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Effect of a Home-Based Lifestyle Intervention on Breastfeeding Initiation Among Socioeconomically Disadvantaged African American Women with Overweight or Obesity

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Abstract

Background: Socioeconomically disadvantaged (SED) African American women with overweight or obesity are less likely to breastfeed.
Objective: To test whether a home-based lifestyle intervention impacts breastfeeding initiation rates in SED African American women with overweight or obesity.
Study Design: This was a secondary analysis of a randomized controlled trial from October 2012 to March 2016 at a university-based hospital within the LIFE-Moms consortium. SED African American women with overweight or obesity and singleton gestations were randomized by 16 weeks to Parents as Teachers (PAT)—a home-based parenting support and child development educational intervention—or PAT+, PAT with additional content on breastfeeding. Participants completed a breastfeeding survey. Outcomes included breastfeeding initiation and reasons for not initiating or not continuing breastfeeding.
Results: One hundred eighteen women were included: 59 in PAT+; 59 in PAT. Breastfeeding initiation rates were similar in each group (78.00% in PAT+; 74.58% in PAT). On a one to four scale, with four denoting ''very important,'' women in PAT+ and PAT were equally likely to rate their beliefs that formula was better than breast milk or breastfeeding would be too inconvenient as the most important reasons to not initiate breastfeeding. On the same scale, women similarly rated their difficulty latching or concern for low milk supply as the most important reasons for breastfeeding cessation.
Conclusion: SED African American women with overweight or obesity who received a home-based educational intervention had higher breastfeeding rates than is reported nationally for black women (59%). However, the intervention with more breastfeeding content did not further increase breastfeeding rates or impact reasons for breastfeeding cessation.
Trial Registration: ClinicalTrials.gov: NCT01768793.

Keywords: African American women, breastfeeding, health disparities, obesity, Parents as Teachers, socioeconomically disadvantaged women

Introduction

Due to the well-established maternal and pediatric benefits of sustained breastfeeding, the American College of Obstetricians and Gynecologists (ACOG) and American Academy of Pediatricians (AAP) recommend exclusive breastfeeding for 6 months.[1–3] There is a significant health disparity in breastfeeding initiation rates in the United States. Seventy-five percent of women initiate breastfeeding nationally, but only 59% of African American women and 66% of socioeconomically disadvantaged (SED) women in the Special Supplemental Nutrition Program for Women,

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Infants, and Children do so.[2] Women with overweight or obesity are also 14% and 46% less likely to initiate breastfeeding compared with normal-weight women, respectively.[4,5] Furthermore, factors associated with breastfeeding noninitiation may act synergistically. Compared with other racial/ethnic groups of varying prepregnancy body mass index (BMI), non-Hispanic black women were most likely to not initiate breastfeeding (30.3% compared with 11.7% for Hispanic and 18.8% for non-Hispanic White), and obese, non-Hispanic black women had 29% higher odds of breastfeeding noninitiation compared with normal-weight non-Hispanic black women.[6]

Prior campaigns have increased breastfeeding rates nationally but have not decreased breastfeeding disparities,[7–9] perhaps because they do not adequately address the physiologic challenges and sociodemographic barriers that SED African American women with overweight or obesity may face while breastfeeding.[2,5] For example, maternal obesity has been identified as a risk factor for both decreased initiation and shortened duration of breastfeeding due to the physiology of obesity: compared with normal-weight women, women with obesity have delayed onset of lactogenesis II and premature involution of mammary cells resulting in decreased milk production.[10,11] Conversely, SED women may have lower rates of breastfeeding because they are more likely to return to work sooner after giving birth and be employed in positions making pumping breastmilk more difficult compared with women with higher incomes,[2] and African American women are significantly less likely to initiate breastfeeding compared with Caucasian women,[12] perhaps due to decreased social support.[2] The combination of physiological challenges and logistical barriers among SED African American women with obesity or overweight may then result in decreased familiarity with techniques for successful breastfeeding or knowledge of normal postpartum and neonatal physiology or breastfeeding benefits.[1–4,13,14] To break this cycle and decrease breastfeeding disparities, the United States Preventive Services Task Force recently encouraged the development and study of new interventions among communities with low baseline breastfeeding rates.[13]

