1.0 Protocol Title (please also add this information to the header):

1.1 Individual Breastfeeding Support with Contingent Incentives for Low-Income Mothers
We will refer to the project study as BOOST: Breastfeeding Onset and Onward with Support Tools

1.2 ClinicalTrial.Gov number: NCT03964454

2.0 Principal Investigator (please also add this information to the header):

2.1 Yukiko Washio, Ph.D.

Co-Principal Investigator: Bradley N Collins PHD

Co-Investigators: Gail M Herrine, MD, Matthew K. Hoffman, MD, MPH, Zugui Zhang, PHD

3.0 Summary of Research:

3.1 We propose to examine the efficacy of monthly financial incentives contingent on observed breastfeeding (BF), supplemental to existing support from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program and home-based individual BF support, among low-income mothers. Low-income racial/ethnic-minority women breastfeed for an average duration of four months despite evidence-based recommendations by the American Academy of Pediatrics to exclusively breastfeed for six months of life in addition to continued breastfeeding through the first year. Insufficient duration of any BF is related to multiple maternal and child health problems, and increases in BF duration could be cost saving medically and societally. Though peer support has been effective in prolonging BF duration, the effect has not been as strong for WIC-eligible, low-income mothers. An incentive-based intervention was tested among low-income Puerto Rican mothers in a pilot study (R03HD077057) resulting in promising outcomes of monthly financial incentives contingent on observed BF for 6 months combined with WIC BF usual care, compared to WIC BF usual care only (BF rates: 89% vs. 44% at 1-month; $p = 0.01$; 89% vs. 17% at 3-month; $p<0.01$; 72% vs. 0% at 6-month; $p<0.01$; $N = 36$). We propose a 2-group parallel randomized controlled trial in which half of the 168 WIC-eligible mothers recruited to the trial will be allocated into each of the two study groups: (1) Standard Care BF Support (**WIC support + home-based individual support; *Standard Care (SC))*** and (2) Incentives contingent on demonstrating successful BF (**SC + Breastfeeding Incentives; *SC+BFI***). Participants randomized into *SC* will receive standard breastfeeding services from WIC and home visitations for individual support and problem-solving. Participants randomized into *SC+BFI* will receive the same services as Control except that monthly financial incentives are contingent on observed BF and delivered at the end of each month. The study will be conducted in two regional sites with high concentrations of low-income racial/ethnic minority mothers, Philadelphia, PA and Newark, DE. The primary outcome will be the BF rate for 6-month postpartum, the exploratory outcome will be the BF rate at 12-month postpartum, and the secondary outcomes will be infant outcomes (i.e., weight gain and emergency room visits). We hypothesize that *SC+BFI* will increase the BF rate by 25% at 6-month postpartum and have significantly lower infant weight gain and incidents of ER visits for infants at 3-month postpartum, compared to *SC*. We will track the costs of intervention, formula purchased by mothers, and infant medical care in both groups. We will also conduct interviews with corporate representatives and insurance companies to explore community- and policy-level support to

sustain the incentive-based intervention for WIC mothers. The aims of the proposal are guided by the mission of National Institute of Child Health and Development's Pregnancy and Perinatology Branch to improve the long-term maternal and infant health of low-income populations via encouraging breastfeeding in the translational research context.

4.0 Purpose of the Study:

4.1 The goal of this project is to address the public health priority of low rates of continued breastfeeding (BF) among low-income racial/ethnic minority women, a population known to wean BF early despite public health efforts to educate these women BF benefits. Low-income racial/ethnic-minority women breastfeed for an average duration of 4 months despite evidence-based recommendations by the American Academy of Pediatrics[1] to exclusively breastfeed for six months of life and to continue breastfeeding through the first year. Low-income Puerto Rican and African American/Black mothers are especially at risk for low rates of continued BF. Low-income African American/Black mothers have the poorest BF outcomes with lowest exclusive BF rates; and over 30% provide infant formulas as early as 2 days postpartum, much higher than the Healthy People (HP) 2020 threshold of 14%.[2,3] Low-income Puerto Rican mothers in U.S. have the shortest BF duration (10% at 6-month with a median duration of 2 weeks) compared to other Hispanic mothers and low-income mothers.[2,4] Improving adherence to BF recommendations among low-income mothers could profoundly impact maternal and child health and inform practices in other high-risk groups. For example, suboptimal breastfeeding increases the risk for infant mortality[5] and a variety of pediatric infectious diseases,[6–13] and childhood overweight and obesity,[14–17] as well as a number of maternal postpartum health issues.[18–21] Improving BF rates to those endorsed by HP2020 would translate to >$3.6 billion in healthcare costs annually in U.S.[8] and up to $118 per mother-infant dyad at the system level (Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]).[22] At the individual level, WIC-eligible BF mothers could save an extra out-of-pocket $46/month by 4-month postpartum without having to buy formula,[23] saving a total of $2800/year.[24]

Some promising BF peer support and counseling interventions have shown greater efficacy in increasing BF duration than those with structured education or professional support.[25] However, the effects are not as strong for low-income mothers.[26] Improvements over existing methods are needed to increase BF rates at 3, 6, and 12-month postpartum[2] in low-income mothers. A preliminary study with low-income Puerto Rican mothers (Washio; R03HD077057)[27] showed that, compared to usual WIC BF support only, an intervention that combined usual WIC support with monthly financial incentives contingent upon observed BF prolonged BF duration (44% vs. 89% at 1-month; $p = 0.01$; 17% vs. 89% at 3-month; $p < 0.01$; and 0% vs. 72% at 6-month; $p < 0.01$; $N = 36$). Further investigation is required to establish the efficacy and test the generalizability of the 6-month incentive-based approach to increase BF duration in WIC-eligible mothers for 12 months in a larger-scale randomized controlled trial. The *primary objective* of this 2-group, fully randomized trial is to examine the efficacy of providing monthly financial incentives for the first 6 months among WIC-eligible mothers while monitoring the impact on BF duration over 12-month postpartum. We will randomize 168 WIC-eligible mothers to be allocated into each of the two study groups: (1) Standard Care BF Support (WIC support + home-based individual support; *Standard Care (SC))* and (2) Incentives contingent on demonstrating successful BF (SC + Breastfeeding Incentives; *SC+BFI*). All participants receive usual WIC BF support and individual home-based support. The study will be conducted in two regional sites with low BF rates due to high concentrations of WIC-eligible, Black and Puerto Rican mothers (Philadelphia, PA and Newark, DE). The current proposal will track the costs for

the intervention, formula purchase by mothers, and medical care for infants during the study period. After data collection, we will conduct interviews with corporate representatives and insurance companies to explore community- and policy-level support to sustain the incentive-based intervention for WIC mothers.

