because she was only able to stay on me for a couple minutes. The nursery came and got her because her blood sugar levels were low... [Allison, 10 days]

More than 12 h later, Allison was allowed to breastfeed a second time but was upset because 'they kept taking her away from me'. Eventually, Allison was allowed her to keep Jacey in her room as long as she supplemented with formula.

Allison stopped feeding formula when her milk came in at 4 days but still had some challenges. To breastfeed, Allison held her breast and used a breastfeeding pillow along with a 'nest' of pillows. She was unhappy with her bras and needed

Table 2. Comparison of experiences between obese and normal-weight women in themes and subthemes

Themes	Obese	Normal weight
Breastfeeding plans and confidence	Goals ranged 6 weeks to 2 years Several women had no goals Lacking confidence prenatally	Goals ranged 6 months to 2 years All women had goals Confident prenatally
Breastfeeding affected by health issues		
Birth experience	Long, difficult labours (several 3 or more days) Labour inductions Caesarean births	Few long, difficult labours Mostly vaginal births
Infant health and consequences of delivery mode/health issues	Infant low blood glucose Formula supplementation Separation from infant Complicated feeding regimens Pumping to stimulate	Formula supplementation Pumping to stimulate
Positioning and latching	Nipple shield use for flat nipples Pumping for flat nipples Inflexible positioning Need for pillows and props Need extra hands or help Pushing on breast tissue so baby can breathe Holding breast while breastfeeding	Nipple shield use for nipple pain More and earlier flexibility with positioning
Nursing bras	Frustration with finding large sizes and with enough support Had to order online Sometimes cost prohibitive Paired nursing bras with nursing tanks	Easy to find in stores Inexpensive styles provided enough support Nursing tanks worked well
Social support	Greater needs for tangible support for prolonged time Low socio-economic status: less social support available	Tangible support needs initially moderate, then decreased

something more 'heavy-duty' for breastfeeding but waited to shop for them 'once I'm able to really move again'. Allison's husband helped take care of Jacey and do things around the house. Allison's mother gave positioning advice.

By 6 weeks, Allison felt breastfeeding was easier because Jacey helped position herself. There were 'times I really wanted to give up, I was just almost done with it... but we made it through those'. Allison continued holding her breast while breastfeeding.

I still have to hold my breast for her, 'cause it pops out easier if I don't. But if I can manage it, with just hold the breast, [then] she just eats... [Allison, 6 weeks]

She was nervous that Jacey sometimes buried her face into her breast and might not be able to breathe. Allison continued using the breastfeeding pillow but wanted to work on breastfeeding without it to easily

breastfeed away from home. Her husband's help was the 'reason I didn't give up'.

At 3 months, Allison returned to work full time. Jacey continued to be exclusively fed breast milk. They had 'finally figured out a position' without special pillows.

...so that makes life even easier when we're out somewhere... I don't always need the [breastfeeding pillow] now. I can just use a random cushion... or armchair. [Allison, 3 months]

She was frustrated because nursing bras in stores did not fit her, and instead ordered nursing bras online. Allison's family remained supportive of breastfeeding, and her husband continued helping at home.

At 6 months, Allison continued breastfeeding and started feeding Jacey some solids. Allison planned to continue breastfeeding until Jacey self-weaned.

Jana: from 'small steps' to 'getting it over with'

Jana was 36 years old, pregnant with her second child and reported a prepregnancy BMI of 39.4 kg/m². She was African American, single, had some college education and was not working. She planned to begin part-time work and school after her baby was born. She received benefits from two federal programmes for low-income individuals: the Supplemental Nutrition Assistance Program, which provides a certain dollar amount each month to use for purchasing food, and WIC. Some of Jana's family supported breastfeeding and others did not. Jana had not breastfed her first child, who was 16 years old, but knew that breastfeeding was healthier. She made step-wise goals for breastfeeding:

So I figure okay we'll do small steps. We'll go 6 weeks, 6 months, and then a year... I don't wanna set myself up for high expectations and then it doesn't work and then I feel bad... [Jana, pregnancy]

Jana had a vaginal delivery and first breastfed her daughter, Alani, in the delivery room. Alani latched right on and 'did surprisingly well'. Jana had difficulty with breastfeeding until a nurse showed her how to do a cross-cradle hold that required lifting her breast. She used pillows to support each arm and the baby.