One new intervention that may increase breastfeeding initiation rates in these communities is Parents as Teachers (PAT). PAT is a national organization that uses trained parent educators to provide an evidence-based curriculum promoting positive child development and school readiness to SED pregnant women free of charge.[15–17] PAT has been shown to improve various public-health outcomes, including increasing third-grade achievement for SED children[16] and higher daily fruit and vegetable consumption for SED families,[18] but has not been evaluated as a breastfeeding intervention. Recently, the PAT curriculum was updated. A lifestyle intervention, including multiple objectives on breastfeeding education and support was embedded within the existing standard PAT curriculum to create PAT plus (PAT+). The impact of PAT+ on breastfeeding initiation rates has not yet been examined. Our objective was to evaluate whether a home-based educational intervention with breastfeeding support (PAT+) more effectively impacted breastfeeding initiation or patient-reported reasons for breastfeeding cessation among SED African American women with overweight or obesity compared with a home-based educational intervention without breastfeeding support (PAT).

Materials and Methods

Study design

This study was a secondary analysis of data from a randomized controlled trial conducted at a single university-based tertiary care institution from October 2012 to March 2016.[19] The trial was part of the LIFE-Moms consortium (https://lifemoms.bsc.gwu.edu/), a collaborative group evaluating the effect of lifestyle therapies on maternal gestational weight gain and maternal, fetal, and infant health in pregnant women with overweight or obesity.[20] Participants were randomly assigned in a 1:1 allocation to treatment with the standard PAT education curriculum or PAT+, which contained curriculum, including diet and exercise counseling and breastfeeding education. Thus, the randomized control trial did not include a control group receiving routine prenatal care.

Participants in both groups were visited by trained parent educators in interactive 1-hour home visits every other week during pregnancy. Participants assigned to the standard PAT curriculum had home visits focused on development-centered parenting support and education using a family strength-based approach. The standard PAT curriculum included limited content encouraging breastfeeding within a single home visit geared toward helping women get ready for their baby; breastfeeding support was provided in subsequent visits as requested by parents. Conversely, participants assigned to PAT+ received the standard PAT curriculum plus a lifestyle curriculum based on cognitive behavior change theory. In addition to reinforcing positive eating and physical activity behaviors, PAT+ covered multiple objectives for breastfeeding, including improving understanding about breastfeeding benefits, exploring strategies to improve successful breastfeeding within the home and in public or at work, providing interactive support on basic breastfeeding techniques using a doll to practice, and assisting in the development of a postpartum breastfeeding plan. The lifestyle intervention within PAT+ was developed in partnership with PAT to assure consistency with organizational mission, format, practice, and funding requirements, and addressed barriers and facilitators for healthy gestational weight gain and breastfeeding identified by SED women during program development.[15] Specific topics embedded within each interactive home visit are outlined in Appendix Table A1.

To ensure the home intervention was delivered as designed, parent educators audiotaped the visits and completed lesson plan checklists documenting delivery of content, which were reviewed by study staff.[19] Study staff also randomly observed two home visits each year for each parent educator, an approach consistent with PAT standards of practice.[15] Of note, all research and routine prenatal visits were conducted by staff that were blinded as to the participants' treatment assignment.[19]

Outcome measures

The primary outcome of this secondary analysis was the rate of breastfeeding initiation. Secondary outcomes were intent to breastfeed with subsequent pregnancies, patient-perceived importance of reasons for not initiating breastfeeding, and, among women who started breastfeeding, patient-perceived importance of reasons for breastfeeding cessation.

Study participants

To be included in the secondary analysis, participants must have been enrolled in the randomized controlled trial. The parent trial's inclusion criteria were: African American ancestry; 18–45 years of age; BMI 25.0–45.0 kg/m^2 measured at the initial visit during the first trimester; singleton viable gestation at or before 15 weeks and 0/7 days gestation (established by date of last menstrual period if it was within 5 days of first trimester ultrasound dating, or by ultrasound itself); and SED status (a Medicaid recipient or home zip code associated with a median household income below the poverty level).[19] As per guidelines from the Centers for Disease Control and Prevention (CDC), study participants were considered obese if their BMI was ≥30.0 kg/m^2 and overweight if their BMI was ≥25.0 kg/m^2, but did not meet the threshold of obesity.[21] Women were excluded from the randomized controlled trial if they had diabetes, glycosylated hemoglobin ≥6.5%, any contraindication to exercise during pregnancy,[22] active substance abuse, or English nonfluency. Appendix Table A2 describes the parent trial's inclusion/exclusion criteria in more detail.[19]