Aim 1: To examine the efficacy of *SC+BFI* compared to *SC* on BF continuation rates at 6- and 12-month follow-up.

Aim 2: To examine the efficacy of *SC+BFI* compared to *SC* on infant outcomes as the secondary outcomes over a 12-month follow-up.

Aim 3: To explore the effect of changes in theoretically important variables that may either moderate or mediate the effect of *SC+BFI* on BF and infant outcomes. We include hypothesized non-program factors (see Figure 1) that may moderate treatment efforts.

Aim 4: To explore community- and policy-level factors that may impact the sustainability of an incentive-based intervention with corporate representatives and insurance companies.

Aim 5: To track the intervention and medical costs for cost-effectiveness analyses.

4.2 The primary outcome is the BF continuation rate at 6-month postpartum. We hypothesize that the isolated effect of monthly incentives contingent on BF in *SC+BFI* will increase BF rates by 25% at 6-month compared to *SC*. The exploratory outcome is the BF continuation rate at 12-month postpartum. We will hypothesize that *SC+BFI* will increase the BF rate at 12-month, compared to *SC.*

We hypothesize that compared to the *SC* condition, the *SC+BFI* condition will have significantly lower infant weight gain and incidents of ER visits for infants at 3-month postpartum. We hypothesize that participants in *SC+BFI* would evidence greater increases in the motivation and self-efficacy, which, in turn, will account for between-group differences in outcomes.

5.0 Background/Literature Review/Rationale for the Study:

5.1 **Background**: Disparities in the health outcomes for mothers and their children exist due to low BF rates. WIC-eligible mothers are identified as at risk for early cessation of BF. Early cessation of BF leads to multiple health risks including increase in mortality and infectious diseases among infants and postpartum health issues. Several promising approaches exist to increase BF duration, including home-based professional and peer lactation support and financial incentives contingent on BF. However, these approaches have never established their efficacy to increase BF duration among low-income mothers.

Breastfeeding (BF) compared to formula saves money and benefits mothers and infants health. The American Academy of Pediatrics recommends mothers to exclusively breastfeed for the first 6 months and continue any breastfeeding during the first year.20 The 6- and 12-month BF continuation rates of 49.4% and 26.7% in U.S. are still lower than the goals of 60.6% and 34.1% endorsed by HP2020, despite the high initiation rate of 79.2% close to the 81.9% goal.1 In the Pennsylvania state, BF rates at 6- and 12-month were 45.7% and 26.1%, and in the Delaware state, the rates were 34.4% and 16.8%.1 Low BF rates among low-income mothers contribute to the overall BF rates in U.S. with an average duration of 4 months.21 In Philadelphia, the BF continuation rates are low among Medicaid-eligible mothers, non-Hispanic Blacks, and Hispanic

mothers with an average duration of only 11.3±11.0 weeks.22,23 In the Delaware state, 20% of Medicaid-eligible mothers continue BF at 6-month.24 Philadelphia PA and Newark DE will be our study sites. Improved efforts to boost rates closer to HP2020 goals are necessary.

5.2 **Innovation**: The proposed research represents an innovative, substantive departure from the status quo in five ways. Primary innovations of this study include: contingent incentives on observed breastfeeding; contingent BF incentives on infant outcomes; theoretically-based factors that mediate the intervention effect; exploration of sustainability of the incentive-based approach; cost-tracking for interventions, formula supplementation, and infant medical issues.

5.3 **Preliminary Study and Results**: A pilot study (R03HD077057) of the proposed intervention was conducted from February 2015 through February 2016.83 WIC- and study-eligible mothers of Puerto Rican descent who initiated BF were recruited. Eligible mothers who showed interest in the study were referred to research staff by a social worker at Temple University Hospital, and research staff met them either at a WIC office or their home for enrollment. Of the 61 women screened, 36 (59%) were enrolled: 5 (8%) stopped breastfeeding before enrollment; 7 (12%) declined to participate; and 13 (21%) expressed an interest but failed to complete the enrollment process.

The study employed a randomized, two-arm parallel-group design. Half of the participants (n = 18) were randomized into the WIC Usual Care (WIC-only) condition, and the other half (n = 18) into the WIC+Incentive condition. All participants were eligible to receive WIC BF support. Those randomized to receive incentives received monthly financial incentives in cash for the first 6 months postpartum in either home setting or WIC office. Research staff directly observed BF at monthly incentive visits to determine eligibility of incentives.

All participants completed an interview at baseline covering socio-demographic characteristics, attitude, history, support, and self-efficacy of BF, as well as maternal and infant health, level of acculturation to U.S., birth place, smoking history, and postnatal depression. Research staff directly observed BF and weighed infants using a portable Health O Meter 386S Infant Scale. Modified versions of this battery were completed at 1-, 3-, and 6-month postpartum post intervention entry either at a WIC office or participant's home. One participant moved out-of-state and was lost to follow-up at 3-month postpartum. All enrolled participants were included in the intent-to-treat analysis that examined outcomes over a 6-month period. All participants in WIC+Incentive and 94% (17/18) of the participants in WIC-only completed all postpartum assessments (97% follow-up rate).