Early post-partum, Jana liked breastfeeding, but she also felt that 'trying to get her in the right position seemed like more work than it would've been if I had just had a bottle'. Breastfeeding at home was more difficult than in the hospital because she did not have help. She held her breast and used pillows for 'more control' while breastfeeding. She wore sports bras because they were cheaper than nursing bras. Jana's older daughter helped take care of the baby, and her cousins provided pumping advice. Alani's father 'teases me all the time [about breastfeeding]: "Every time you turn around you got your titty whipped out"'.

At 5 weeks post-partum, Jana started working a couple days a week. At 6 weeks, Alani was still receiving breast milk exclusively, but Jana found breastfeeding 'frustrating' because of the many demands on her time.

...being busy, having stuff to do, it's *demanding*. It can be a little frustrating because it's like...I have to stop right now what I'm doing to feed you, you know, versus if she was bottle-fed...you could say, 'can you feed her really quick for me?' [Jana, 6 weeks]

Despite this, Jana liked 'the bond' from breastfeeding, and it became easier: '[Alani] does what she needs to do, we get it over with'. Jana learned to breastfeed with one hand so she could multitask. She received formula from WIC and fed it once 'just to see if she would take it'.

By 3 months, Jana was breastfeeding for half of the feedings and providing formula for half of the feedings. The amount of formula gradually increased as Jana worked more hours and prepared for school. When she was away from home with her baby, she mostly fed formula because it was easier than keeping her pumped milk cold and warming it prior to feeding.

Around 4 months post-partum, Jana started school and breastfed less because she was exhausted. This, along with not being able to pump at school because of lack of time and breaks between classes, led to a decrease in her milk production, so she stopped breastfeeding entirely.

I just wish that I could've, you know, been able to pump more and nurse her... but I'm so busy, so it [formula] works out. [Jana, 6 months]

Natalie: from 'excruciatingly painful' to 'the best thing in the world'

Natalie was 30 years old, pregnant with her first child and reported a prepregnancy BMI of 20.4 kg/m². She was White, married, had a college degree and worked part time. Natalie heard that 'breastfeeding does not come easy', but she expected to 'persevere' and breastfeed for 9 to 12 months, returning to work part time around 2 months.

Natalie described her 40-h labour as 'traumatic' including a 'cascade' of interventions and eventually a caesarean delivery. Natalie first breastfed her daughter, Hazel, in the recovery room. Hazel 'wasn't very good at latching', and Natalie found breastfeeding 'excruciatingly painful'. In the hospital, she developed cracked, bleeding nipples, so she also gave some formula. Natalie was instructed to pump after breastfeeding to provide extra stimulation and to drain the breasts.

By 10 days, Natalie had gradually decreased formula feeding and increased breastfeeding. She found breastfeeding difficult while recovering from her delivery because 'you can't get in and out of bed very easily'.

She continued pumping to stimulate milk production because her milk came in around 5 days post-partum, and she fed what she pumped to her baby.

I think that's probably every method of feeding your baby. ...it would be really easy to give up in the beginning, 'cause I was just like I don't wanna pump... Like, I just want to breastfeed, I don't want to do all these other things. [Natalie, 10 days]

Natalie was exhausted from constantly feeding and pumping. Despite these challenges, she 'figured out how to breastfeed wherever [they were]'. Initially, she used a breastfeeding pillow or regular pillows, but her need for these had decreased. Natalie's friends, mother-in-law and husband helped with meals and housework. Because other people were helping, Natalie felt her 'one job of the day' was to breastfeed.

By 2 to 3 weeks, Natalie stopped feeding formula, and by 4 weeks, she no longer had pain when breastfeeding. By 6 weeks, she even 'enjoyed' breastfeeding. Natalie stopped using pillows after 2 weeks because 'it's just an encumbrance to have to find all your little tools to breastfeed to put the baby on'. She continued to breastfeed wherever they were – at the dinner table, cross-legged on the ground or when out running errands. She bought a nursing bra at a big-box store that worked well. Natalie's friends provided emotional support, but most of her extra tangible help was gone.