The secondary analysis included additional eligibility criteria: women had to have delivered a liveborn neonate within 6–12 months before data collection on breastfeeding and could not have a contraindication for breastfeeding. We chose these inclusion criteria because they mirror those from prior breastfeeding studies,[23,24] and our study questionnaire has been validated for low-income women during this postpartum period.[25] Separate informed consent was obtained from all participants before they participated in the secondary analysis, which was approved by the Washington University Institutional Review Board.

Data collection

All women eligible for the secondary analysis were approached. Consenting women were contacted by study staff blinded to the participants' treatment assignment and were administered a telephone questionnaire modified from the Infant Feeding Practices Study II, a well-validated survey created by the CDC.[25] Women were asked whether they initiated breastfeeding or would plan to breastfeed with subsequent pregnancies and were also prompted to rate their reasons on a one to four scale of importance for not initiating breastfeeding or for stopping breastfeeding. Participation did not require an in-person clinic visit; as such, breastfeeding data were obtained entirely through patient report without validation through review of medical records.

Statistical analyses

The parent trial was powered to detect a 30% reduction in gestational weight gain exceeding the Institute of Medicine recommendations, with a 10% attrition rate, a power of 0.9, and an alpha value of 0.05; an estimated 133 women were needed in each arm.[19] Because the parent trial's study population was fixed, and all consenting patients' meeting eligibility criteria for our secondary analysis were included, we did not conduct a prior power calculation to determine the minimum sample size needed to detect a difference in breastfeeding initiation rates between PAT+ and PAT. A post-hoc power analysis suggested our study population had less than 80% power to detect a difference in breastfeeding initiation rates between the two groups. Continuous variables were compared by using the Student's *t*-test or Mann–Whitney *U* test, as appropriate. Categorical variables were compared by using the χ^2 or Fisher's exact test, as appropriate. Analyses were performed using STATA (Special Edition 14; StataCorp LP, College Station, TX) and SAS software (Version 9.2; SAS Institute, Inc., Cary, NC).

Results

The parent study enrolled participants from 2012 to 2016, and recruitment for the secondary analysis started in October, 2015 and continued until 6 months after the parent study's completion. Of the 267 participants in the parent study, 118 women (44.2%) delivered after October, 2014. Each of these women had liveborn neonates and did not have breastfeeding contraindications; as such, all 118 were eligible to participate in our secondary analysis. All eligible women agreed to participate and were consented, resulting in a final study population of 59 women who had been randomized to PAT+ and 59 who had been randomized to PAT.

The baseline sociodemographic characteristics and obstetric history of the study population are presented in Table 1. Sociodemographic factors, including maternal age, gravidity, education, and income level less than $25,000 were similar between the treatment groups. Obstetric and medical factors, including rates of obesity (BMI ≥30 kg/m^2), gestational diabetes, gestational hypertension and/or preeclampsia, and history of cesarean section, were also similar between groups.

The rate of breastfeeding initiation was similar between groups (78.00% in PAT+ versus 74.58% in PAT; relative risk [RR] 1.05 [95% confidence interval (CI) 0.87–1.28]) (Table 2). Likewise, most women in both groups reported intending to breastfeed again with subsequent children. Table 2 also includes a comparison of the reasons for not initiating

Table 1. Comparison of Baseline Characteristics of Women Who Received Parents as Teachers Curriculum With Breastfeeding Education (PAT+) and Without (PAT)

	PAT+(n = 59)	*PAT (n = 59)*	p
Age (years)			0.73
18–34	55 (93.22)	54 (91.53)	
≥35	4 (6.78)	5 (8.47)	
Gravidity	2.00 (1.00–3.00)	2.00 (1.00–3.00)	0.37
Maternal education			0.52
Less than high school	11 (18.64)	13 (22.03)	
High school graduate	29 (49.15)	21 (35.59)	
Some college	16 (27.12)	21 (39.59)	
College graduate	3 (5.09)	4 (6.78)	
Income level			0.55
<$25,000	52 (88.14)	49 (83.05)	
≥$25,000	6 (10.17)	8 (13.56)	
Obesity (BMI ≥30 kg/m^2)[a]	43 (55.13)	35 (44.37)	0.30
Gestational diabetes	4 (6.78)	4 (6.78)	1.00
Gestational hypertension and/or preeclampsia	11 (19.30)	7 (12.50)	0.32
History of cesarean section	18 (30.51)	15 (25.42)	0.54
Spontaneous labor	27 (45.76)	26 (44.06)	0.73

Data presented as *n* (%) or median (IQR).