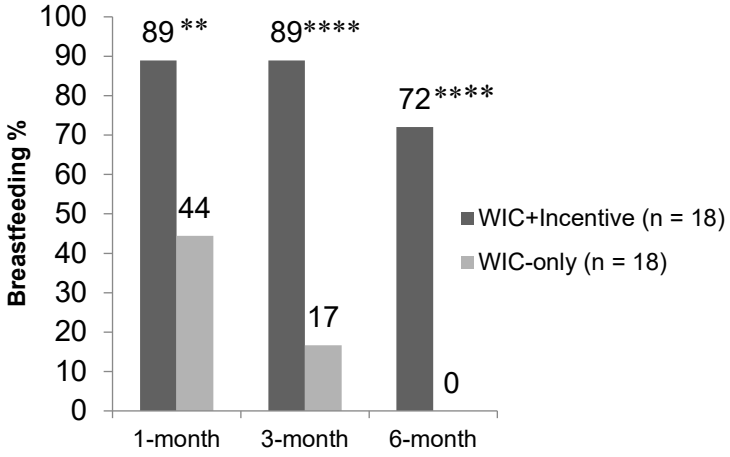

Figure 1. Breastfeeding rates at each month

The pilot study was not statistically powered to test differences in baseline participant characteristics, and no significant differences were observed. Significantly more mothers in the WIC+Incentive group breastfed at each time point compared to those in the WIC-only group (1-month: $p = 0.01$; 3-month: $p < 0.0001$; 6-month: $p < 0.0001$; Figure 1). Mothers who breastfed at 1-month postpartum in the WIC+Incentive group notably continued BF, without any significant subsequent decline ($p = 0.19$). Breastfeeding significantly declined over time in the WIC-only group ($p < 0.01$). Only 1 WIC+Incentive participant and no WIC-only participants exclusively breastfed for 6 months. The mean duration of breastfeeding was 149±54 days in the incentive group and 49±44 days in the control group ($p < 0.001$). The participants in the incentive group earned on average a total of $199±106 for contingent monthly financial incentives during 6-month postpartum. Seventy-two percent of WIC+Incentive and 89% of WIC-only mothers started providing formula supplementation by 1-month postpartum ($p = 0.40$), and 89% in the WIC+Incentive and 100% in the WIC-only groups had introduced supplementation by 3-months postpartum ($p=0.49$).

Table 2. Infant Weight Measures

	Infant weight(M±SD) (WIC+Incentive)	Infant weight(M±SD) (WIC-only)	Difference in mean weights [95%CI]	*p*	Effect size[95%CI]
1-month	3772.0±767.2	4223.3±1150.7	-451.3±977.9 [-1117.4, 214.8]	0.13	-0.46 [-1.16,0.24]
3-month	5503.2±782.3	5884.9±1016.1	-381.7±903.2 [-1010.2, 246.8]	0.23	-0.42 [-1.14,0.30]
6-month	7610.3±950.5	7726.4±1294.1	-116.2±1130.2 [-904.5, 672.2]	0.80	-0.10 [-0.81,0.61]

Excessive infant weight gain increases the risk of childhood overweight and obesity especially among low income racial/ethnic minority groups.102 WIC+Incentive infants weighed considerably less, though not significantly, than WIC-only infants at 1-month (3772.0±767.2 vs. 4223.3±1150.7, $p = 0.13$; -0.46[95%CI: -1.16,0.24]), and continued to weigh slightly less at 3-month postpartum (5503.2±782.3 vs. 5884.9±1016.1, $p = 0.23$; -0.42[-1.14,0.30]). By 6 months the difference in the groups' weight were similar to those observed at birth, and the Bootstrap estimate of Cohen's d effect sizes were small (7610.3±950.5 vs. 7726.4±1294.1, $p = 0.80$; -0.10[-0.81,0.61]). The standardized differences from weight for age z-scores based on the WHO Growth Reference Standards103 in each study group also did not significantly differ between the

groups with the standardized differences consistently smaller in the incentive group than the control group at each time point. Although the proportion of emergency room visits for infants was consistently lower in the incentive group, no significant differences were detected between study groups (11% vs. 22% at 1-month, p = 0.66; 0% vs. 18% at 3-month, p = 0.10; 6% vs. 12% at 6-month, p = 0.60). The estimated Cohen's h effect sizes and their 95% confidence internals were small at 1-month postpartum (0.28[95%CI: -0.34, 0.94]), moderate at 3-month postpartum (0.63[95%CI: 0.21,1.05]), and small at 6-month postpartum (0.22[95%CI: -0.43,0.87]).

6.0 Setting of the Human Research

6.1 The study will be conducted as a partnership between RTI, Christiana Care, and Temple University Hospital. RTI has a central research infrastructure to manage a federally funded research project. Christiana Care Hospital Department of Obstetrics and Gynecology in Delaware is designated as a Baby-Friendly Hospital, achieving 80% BF initiation. Over 6,000 give birth at Christiana Care, and we expect that over 50% are Black, are in their 20's, and are educated for 12 years or less; 30% are Hispanic with Puerto Rican being the second dominant Hispanic subgroup; over 70% are Medicaid-eligible and unmarried; over 40% are unemployed. Over 90% speak English. The hospital will be a recruitment site in Newark, DE. Temple University Hospital is located in northeast of Philadelphia, PA in the neighborhood with a high concentration of Puerto Rican populations. The hospital enrolls on average 15 multi-racial/ethnic pregnant patients a day and provides care to approximately 1300 Medicaid-eligible pregnant patients a year with 20% being Puerto Rican and 70% Black. The hospital is also designated as a Baby Friendly Hospital and succeeded in up to 80% of mothers initiating BF. The hospital will be a recruitment site in Philadelphia, PA for the study. Referrals for this trial (Breastfeeding Onset and Onwards with Support Tools [BOOST]) will come from these sites. Hospital staff will identify WIC-eligible mothers who initiated BF and refer them to a Research Assistant (RA) for invitation to the study. Eligibility screening will be conducted during the hospital stay. Eligible mothers will be provided with the informed consent and HIPAA forms for mothers and babies. The RA will discuss the content of the study to ensure understanding of procedures, risks and benefits, human subject protections, and participants' autonomy.

6.2 Standard care services are delivered to participants by WIC and will include on-site lactation consultation, bilingual peer counseling, peer support meetings, free breast pump, and enhanced food package for BF mothers. On-site lactation consultation, bilingual peer counseling, and peer support meetings occur once a week in each WIC office.