At 9 weeks, Natalie returned to work 1 to 2 days a week and provided pumped milk to the daycare. By 3 months, Natalie felt that breastfeeding was 'the best thing in the world'. She fed at the breast when she was with Hazel using only one arm, which left one hand free. They remained flexible with breastfeeding positions and locations.

I just sat Indian-style and, you know, fed her. But that might be different for other people, too, like depending on your physical, uh, condition. [Natalie, 3 months]

Most of Natalie's friends who provided emotional support breastfed, and she had many friends with babies around the same age as Hazel.

Until 6 months, Natalie and Hazel continued breastfeeding exclusively with no problems or changes: 'It's just what we do...part of life'.

Comparison of cases

All women in our study intended to breastfeed. However, obese women, particularly those who were primiparous or lacked prior successful breastfeeding experience, were less confident prenatally in their ability to breastfeed. Allison and Jana were similar to other obese women in the study; low confidence led them to set low or no breastfeeding goals to avoid disappointment. Multiparous obese women with previous breastfeeding success were more confident. All normal-weight women in our sample had breastfeeding duration goals, and only two lacked confidence about their plans.

Obese women experienced more health challenges that affected breastfeeding. More obese than normal-weight women had caesarean deliveries, which impaired their mobility post-partum and created challenges for positioning. Following their caesarean deliveries, several obese women and one normal-weight woman, Natalie, had complicated infant feeding regimens. These included feeding at the breast, pumping, feeding pumped milk and feeding formula, and were perceived as exhausting and infeasible to sustain. Although Natalie and Allison were able to eliminate formula as their milk production increased, many obese women with complicated feeding regimens were never able to reduce or eliminate formula.

Four of the five women whose infants had problems with low blood glucose were obese. For Allison's infant, low blood glucose post-natally led to separation of mother and baby for many hours at a time, causing distress. Allison's infant also received formula *instead* of breastfeeding as a result of hospital policy. Notably, all infants except one (born to a multipara who had breastfed previously) who were monitored for low blood glucose received supplemental formula.

The two heaviest women in our sample were super obese (BMIs of 59 kg/m² and 68 kg/m²) and had unique post-partum challenges. Both developed severe infections following caesarean deliveries, started complicated feeding regimens in the hospital and were unable to maintain breastfeeding. One woman's infection led to many medical appointments, several procedures after which she was instructed to 'pump and dump' for 24 h and exhaustion that left her too tired

to manage breastfeeding and pumping. The other woman who developed an infection was admitted to the intensive care unit with sepsis. Her sister and husband pumped her breasts in the intensive care unit, but she later ceased pumping when she learned that she would be on medications for 9 months that her health professionals told her were incompatible with breastfeeding.

Although women of all sizes described a 'learning curve' for breastfeeding, obese women, including Allison and Jana, tended to have more challenges with positioning and latching, and challenges lasted longer. Some obese women had difficulties latching their infants because of flat nipples. Pumping to pull out the nipples before latching was challenging because women could not always anticipate when their babies would be hungry. Nipple shields were perceived as a hassle and, in one instance, were provided in a too-small size. None of the normal-weight women in our study reported challenges with flat nipples.

Obese women required modified positions and were less flexible with how or where they positioned to breastfeed than normal-weight women. Many obese women required props, held their breast to breastfeed or pushed breast tissue away from their babies' noses. One obese woman commented that women who did not have to hold their breast made breastfeeding look easy. Both Allison and Jana held their breast to breastfeed for several weeks, required pillows for positioning and took weeks or months to gain flexibility with positioning. Some obese women did not gain flexibility with positioning by the study's end. This is different from normal-weight women, such as Natalie, who was flexible with where and how she breastfed by 10 days. Inflexible positioning affected obese women's ability to multitask or breastfeed away from home.

Obese women, including Allison and Jana, expressed more frustration with finding nursing bras that were sufficiently large and/or supportive. Although seven obese women expressed these frustrations, only one normal-weight woman mentioned challenges with finding nursing bras; she was large breasted. Some obese women believed their sizes were simply not available. Others, like Allison, only found adequate bras online, or, like Jana, felt that adequate nursing bras were cost prohibitive. Conversely, normal-weight women, such

as Natalie, were able to purchase inexpensive nursing bras that worked for them.