[a]In this study, women who were not obese were overweight, as defined by having a BMI ≥25 kg/m^2 but <30 kg/m^2.

BMI, body mass index; PAT, Parents as Teachers.

Table 2. Comparison of Breastfeeding Rates and Reasons for Not Initiating Breastfeeding Among Women Who Received Parents as Teachers Curriculum With Breastfeeding Education (PAT+) and Without (PAT)

	PAT+ (n = 59)	*PAT (n = 59)*	*RR (95% CI)*
Rate of breastfeeding initiation	46 (78.00)	44 (74.58)	1.05 (0.86–1.28)
Agreement with statement: ''I am likely to breastfeed again if I have another child''	39 (66.10)	36 (61.01)	1.03 (0.86–1.25)
Importance of following reasons to decide not to breastfeed:	*PAT+ (n = 13)*	*PAT (n = 15)*	*RR (95% CI)*
Belief formula was better than milk	3.08 (±1.19)	2.33 (±1.23)	1.30 (0.72–2.36)
Belief breastfeeding would be too inconvenient	2.31 (±1.38)	1.73 (±0.88)	1.73 (0.62–4.82)
Desire to return to school or work	2.31 (±1.32)	1.00 (±1.31)	1.92 (0.97–3.82)
Concern for low milk supply	2.08 (±1.44)	1.80 (±1.01)	1.44 (0.49–4.26)
Too many household duties	1.77 (±1.24)	0.73 (±0.96)	1.85 (0.80–4.25)
Health professional advised not to for medical reasons	1.53 (±1.03)	1.78 (±1.20)	5.19 (1.36–19.83)
On medication	0.85 (±1.34)	0.40 (±1.06)	2.31 (0.50–10.62)

Data presented *n* (%) or mean (±standard deviation) on a one to four scale of importance, with four denoting higher importance, unless otherwise noted.

CI, confidence interval; RR, relative risk.

breastfeeding provided by the 28 women (13 in PAT+ versus 15 in PAT) who did not attempt breastfeeding. On a one to four scale, with four denoting ''very important,'' women in PAT+ and PAT were equally likely to rate the following factors as the most important reasons in their decision to not breastfeed: their belief that formula was better than milk, their belief that breastfeeding would be too inconvenient, their desire to return to work or school, or their concern they would have low milk supply (RR 1.30 [95% 0.72–2.36]; RR 1.73 [95% CI 0.62–4.82]; RR 1.92 [95% CI 0.97–3.82]; RR 1.44 [95% CI 0.49–4.26]; respectively). Less important motivators for not breastfeeding in both groups included having too many household duties or taking medication. Of note, women in PAT+ were more likely to rate the statement, ''A health professional told me not to breastfeed'' lower on the importance scale compared with women in PAT (mean 1.53 ± standard deviation 1.03 versus 1.78 ± 1.20; RR 5.19 [95% CI 1.36–19.83]) (Table 2).

Table 3 describes the patient-elicited importance of reasons for breastfeeding cessation among the 90 women who initiated breastfeeding (46 in PAT+ and 44 in PAT). In both groups, women rated common breastfeeding issues as the most important factors for their decision to stop breastfeeding. These issues included difficulty latching, concern for low milk production, or pain during breastfeeding (RR 1.12 [95% CI 0.69–1.84]; RR 0.96 [95% CI 0.56–1.62]; RR 0.58 [95% 0.31–1.09]; respectively). Similarly, those in PAT+ were equally likely to rate their desire to leave their baby for several hours, their medication use, or their desire to return to prior diet as less important reasons to stop breastfeeding.