6.3 Survey administration and breast-feeding support is delivered during routine home visits and over the phone. These visits facilitate delivery of intervention, allow staff to provide hands-on breastfeeding support, and allow staff to verify breastfeeding. Visits can also be conducted at a WIC office if the participant prefers.

7.0 Resources Available to Conduct the Human Research

7.1 Based on the pilot study conducted in Philadelphia, PA, we predict that 60% of eligible mothers will be interested and will complete enrollment. On average, 6 participants per month were enrolled in the pilot study with a Philadelphia site (a feasible target based on our weekly enrollment in our pilot). Thus, we estimate to take approximately 35 months to complete enrollment for 168 participants with two study sites.

8.0 Collaborators:

8.1 Collaborators

This study involves two other institutions besides RTI international: Temple University (College of Public Health and College of Medicine) in Philadelphia, PA and Christiana Care Health System in Newark, DE. The study will comply with a single IRB of record under Advarra. Temple University has a senior investigator Dr. Brad Collins at the College of Public Health and Dr. Gail Herrine at College of Medicine Department of Obstetrics and Gynecology. Christiana Care Health System has Dr. Matthew Hoffman at Department of Obstetrics and Gynecology and Dr. Zugui Zhang at Value Institute as a biostatistician. Dr. Collins is a co-principal investigator and site PI, providing office space, space for data storage, and overseeing the study implementation with the PI. Dr. Herrine provides clinical oversight in assisting recruitments and providing linkage to existing breastfeeding services in the community. Dr. Hoffman assists in recruitments in Christiana Care, and Dr. Zhang assisting in randomization, data analyses, and interpretations. RTI International being the prime institution funded by NIH subcontracts both institutions.

Names	Institution	Role
Bradley Collins, PHD	Temple University College of Public Health	Co-principal investigator, providing study oversight with the PI and providing office work space for staff
Gail Herrine, MD	Temple University College of Medicine	Co-investigator, assisting recruitments at Temple and providing clinical oversight to support breastfeeding
Matthew Hoffman, MD MPH	Christiana Care Health System	Co-investigator, assisting recruitments at Christiana Care
Zugui Zhang, PHD	Christiana Care Health System	Co-investigator, providing biostatistical support

8.2 Prior Approvals

IRB approval has been obtained by University of Delaware, Christiana Care, and Temple University prior to involvement of human subjects and principal investigator's move to RTI. University of Delaware and Temple University provided expedited review, and Christiana Care exempted a review and relied on an institutional agreement with University of Delaware IRB.

Co-investigator Dr. Gail Herrine, who is the medical director of post-partum at Temple University Hospital, where we will be enrolling participants has agreed to our recruiting post-partum women at Temple Hospital. Co-investigator Matthew

Hoffman, who is the Chair of Obstetrics and Gynecology at Christiana Care Health Network, where we will also be enrolling participants, has agreed to our recruiting post-partum women at Christian Care.

All BOOST staff will obtain CITI certification in human subjects research.

9.0 Study Design:

9.1 Recruitment Methods

Study brochures will be placed at prenatal clinics and WIC offices. Staff can also actively engage in community outreach such as community baby shower events at WIC offices and prenatal breastfeeding education classes to share materials to advertise the study. Mothers who plan on or who have initiated BF postpartum will be identified and contacted by the mother's doctor either in person or phone call to tell them about the study. If interested, they will then be referred to a Research Assistant (RA) for invitation to the study.

Eligibility screening will be conducted during the hospital stay. The participants will be assured that all study data will be kept strictly confidential and will not affect the status of their treatment or services at the hospital or community service. Eligible mothers will be provided with the informed consent and HIPAA forms for mothers and babies. The RA will discuss the content of the study to ensure understanding of procedures, risks and benefits, human subject protections, and participants' autonomy. Mothers reporting current suicidal thoughts or attempts will be referred for psychosocial care at the hospital or in the community.

If the mother is not interested in participating in the study, staff will say "that's okay, we understand that all happening to you right now can be overwhelming. Thank you very much for your time! Congratulations again and let me know if you need any immediate assistance from the staff." If there is need for immediate breastfeeding and other support, staff will refer the mother immediately to the postpartum floor staff or a lactation consultant.

9.2 Inclusion and Exclusion Criteria

To be eligible for the study, mothers must: (1) initiate BF; (2) be WIC-enrolled or eligible to enroll in WIC services; (3) reside and plan to stay in the study county for 12 months postpartum; (4) consent voluntarily; (5) understand 5th grade level of English; and (6) be 18 years or older. We will exclude mothers whose babies are medically contraindicated against BF, who are hospitalized for severe postpartum medical issues, who have ongoing illicit drug use issues, who had a psychiatric hospitalization within the last three months, who currently have suicidal thoughts or attempts. For women who are incarcerated during 6 months of study participation as well as participants who fail to attend scheduled visits during 6 months of study participation for more than 3 months, their study participation will be terminated.

We include infants of the participants, but infants are not subject to inclusion criteria. Written permission for a minor by a parent or legal guardian will be required for infant participants.

9.3 Consent Process

The consent process will take place following the eligibility screening during the hospital stay. RAs will be involved in obtaining the written consent. The RA will discuss the content of the study to ensure understanding of procedures, risks and

benefits, human subject protections, and participants' autonomy to ensure the voluntary nature of study participation and human subject protection. RA will summarize the consent form paragraph by paragraph and ask questions at the end to ensure participants' understanding of the consent form. Women who would not be able to communicate with RA and understand the content of consent form will not be eligible for the study.

Infants: An infant of the parent will be included in the study: trained RAs will collect length and weight measurements of the child, and collect anal swabs for microbiome analysis. The permission of one parent is sufficient even if both parents are alive, known, competent, reasonably available, and shares legal responsibility for the care and custody of the child. Assent of the child will not be obtained because their capability is so limited that they cannot reasonably be consulted.

Two copies of consent signed by the study participant and RA will be obtained in person at the hospital – one for study staff and one for mom to keep for her records.

9.4 Study Timelines

Subjects agree to participate for one year.