Social support *needs* differed between obese and normal-weight women, especially early post-partum. All women described the importance of tangible support; however, obese women needed more tangible support. Obese women talked more about needing extra hands to help with positioning the baby or props. Allison had uniquely high social support, and she attributed her ability to continue exclusive breastfeeding to her husband's tangible support.

The social support *available* from their networks did not differ between obese and normal-weight women. Among the obese women, however, less general and tangible social support was available for women with lower SES ($n=6$) than higher SES ($n=7$). Because low SES was minimally present in our normal-weight group ($n=1$), we could not determine whether SES influenced social support among them or in the whole sample. Lower social support for low SES, obese women amplified the effects of their challenges because their higher tangible support needs were addressed inadequately. Notably, all of the Black women ($n=4$) in our study had low SES, less available general and tangible support, and all stopped breastfeeding before 6 months.

Discussion

Obese women experienced some unique challenges with breastfeeding, which were particularly problematic in the early post-partum period. Importantly, they experienced challenges that normal-weight women also encountered, but to a greater degree or for a longer time. For example, although normal-weight women had some early challenges with positioning and latching their infants to breastfeed, these issues typically resolved by 6 weeks. Among obese women, however, these challenges persisted for many weeks or months (if they resolved at all before breastfeeding ceased). Furthermore, obese women experienced a larger number of breastfeeding challenges than normal-weight women, and thus had more barriers to overcome. Together, our results suggest that the multiple challenges, their degree and duration, experienced by obese women may help explain the shorter breastfeeding durations observed among them.

Results from previous research indicate that prenatal breastfeeding intentions and confidence are significant predictors of breastfeeding duration (Kronborg & Væth 2004; DiGirolamo *et al.* 2005; Verret-Chalifour *et al.* 2015). In our study, primiparous obese women expressed low confidence in their ability to breastfeed and, among some, confidence was so low they hesitated to make breastfeeding goals for fear of disappointment. These findings support those from a national US sample that obese women had lower confidence than normal-weight women (Hauff *et al.* 2014). It is possible that obese women's confidence may be affected by poor body image (Hauff & Demerath 2012) or past failures to control their bodies (such as by losing weight). Multiparous obese women in our study who had successfully breastfed previous children expressed more confidence. This is consistent with findings from Kronborg *et al.* (2013) that parity and previous breastfeeding experience affected the association between high BMI and breastfeeding duration. These results suggest that obese women without prior breastfeeding experience may benefit from prenatal interventions to improve self-efficacy.

Obese women in our study described more difficulties with positioning and latching, consistent with health professionals' perceptions (Garner *et al.* 2014) and previous findings that obese women reported physical breastfeeding difficulties (Mok *et al.* 2008; Keely *et al.* 2015). These findings support those from O'Sullivan *et al.* (2015) that a collection of problems that included a factor for 'Baby had trouble sucking or latching' mediated the association between maternal obesity and exclusive breastfeeding duration. Positioning strategies for our obese participants required more effort, such as holding breast tissue and/or pushing on their breast tissue so their infants could breathe. Large breasts have been identified as a potential breastfeeding challenge (Jevitt *et al.* 2007; Katz *et al.* 2010). Obese women also depended more and for a longer time on pillows and props to support themselves and their babies while breastfeeding. These data indicate that obese women could benefit from continued lactation support after hospital discharge to help develop positions that allow them to breastfeed more comfortably and with fewer props.

One challenge that was unique to the two heaviest women in our study was severe infection after caesarean delivery that negatively affected breastfeeding

continuation. Jarlenski *et al.* (2014) identified maternal illness as a more common reason for not initiating breastfeeding among obese women. Our study demonstrates that among the heaviest women who initiate, maternal illness may result in challenging treatments that lead to early cessation of breastfeeding. With more women of similar size (BMI >50 kg/m²) giving birth, such complications may become more common. Moreover, avoidance of caesarean delivery may be difficult among these women (Martin *et al.* 2014).