Discussion

In this study among SED African American women with overweight or obesity, we found that an in-person education intervention increased breastfeeding initiation rates above the national average for African American women; however, an at-home breastfeeding support and education intervention (PAT+) did not increase breastfeeding initiation rates beyond those achieved with typical PAT home visits. In addition, PAT+ did not decrease women's misconceptions about the

Table 3. Comparison of Reasons for Not Continuing to Breastfeed Among Women Who Initiated Breastfeeding and Who Received Parents as Teachers Curriculum With Breastfeeding Education (PAT+) and Without (PAT)

	PAT+ (n = 46)	*PAT (n = 44)*	*RR (95% CI)*
Concern for low milk supply	2.44 (±1.36)	2.28 (±1.32)	1.22 (0.77–1.92)
Difficulty latching	2.36 (±1.40)	2.21 (±1.37)	1.12 (0.69–1.84)
Having pain during breastfeeding	1.96 (±1.17)	2.14 (±1.30)	0.96 (0.56–1.62)
Belief breastfeeding was too inconvenient	1.67 (±1.04)	2.02 (±1.18)	0.58 (0.31–1.09)
Desire to leave baby for several hours at a time	1.49 (±0.94)	1.98 (±1.26)	0.51 (0.24–1.08)
Not wanting to breastfeed in public	1.49 (±0.94)	1.72 (±1.14)	0.69 (0.31–1.56)
Wanted/needed someone else to feed baby	1.42 (±0.92)	1.86 (±1.19)	0.52 (0.23–1.19)
On medication	1.40 (±0.91)	1.86 (±1.26)	0.52 (0.23–1.17)
Desire to go back on usual diet	1.29 (±0.76)	1.72 (±1.16)	0.32 (0.11–0.91)
Not wanting to breastfeed (prompt: I did not like breastfeeding)	0.67 (±1.11)	0.54 (±0.88)	1.56 (0.53–4.62)
Belief breastfeeding was too tiring	0.64 (±1.11)	1.00 (±1.20)	0.59 (0.31–1.17)
Concern baby was not gaining enough weight	0.62 (±1.05)	0.98 (±1.26)	0.57 (0.28–1.16)
Concern breast milk alone did not satisfy my baby	0.42 (±0.92)	0.86 (±1.19)	0.74 (0.43–1.30)
Baby's father desired breastfeeding to stop	0.20 (±0.63)	0.33 (±0.78)	0.72 (0.17–3.02)

Data presented *n* (%) or mean (±standard deviation) on a one to four scale of importance, with four denoting higher importance, unless otherwise noted.

benefits of formula feeding or alleviate their concerns about breastfeeding. Finally, despite receiving formal breastfeeding education and support, women in PAT+ were equally likely to report breastfeeding cessation due to common breastfeeding issues such as difficulty latching, concern for low milk supply, or having pain during breastfeeding.

Although limited, prospective data suggest interventions specifically targeting SED women to increase their breastfeeding initiation rates. For example, two randomized studies concluded breastfeeding rates among SED women increased with financial incentives[26] or individualized postnatal support,[27] whereas a recent observational study demonstrated an association between paraprofessional home visitors and increased breastfeeding initiation rates among SED women.[28] Findings from these individual studies are supported by meta-analyses, which have shown that individual-level combination education and support interventions available during pregnancy and after delivery result in the highest increases in breastfeeding initiation rates.[13,29,30] PAT and PAT+ support these findings: both are individual-level education and support interventions that resulted in SED African American women with overweight or obesity have higher breastfeeding initiation rates than is reported for African American women nationally (59%).[2]

However, the targeted breastfeeding educational component within PAT+ did not result in higher breastfeeding initiation rates relative to the standard PAT curriculum. The lack of additional benefit through PAT+ has multiple explanations. First, women randomized to the control (PAT) also received at-home individualized peer-teaching during and after pregnancy. Women exposed to at-home motivational peer-teaching sessions have been shown to be more likely to breastfeed compared with the baseline population.[31] Thus, the support provided by PAT educators may have increased breastfeeding initiation rates, thereby decreasing our ability to detect any additional benefit of the PAT+ curriculum. Conversely, prior interventions shown to most effectively increase breastfeeding initiation rates among SED women contain only breastfeeding education or breastfeeding-related incentives,[26–28] whereas PAT+ included content on breastfeeding, weight control, and the complete PAT curriculum. Thus, it is possible that PAT+ was less effective as a breastfeeding intervention because of the significant amount of nonbreastfeeding material included within the home visits. Indeed, the fact that women in PAT+ and PAT were equally likely to blame breastfeeding problems for their breastfeeding cessation suggest that neither PAT+ nor PAT may have provided sufficient breastfeeding support, hands-on instruction, or education.