We propose a 5-year (60 month) timeline: formative evaluation, hiring and training, study setup (months 1-6); recruitment (months 7-42); trial implementation (months 7-55); data collection, cost tracking (months 7-55); stakeholder interviews, dissemination of efforts, analyses, presentations, and manuscripts (months 56-60).

9.5 Study Endpoints

The primary outcome is the BF continuation rate at 6-month postpartum. This is determined by observed breastfeeding which includes: audible swallowing, regular suck/swallow/breath patters, visible milk in the infant's mouth after the infant is not latched anymore. Or, in the case of pumping moms, pumped milk and successful feeding to the infant. We hypothesize that the isolated effect of monthly incentives contingent on BF in SC+BFI will increase BF rates by 25% at 6-month compared to SC.

The exploratory outcome is the BF continuation rate at 12-month postpartum. We will hypothesize that SC+BFI will increase the BF rate at 12-month, compared to SC.

10.0 Study Procedures Involved:

10.1 We will use a randomized, two-group design (Standard Care+Breastfeeding Support vs.Standard Care+Breastfeeding Incentives).

10.2 We will use a permuted block random assignment (with block size = 6), assigning participants to one of 2 groups: *Standard Care* or *Standard Care + BFI*. This will allow us to keep group sizes approximately equivalent during the study maintaining an approximately equal size for the 2 groups. We will use propensity score matching to randomize the participants based on study site, as well as Black race and Puerto Rican ethnicity to maximize internal validity.

Allocation to study groups in randomization will be administered by Dr. Zhang (Co-I) who will not have access to collected data until the end of the study. Dr. Zhang will generate computer-

generated random numbers and keeps the original sequence in a password-protected electronic file that no other research staff can access. Dr. Zhang will program the list of random numbers into an electronic file on RedCap which will automatically assign each participant to either condition. Other research staff can only view the result of randomization so that the allocation process remains concealed.

Differences between the study arms are that Standard Care receives compensations at the end of 6 month based on the number of completed home visitations ($40/home visit) and Standard Care + BFI receives compensations at every home visit appointment if they are breastfeeding. The compensation for Standard Care + BFI is in an escalating schedule in which the first home visitation receives $20 increasing by $10 at every month up to $70 if they demonstrate breastfeeding every month. Participants in Standard Care + BFI also receive $50 per selection of full breastfeeding food package at WIC, potentially at baseline, 3, and 6 months postpartum.

10.3 *Standard Care BF Support (WIC support + home-based individual support; Standard Care[SC]).* Participants in *SC* will receive standard BF services from the WIC program, receive education on family nutrition, monitor their monthly nutritional habit, and be asked to participate in periodic assessments (1-, 3-, 6-, 9-, and 12-month postpartum). Combined institutional and home-based individual BF support by WIC and home-visiting lactation counselors has been already available in the community for Hispanic mothers as the standard of care model. Each periodic assessment will take approximately 30 minutes to complete.

WIC support component: Standard services from WIC will include on-site lactation consultation, bilingual peer counseling, peer support meetings, free breast pump, and enhanced food package for BF mothers. On-site lactation consultation, bilingual peer counseling, and peer support meetings occur once a week in each WIC office. Free breast pumps are given to WIC participants who have not had the benefit by the time they enroll into WIC. Enhanced food packages for BF mothers are distributed to WIC participants every three months.

Home-based support and problem-solving component: Blinded RA will also provide individual support and problem-solving in addition to WIC services. At each monthly home visit, blinded RA will ask participants to demonstrate BF, praise participants' efforts to continue BF, problem-solve issues around BF, provide local BF resources, and identify any issues with BF and other medical and psychosocial needs. Signs to verify ongoing BF include audible swallowing of breastmilk, regular suck/swallow/breathing patterns, visible milk in an infant's mouth, and (in case of pumping moms) pumped milk and successful feeding of an infant. When a participant has trouble with BF, she will be referred to a certified lactation consultant (CLC). Should a participant report any adverse maternal and infant outcome during the study period, blinded RA will document the event, report to the PI and IRBs, and make referrals as needed. Participants in *SC* will be asked to monitor their nutritional habit each month and to complete 24-hour recalls for each month. Research staff will mark a tally on a checklist at each monthly visit, and completion of nutritional monitoring will lead to a lump sum compensation for a total potential earning of $240 with $40 per completed monthly nutritional monitoring. Participants will also receive diapers and wipes at every home visit. This is comparable to the *SC+BFI* group to control for the incentive amount. However, in *SC*, this payment is tied to monitoring the nutritional habit and paid in a lump sum– not to observed BF at each month as in the *SC+BFI* group.

If a participant misses an appointment, this will be counted as incompliance with monthly nutritional monitoring. The participant will be given an opportunity to make up for the missed appointment within one-week timeframe from a due date. Blinded RA will contact a participant a week prior to the due date and make an appointment. After 3 attempts to reach a participant by

phone, blinded RA will provide a daytime unannounced home visit. Participants will be informed of potential unannounced home visits during study consent.

Standard Care + Breastfeeding Incentives (SC+BFI). Participants in *SC+BFI* will receive all WIC usual care elements the *SC* group receives, plus (the only element that is different between groups) an escalating amount of monthly financial incentives contingent on observed BF and that incentives will be delivered immediately upon verified BF at each month. This will isolate the component of contingent incentives on BF which is hypothesized to produce the largest effect on continued BF rates. Blinded RA will ask participants to demonstrate BF and provide individual support to praise efforts to continue BF and problem-solve BF issues.

Contingent incentive component: The incentive amount was $20.00 at the end of the first month and increased by $10.00 every month until the end of 6 months. The maximum potential earning is $270.00. The initial incentive value of $20 was determined in the pilot study based on inputs from WIC-receiving Puerto Rican mothers as the minimum amount of monthly incentives that would motivate them to breastfeed (not to substitute for compensation from work outside of home). An escalating schedule of monthly incentives was employed based on previous incentive-based interventions to encourage continuous abstinence from substance use. A participant who successfully demonstrates BF receives the incentive amount on a pre-paid credit card at the end of each month. If a participant misses an appointment or does not demonstrate BF, she will not receive the incentive. The rest of the procedure will be the same as for *SC.* We will also provide bonus incentives of $50 to mothers who selected full BF food package from WIC at baseline, 3 months and 6 months postpartum. Selection of the WIC food package will be verified through WIC.