The infants of obese women were monitored and treated for low blood glucose. Maternal obesity is associated with higher prevalence of diabetes (Weiss *et al.* 2004), a risk factor for low infant blood glucose (American Academy of Pediatrics (AAP) Committee on Fetus and Newborn 2011; Wight & Marinelli 2014). Not all hospitals' practices aligned with current recommended protocols to encourage early and continued breastfeeding and skin-to-skin contact to stabilize blood glucose (Wight & Marinelli 2014). Some women were separated from their infants for extended times for monitoring and treatment of low blood glucose. Skin-to-skin contact is associated with higher infant blood glucose levels after birth (Moore *et al.* 2012) and is also feasible and beneficial after caesarean delivery (Stevens *et al.* 2014). Interventions that increase skin-to-skin contact and breastfeeding frequency among obese mothers could help manage infant hypoglycemia and facilitate improved breastfeeding outcomes.

Our findings suggest that tangible social support, previously identified as important for breastfeeding success (Britton *et al.* 2007; Hannula *et al.* 2008), may be particularly important for obese women. The extra effort and time it took them to position their infants for breastfeeding left less time for other things. This was worse for women with caesarean incisions and complicated feeding regimens. In a qualitative study with post-partum women, Negron *et al.* (2013) identified tangible support as key for dealing with physical and emotional post-partum stressors. In the setting of maternal obesity, low SES may create a wider gap between women's needs and social support availability. This gap may be wider still among Black women, as breastfeeding prevalence is lower and breastfeeding support is less available among them (Centers for Disease Control and Prevention (CDC) 2010). However,

Kugyelka *et al.* (2004) found minimal differences by BMI among Black women; although breastfeeding rates were low among Black women, the trend of decreasing breastfeeding duration with increasing BMI observed among Caucasian and Hispanic women was absent among Black women. Together, our findings suggest that obese women could benefit from breastfeeding preparation that includes education of their significant others about how to provide support. Among lower SES women, additional strategies may be warranted for providing social support (e.g. home health visitors in the post-partum period).

To improve breastfeeding duration among obese women, increased and ongoing support from health professionals may be important. Our findings indicate that obese women do not receive tailored breastfeeding information prenatally, consistent with our previous research with health professionals (Garner *et al.* 2014). Tailoring prenatal breastfeeding information may help obese women prepare for realities such as infant low blood glucose and positioning difficulties. Care must be taken, however, to build women's confidence and self-efficacy simultaneously.

Strengths and limitations

This study's longitudinal design was a major strength. It allowed us to build trust, understand women's perceptions prenatally and understand how they experienced breastfeeding from initiation through 3 to 6 months post-partum. This provided a broader perspective of women's expectations, challenges and supports. We used peer debriefing and member checking to enhance credibility and assess accuracy of interpretation of ongoing analysis. Additionally, we included women with a variety of characteristics, which may be similar to women in other regions. We did not measure breastfeeding self-efficacy using a standard questionnaire; this limits our ability to make conclusions about the differences that emerged.

Conclusions

Obese women experienced more breastfeeding challenges than normal-weight women. They experienced

many similar challenges, but these were experienced to a greater degree or lasted longer among obese women, such as difficulties with positioning. Obese women were also less confident about their plans to breastfeed prenatally and experienced some unique challenges, such as flat nipples and health issues. Obese women could benefit from more breastfeeding support prenatally to prepare them for challenges and build confidence, and post-partum for continued assistance with positioning. Although all women and their infants could benefit from hospital policies and protocols that support breastfeeding while managing infant blood glucose and post-caesarean health concerns, obese women may be particularly likely to benefit because of their higher rates of diabetes and caesarean delivery. Obese women may also benefit from adequate staffing to provide breastfeeding support. To be successful, future interventions to improve breastfeeding among obese women should, if possible, address the challenges identified here.

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Conflict of interest

The authors declare that they have no conflicts of interest.

Contributions

CDG was the project lead for this study and collected all the data. CDG and KMR had the original

conceptions for the paper. CMD and LLT significantly contributed to the study design. CDG and SAM conducted the analysis and interpreted findings. CDG produced the initial draft of the paper, and CMD and KMR provided feedback. All authors critically reviewed and approved the final content.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Supplementary Appendix. Excerpt of key interview guide questions