Our study has several strengths. First, to specifically address breastfeeding disparities, we included only a high-risk population known to have the lowest rates of breastfeeding initiation. Second, the randomization in the parent trial of participants to PAT or PAT+ curriculum reduced selection bias. Finally, we used a well-validated questionnaire on infant feeding practices,[25] which was administered by a blinded research assistant through telephone rather than relying on patient response through mailed surveys. In addition to further reducing selection bias, conducting verbal telephone surveys eliminated the need for healthcare literacy as the research assistant could ensure the participant understood each question before responding.

However, our study is not without potential limitations. First, an a priori power calculation was not conducted for the secondary analysis because the sample size of the parent trial was fixed. Inadequate power may have resulted in a type II error for our primary aim of breastfeeding initiation. Indeed, a post-hoc power analysis suggested our study population had less than 80% power to detect a difference in breastfeeding initiation rates between PAT+ and PAT. Second, there is a risk that recall bias impacted our results. Although it was possible to include the entire parent trial's study population who did not have a contraindication for breastfeeding in this secondary analysis, the decision was made to intentionally limit eligibility to those who delivered within the preceding 6–12 months to decrease the risk of recall bias. Although the risk of recall bias remains, our primary outcome of breastfeeding initiation was likely not substantially impacted by such bias.

Lastly, this study was a secondary analysis of a traditional two-armed randomized controlled trial: in the parent study, women were randomly assigned to receive PAT (control) or PAT+(intervention).[19] Because the primary study was not designed to analyze three-arms (women randomized to routine prenatal care versus to PAT versus to PAT+), we are unable to determine in our secondary analysis whether PAT or PAT+ increased the breastfeeding initiation rate compared with that of women receiving routine prenatal care. Furthermore, without prior breastfeeding data on PAT, we are unable to specifically evaluate PAT+ in terms of the program's impact of breastfeeding rates, much less compare the impact of PAT+ to that of PAT. However, in unpublished internal data, the breastfeeding initiation rate was 62% among African American who delivered at our hospital during the primary study's enrollment period, suggesting that both PAT and PAT+ did significantly increase this rate compared with that of the baseline population.

Conclusion

Our study showed that an at-home, peer-based educational program increased breastfeeding initiation in an at-risk population to a rate notably higher than that anticipated based on national averages. However, a curriculum with breastfeeding education did not impact patient-perceived importance of factors for either noninitiation or discontinuation of breastfeeding in SED African American women with overweight or obesity beyond that of a traditional home-visit program. These findings can help PAT and other public-health campaigns design more effective interventions that successfully increase breastfeeding rates in this high-risk population.

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Disclosure Statement

No competing financial interests exist.