10.4 **Assessment.** All participants in both groups will be asked to complete periodic assessments at 1-, 3-, 6-, 9-, and 12-month postpartum intervals either at home or by phone. Assessments at 1, 3, and 6-month postpartum will be conducted by phone one week prior to home visit appointments and those at 9 and 12-month postpartum will be conducted in person. An RA will call a participant and make an appointment a week prior to the scheduled assessment date. The pilot study had the 97% follow-up rate at 6-month postpartum with this approach. Research measures for each timepoint is shown below. When a participant stops BF, she will be asked to explain the psychosocial or medical reasons of stopping BF, such as return to work, workplace policy on pumping, and lack of social support. Appointment cards will be given to participants for future appointments.

10.5 **Payments.** Participants in SC+BFI will receive dollar amount incentives on a pre-paid credit card for breastfeeding. This type of system functions just like a Master Card and allows remote reloading. This system has been feasibly and effectively used by clinical populations. Un-blinded Project Coordinator will credit a dollar amount remotely on a Master Card for each participant.

Participants in SC will receive a lump sum payment in form of retail gift cards at the end of 6 months based on the number of completed home visitations. The lump sum will be calculated after 6th month home visitation, and unblinded staff will notify the participant that the payment is ready for pick-up at the Temple University College of Public Health.

All participants will receive retail gift cards for completing periodic assessments. Gift cards will be delivered in person on the day of in-person assessments, and at the next home visitation for phone-based assessments that are completed prior to the upcoming home visitation appointment.

All participants will receive a gift basket at the 12-month visit as well.

10.6 Data source includes validated instruments for interview questions, breastfeeding observation records, and biological data and samples.

10.7 Description of data to be collected at each timepoint.

Screening/First home visitation:

Questionnaires to complete with staff between now and at the first home-based research assessment include:

Questionnaires	Description	When administered
Locator form	Participant contact information and emergency contacts	At the hospital floor
Sleep environment questionnaire	Sleep environment at home	At the hospital floor
Consent quiz	Questions based on the consent form	At home-based research assessment
Demographic questionnaire	Race/ethnicity, education, employment, pregnancy related questions	At home-based research assessment
LATCH	Breastfeeding observation checklist	At home-based research assessment
Iowa infant feeding attitude scale	General attitude for breastfeeding	At home-based research assessment
Breastfeeding self-efficacy scale	How confident and knowledgeable you are in breastfeeding	At home-based research assessment
Breastfeeding history/attitude	Own and family history of breastfeeding	At home-based research assessment
Acculturation scale	How comfortable you are with the American culture	At home-based research assessment
Brief infant sleep questionnaire	Infant sleep pattern	At home-based research assessment
Breastfeeding barriers	Identified barriers to continue breastfeeding and solutions	At home-based research assessment
History of tobacco, alcohol, and other substance use (including AUDIT-C)	Tobacco, alcohol, and other substance use in lifetime and prior to and during pregnancy and beliefs about use	At home-based research assessment
Fagerstrom test	Nicotine dependence	At home-based research assessment
Smoking cessation self-efficacy	Confidence of not smoking or maintaining abstinence	At home-based research assessment
TWEAK	Risk of maternal drinking	At home-based research assessment
Body uneasiness test	Body image concern	At home-based research assessment

Barratt impulsivity scale	How impulsive you think you are	At home-based research assessment
Daily log for infant feeding	Calendar on feeding patterns	At home-based research assessment
Daily log for pumping	Calendar on pumping patterns	At home-based research assessment
Edinburgh postnatal depression scale	How depressed you feel	At home-based research assessment
Employment	Employment situation and maternity leave	At home-based research assessment
Maternal/infant health survey	Recent medical events for moms and infants	At home-based research assessment
Breastfeeding self-efficacy scale	How confident and knowledgeable you are in breastfeeding	At home-based research assessment
Breastfeeding motivation	How motivated to breastfeed for 6 and 12 months	At home-based research assessment
Breastfeeding support	Type of social support for breastfeeding	At home-based research assessment
Confusion hubbub and order scale	Household environment	At home-based research assessment
Home smoking rules and household structure	About smoking rules at home and number of smokers living with the participant	At home-based research assessment
Menstrual Cycle	Questions about the last period	At home-based research assessment
Brief infant sleep questionnaire	Infant sleep pattern	At home-based research assessment

At baseline assessment as the first home-based assessment,

- Breastfeeding observation (using LATCH measure): Identify BF behavior: Audible swallowing, regular suck/swallow/breathe pattern, or visible milk in the infant's mouth. For pumping, observed pumping combined with observed resulting milk being fed to the infant.
- Maternal weight measure: Measured with a portable Health-O-Meter Floor Scale. Maternal weight will be measured at each assessment.
- Maternal waist and hip measure: Measured with a flexible measurement tape and applied at the waist and hip levels.
- Infant weight measure: Measured with a portable Health-O-Meter Digital Infant Scale. Research staff will not touch the infant but arrange the scale to place the infant. Infant weight will be measured before and after each breastfeeding observation in case of breastfeeding mothers to also measure the breast milk in the stomach.

- Infant length measure: Measured with Hopkins Measure Mat at home. Research staff will not touch the infant but arrange the measurement to place the infant.
- Saliva sample from mothers: Saliva samples in 3 collection tubes by Norgen Biotek Corporation will be used to collect maternal saliva samples by research staff. Saliva samples will be collected by noninvasive means defined by OHRP Category 3 (i.e., "uncannulated saliva collected either in an unstimulated fashion or stimulated by chewing gumbase or was or by applying a dilute citric solution to the tongue"). The saliva samples will be used for examining inflammatory and immunologic responses, hormones related to pregnancy, postpartum, and stress, and cotinine as nicotine metabolites and will not be used for genetic testing.
- Anal swab from infants: Swabs from Zymo Research Corporation will be used to take a rectal swab from infants by research staff. Anal swabs will not go beyond the rectum area for sampling. The specific method will follow the noninvasive method of anal swab sampling defined by WHO (i.e., "Insert the swab tip just past the anal sphincter and rotate gently. Withdraw the swab and examine to ensure that the cotton tip is stained with faeces. Place the swab in a sterile tube/container containing the appropriate transport medium.").[28] The anal swab will be used for examining microbiome composition and will not be used for genetic testing.

Monthly home visitations:

Interview questions include:

Questionnaires	Description
Daily log for pumping	Calendar on pumping patterns
Daily log for infant feeding	Calendar on feeding patterns
Daily log for moms eating	Calendar on moms' eating pattern
Barriers against breastfeeding	Barriers to problem solve to continue breastfeeding
Maternal/infant health survey	Recent medical events for moms and infants
Tobacco, alcohol, caffeine, marijuana use past 7-day	Recent use of licit substances
Household structure	Total number of smokers living with the participant
Menstrual cycle	Questions about the last menstrual period

- Breastfeeding observation (LATCH): Identify BF behavior: Audible swallowing, regular suck/swallow/breathe pattern, or visible milk in the infant's mouth. For pumping, observed pumping combined with observed resulting milk being fed to the infant.
- Maternal weight measure: Measured with a portable Health-O-Meter Floor Scale. Maternal weight will be measured at each assessment.
- Maternal waist and hip measure: Measured with a flexible measurement tape and applied at the waist and hip levels.
- Infant weight measure: Measured with a portable Health-O-Meter Digital Infant Scale. Research staff will not touch the infant but arrange the scale to place the infant. Infant

weight will be measured before and after each breastfeeding observation in case of breastfeeding mothers to also measure the breast milk in the stomach.

- Infant length measure: Measured with Hopkins Measure Mat at home. Research staff will not touch the infant but arrange the measurement to place the infant.
- Saliva sample from mothers: Saliva samples in 3 collection tubes by Norgen Biotek Corporation will be used to collect maternal saliva samples by research staff.

Periodic assessments:

All participants will be asked to engage in either phone-based or in-person periodic assessments. Assessments at 1-, 3-, and 6-month are phone assessment, and will be scheduled one week prior to monthly home visitation appointments. Assessments at 9- and 12-month are in-person at home. Interview questions include:

Questionnaires	Description	When administered
Breastfeeding motivation	How motivated to breastfeed for 6 and 12 months	Each assessment
Breastfeeding self-efficacy scale	How confident and knowledgeable you are in breastfeeding	Each assessment
Breastfeeding support	Type of social support for breastfeeding	Each assessment
Household structure	Total number of smokers living with the participant	Each assessment
Edinburgh postnatal depression scale	How depressed you feel	Each assessment
Sleep environment questionnaire	Sleep environment at home	1-month
Smoking cessation self-efficacy	Confidence of not smoking or maintaining abstinence	6-month
Brief infant sleep questionnaire	Infant sleep pattern	3-, 6-, 9-, and 12-month
Pittsburgh sleep quality index	How your sleep pattern is	3-, 6-, 9-, and 12-month
Barratt impulsivity scale	How impulsive you think you are	6- and 12-month
Daily log for pumping	Calendar on pumping patterns	9-, 12-month
Daily log for infant feeding	Calendar on feeding patterns	9-, 12-month
Breastfeeding barriers	Identified barriers to continue breastfeeding and solutions	9-, 12-month
Tobacco, alcohol, caffeine, marijuana use past 7-day	Recent use of licit substances	9-, 12-month
Menstrual cycle	Questions about the last menstrual period	9-, 12-month

Maternal/infant health survey	Recent medical events for moms and infants	9-, 12-month
Social constraints scale	People's perception on social support	12-month
AUDIT-C	Recent alcohol use	12-month
TWEAK	Risk of maternal drinking	12-month
Participant satisfaction survey	How satisfied you are with the intervention	12-month
Holmes-Rahe life stress inventory	Stressful events that occurred in the last 12mos	12-month
Body uneasiness test	Body image concern	12-month
Employment	Employment situation and maternity leave	12-month
Infant behavior questionnaire	Behavior patterns and signs of your infant	12-month

- Breastfeeding observation (LATCH): Identify BF behavior: Audible swallowing, regular suck/swallow/breathe pattern, or visible milk in the infant's mouth. For pumping, observed pumping combined with observed resulting milk being fed to the infant at every in-person assessment.
- Maternal weight measure: Measured with a portable Health-O-Meter Floor Scale. Maternal weight will be measured at each assessment at every in-person assessment.
- Maternal waist and hip measure: Measured with a flexible measurement tape and applied at the waist and hip levels.
- Infant weight measure: Measured with a portable Health-O-Meter Digital Infant Scale. Research staff will not touch the infant but arrange the scale to place the infant. Infant weight will be measured before and after each breastfeeding observation in case of breastfeeding mothers to also measure the breast milk in the stomach.
- Infant length measure: Measured with Hopkins Measure Mat at home. Research staff will not touch the infant but arrange the measurement to place the infant.
- Anal swab from infants: Swabs from Zymo Research Corporation will be used to take a rectal swab from infants by research staff at 6- and 12-month. For 6-month, home-visiting staff will collect the anal swab at their 6-month home visitation.
- Saliva sample from mothers: Saliva samples in 3 collection tubes by Norgen Biotek Corporation will be used to collect maternal saliva samples by research staff at 9 and 12-month.

11.0 Risks to Participants:

11.1 Anticipated potential risks for participants who are enrolled in this study are 1) participants may be exposed to psychological by clinical and research staff and others; 2) participants may feel hesitance or concern completing research measures including breastfeeding observation; and 3) participants may be at risk of harm resulting from breach of confidentiality. They are considered minimal because they are not greater than those ordinarily encountered in daily life.

1. Participants may be exposed to psychological or physical coercion by clinical and research staff and others.

Protections: If research staff detects such psychological and physical coercion through direct and indirect observations during the study period, they will remind mothers that it is their choice to be in the study and that research staff will not tell anybody about the status of study participation. If a participant reports any psychological concern or shows 13 or greater score or endorsement in suicidal ideation in the Edinburgh postnatal depression scale, then staff will refer the participant to nearby community or hospital-based mental health treatment programs.