References

1. Rollins NC, Bhandari N, Hajeebhoy N, et al. Why invest, and what it will take to improve breastfeeding practices? *Lancet* 2016;387:491–504.
2. American College of Obstetricians and Gynecologists Women's Health Care Physicians; Committee on Health Care for Underserved Women. Breastfeeding in underserved women: Increasing initiation and continuation of breastfeeding. *Obs Gynecol* 2013;122:423–428.
3. American Academy of Pediatrics. Breastfeeding and the use of human milk. *Pediatrics* 2012;129:e827–e841.
4. Bever Babendure J, Reifsnider E, Mendias E, et al. Reduced breastfeeding rates among obese mothers: A review of contributing factors, clinical considerations and future directions. *Int Breastfeed J* 2015;10:21.
5. Oken E, Fields DA, Lovelady CA, et al. The obesity society scientific position statement: Breastfeeding and obesity. *Obesity* 2017;25:1864–1866.
6. Masho SW, Cha S, Morris MR. Prepregnancy obesity and breastfeeding noninitiation in the United States: An examination of racial and ethnic differences. *Breastfeed Med* 2015;10:253–262.
7. Khan LK, Sobush K, Keener D, et al. Recommended community strategies and measurements to prevent obesity in the United States. *MMWR Recomm Rep* 2009;58:1–26.
8. World Health Organization & UNICEF. Baby-Friendly Hospital Initiative: Revised, Updated, and Expanded for Integrated Care. Switzerland: WHO, 2009.
9. Healthy People 2020. Washington, DC: U.S. Department of Health and Human Services, Office of Disease Prevention and Health promotion. https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health (accessed October 10, 2017).
10. Turcksin R, Bel S, Galjaard S, et al. Maternal obesity and breastfeeding intention, initiation, intensity and duration: A systematic review. *Matern Child Nutr* 2014;10:166–183.
11. Hilson JA, Rasmussen KM, Kjolhede CL. High prepregnant body mass index is associated with poor lactation outcomes among white, rural women independent of psychosocial and demographic correlates. *J Hum Lact* 2004;20:18–29.
12. Petrova A, Hegyi T, Mehta R. Maternal race/ethnicity and one-month exclusive breastfeeding in association with the in-hospital feeding modality. *Breastfeed Med* 2007;2:92–98.
13. Bibbins-Domingo K, Grossman DC, Curry SJ, et al. Primary care interventions to support breastfeeding. *JAMA* 2016;316:1694–1705.
14. Stuebe AM, Bonuck K. What predicts intent to breastfeed exclusively? Breastfeeding knowledge, attitudes, and beliefs in a diverse urban population. *Breastfeed Med* 2011;6:413–420.
15. Parents as Teachers National Center. *PAT Quality Assurance Guidelines.* St. Louis: Parents as Teachers National Center, 2016.
16. Zigler E, Pfannenstiel JC, Seitz V. The Parents as Teachers program and school success: A replication and extension. *J Prim Prev* 2008;29:103–120.
17. Winter MM, McDonald DS. Parents as Teachers: Investing in good beginnings for children. In: *Primary Prevention Works: Issues in Children's and Families' Lives,* Albee GW, Gullotta TP, eds. Thousand Oaks, CA: SAGE Publications, 1997, pp. 119–145.
18. Nanney MS, Haire-Joshu D, Elliott M, et al. Evaluating changeability to improve fruit and vegetable intake among school aged children. *Nutr J* 2005;4:34.
19. Cahill AG, Haire-Joshu D, Cade WT, et al. Weight control program and gestational weight gain in disadvantaged women with overweight or obesity: A randomized clinical trial. *Obesity* 2018;26:485–491.
20. Clifton R, Evans M, Cahill AG, et al. Design of lifestyle intervention trials to prevent excessive gestational weight gain in women with overweight or obesity. *Obesity* 2016;24:305–313.
21. CDC Obesity Statistics. Centers for Disease Control and Prevention. Published 2018. Available at https://www.cdc.gov/obesity/adult/defining.html (accessed September 4, 2018).
22. American College of Obstetricians and Gynecologists. ACOG Committee opinion. Number 267, January 2002: Exercise during pregnancy and the postpartum period. *Obstet Gynecol* 2002;99:171–173.
23. Anstey EH, Chen J, Elam-Evans LD, et al. Racial and geographic differences in breastfeeding—United States, 2011–2015. *MMWR Morb Mortal Wkly Rep* 2017;66:723–727.
24. Merten S. Do baby-friendly hospitals influence breastfeeding duration on a national level? *Pediatrics* 2005;116:e702–e708.
25. Thompson AL, Mendez MA, Borja JB, et al. Development and validation of the infant feeding style questionnaire. *Appetite* 2009;53:210–221.
26. Washio Y, Humphreys M, Colchado E, et al. Incentive-based intervention to maintain breastfeeding among low-income Puerto Rican mothers. *Pedatrics* 2017; [Epub ahead of print]; DOI: 10.1542/peds.2016-3119.
27. Vural F, Vural B. The effect of prenatal and postnatal education on exclusive breastfeeding rates. *Minerva Pediatr* 2017;69:22–29.
28. McGinnis S, Lee E, Kirkland K, et al. Let's talk about breastfeeding: The importance of delivering a message in a home visiting program. *Am J Heal Promot* 2018;32:989–996.
29. Sinha B, Chowdhury R, Sankar MJ, et al. Interventions to improve breastfeeding outcomes: A systematic review and meta-analysis. *Acta Paediatr* 2015;104(Suppl 467):114–135.
30. Patnode CD, Henninger ML, Senger CA, et al. Primary care interventions to support breastfeeding. *JAMA* 2016;316:1694–1705.
31. Balogun O, O'Sullivan EJ, McFadden A, et al. Interventions for promoting the initiation of breastfeeding. *Cochrane Database Syst Rev* 2016:CD001688.

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(*Appendices follow* →)

APPENDICES

Appendix Table A1. Parents as Teachers Plus Home Visit Curriculum

Visit	*Topic*	*Objectives*
1	Healthy weight gain in pregnancy	Improve understanding of healthy weight gain during pregnancy and learn how to chart weight gain. Set healthy goal and discuss value for mom to stay involved. Improve understanding of physical activity in a healthy pregnancy.
2	Healthy foods and beverages	Improve understanding of current fetal development and reasons why nutrient-dense foods are so important for optimal ongoing development. Assist participant in discovering high-calorie foods/beverages she consumes and ways to replace those foods/beverages with healthier choices. Explore participant's experience/thoughts/beliefs about breastfeeding.
3	Self-monitoring	Improve understanding of appropriate portion sizes and provide opportunity to measure out foods in the home. Assist parent in learning how to self-monitor intake and physical activity and provide opportunity to use pedometer. Improve understanding about benefits of breastfeeding.
4	Meal planning	Improve understanding of importance of regular routines, meals, and snacks. Assist parent in developing a weekly food plan and grocery list. Explore reasons participant might not want to breastfeed.
5	Grocery shopping	Assist participant in discovering how to purchase healthier foods in grocery store, within her budget. Practice reading food labels on actual foods in home. Explore thoughts and strategies about breastfeeding in public/away from home.
6	Cooking	Improve understanding of the role cooking can play in providing healthy and cost effective meals. Provide opportunity to prepare a simple recipe in the home. Improve understanding of Missouri WIC food package for breastfeeding woman/infant.
7	Eating out	Provide opportunity to compare cost of eating out to meal prepared in home. Build skills in making best choice when eating out. Improve understanding of benefits of breastfeeding versus formula feeding infant.
8	Infant feeding	Improve understanding of basic breastfeeding techniques. Practice breastfeeding positions with a doll. Assist participant in developing a plan for infant feeding immediately following birth.
9	Problem solving–self efficacy	Assist participant in discovering who will be significant people who will help her after the baby is born and how they can support her. Identify positive changes she has made in her lifestyle during her pregnancy. Assist participant in discovering signs of hunger and how she knows her baby is getting enough.
10	Maintain behaviors	Build skills in maintaining lifestyle changes following delivery. Provide opportunity for participant to discuss any concerns/anxieties she is having about the upcoming birth of her baby. Improve understanding of how participant might feel emotionally and physically after her baby is born.

(*Appendix follows* →)

Appendix Table A2. Comprehensive Inclusion and Exclusion Criteria

Inclusion criteria
Pregnant women, African American, socioeconomically disadvantaged, 18–35 years of age
Singleton gestation, between 15 weeks and 0/7 days, and 20 weeks and 0/7 days
Normal fetal anatomy (no major structural abnormalities identified on standard-of-care survey before enrollment)
Established prenatal care at Women's Health Clinic before 20 weeks gestation, with plans to deliver at our hospital
Obese: BMI ≥30.0 kg/m^2 and <45.0 kg/m^2 (calculated from prepregnancy self-reported weight and clinic height)
Exclusion criteria (rationale)
Pregestational diabetes/previous diagnosis of diabetes (need specific therapy)
BMI ≥45.0 (restricted ability to participate in activity intervention, and represents a very small proportion of subjects)
History of GDM or prior macrosomic (>4,500 g) infant (each elevates the risk for GDM)
Known aneuploidy or major congenital anomaly (increased risk for adverse fetal and neonatal outcomes)
Prior spontaneous preterm birth (increased risk for recurrent preterm birth)
Multiple gestation (are at a higher risk for insulin resistance and abnormal neurodevelopment and represent a small number so subgroup analysis not possible)
Active substance abuse with alcohol or drugs by self-report (risk for poor adherence and could impact outcomes)
Treatment with medications (e.g., corticosteroids, antipsychotics) known to have metabolic/body weight effects

BMI, body mass index; GDM, gestational diabetes mellitus.