2. Participants may feel hesitance or concern completing research measures including breastfeeding observation.

Protections: Participants will be informed of potential hesitance or concern from completing research measures before signing the consent form and will be allowed to refuse to answer any question, provide biological samples, or let research staff observe BF or pumping without penalty. All research staff will be females. In the event of refusing to let research staff observe BF or pumping, mothers will not be eligible for receiving monthly financial incentives contingent on observed BF; however, they receive compensations for monthly nutritional monitoring and periodic assessments as those in the control condition. Their data will not be used for analyses. Direct observation of BF in a home setting has been acceptable to pilot study participants, and no participants refused to demonstrate BF in front of research staff that they built rapport with. Research staff will be trained in how to address hesitance or concern among participants and how to ask observing BF or pumping in a non-invasive manner.

3. Harm resulting from a breach of confidentiality: Breach of confidentiality could include unauthorized persons accessing information contained in their study files.

Protections: Every effort will be made to protect confidentiality of the information that participants provide. We will adhere to all applicable state and federal confidentiality regulations. All participants will be informed of all anticipated risks prior to giving their informed consent to participate in the research study. They will be told that they can discontinue participation at any time without penalty. Research materials will be encoded with a research number and will contain no other identifying information in order to protect participant confidentiality. The majority of the data associated with the study will be entered directly by research staff into a secured web-based data entry system (RedCap) via WiFi-connected laptop. Materials that need to be completed in paper-and-pencil format (only in case of equipment failure or lack of access to the internet) will be secured in locked filing cabinets in the research office located at Temple University College of Public Health and transported by research staff from the study site to Temple University College of Public Health in locked briefcases. Any information containing client identifiers will be kept in locked filing cabinets at Temple University College of Public Health or in a password-protected electronic file on a secure online database, separate from the data management security will be monitored by the Project Coordinator (PC) and the PI.

12.0 Withdrawal of Subjects

12.1 If women are incarcerated during 6 months of study participation, and if participants fail to attend scheduled visits during 6 months of study participation for more than 3 months, participants may

be subject to study withdrawal without their consent. Participants deemed eligible for study withdrawal by the PI will be informed of the decision by phone or mail.

Participants who were terminated on their study participation will not be followed up for periodic assessments or monthly home visitations. However, if participants need assistance in breastfeeding and other psychosocial issues, research staff provides referrals to appropriate community and hospital services.

13.0 Potential Benefits to Participants:

13.1 We believe that the aforementioned risks are reasonable in relation to the anticipated benefits to the mother and infant from continued BF. Participants receive direct benefits from participating in the study to increase access to existing breastfeeding support available in the community. Participants in the SC+BFI group may also experience increased motivation and confidence to continue breastfeeding for 6 months and beyond. In addition, the proposed project has the potential to provide important new scientific information regarding developing effective strategies for maintaining BF during 12 months. We believe the combined direct therapeutic benefits to subjects and new scientific information to be gained in the proposed studies outweigh any risks involved.

14.0 Financial Compensation:

14.1 There are three kinds of financial compensations involved in the study.

1) Contingent incentives on breastfeeding for participants in SC+BFI: This will be paid immediately and remotely on a Master Card as soon as breastfeeding is confirmed. The amount in the first month home visitation will be $20, increasing by $10 every month, for a total potential earning of $270. Participants in this group will also be eligible to receive $50 per selection of full breastfeeding food package at WIC at baseline, 3 months, and 6 months postpartum. Thus, a potential total earning in this group is $420.

2) Incentives on home visitations for participants in SC: This will be paid at the end of 6 months based on the number of completed home visitations. The amount per home visit will be $40 for a total potential earning of $240. This will be paid in form of retail gift cards.

3) Assessment compensations for all participants: This will be paid after each completed assessment in form of retail gift cards. After phone assessments one week prior to home visitation appointments, $20 gift cards will be delivered at the next home visitation appointment. At baseline, 9, and 12-month, $40 will be paid in person at their home after in-person assessments.

14.2 Contingent incentives on breastfeeding in SC+BFI will be provided immediately upon each monthly home visitation. Incentives on home visitations in SC will be prorated at the end of 6 months based on the number of completed home visitations. Payments for completing assessments will be provided after each assessment in person.

Participants in SC+BFI will receive dollar amount incentives on a pre-paid credit card for breastfeeding. This type of system functions just like a Master Card and allows remote reloading. This system has been feasibly and effectively used by

clinical populations. Un-blinded Project Coordinator will credit a dollar amount remotely on a Master Card for each participant.

Payments for home visitations for participants in SC and for assessments for all participants will be provided in form of retail gift cards in person.

14.3 Payments for assessments for all participants and contingent incentives for breastfeeding in SC+BFI will be provided immediately after each completion. If participants in SC withdraw before study completion, incentives will be paid based on the number of completed home visitations prior to withdrawal.

14.4 Since interventions and assessments occur in their homes or over the phone, we do not anticipate any costs incurring on the participants' side. Depending on the participants' calling plan of their phones and whether they choose to use their phone minutes or Wifi connections, phone minutes may be consumed during phone assessments at 1, 3, and 6-month postpartum.

15.0 Provisions to Protect the Privacy Interests of Participants:

15.1 Following screening and consenting during the hospital stay, all in-person home visitations and assessments will occur in participants' home setting where participants can ensure privacy during data collection according to their standard.

15.2 All data collection after screening and consenting during the hospital stay, except for three phone-based assessments, will occur in participants' home setting, where adequate privacy will be provided according to the participants' standard.

15.3 1, 3, and 6-month assessments will occur over the phone one week prior to the next monthly home visitation. Phone appointments will be made in advance so that participants can ensure privacy during the assessment calls. Research staff will make calls in a private research room.

15.4 Only investigators, project coordinator, and research assistants are permitted to access identifiable information about the participants.

16.0 Confidentiality and Data Management:

16.1 Written consents, surveys conducted by research assistants, progress notes, notes of breastfeeding observation, height of infants, weights of participants and their infants, hip and waist measures of participants, saliva samples of participants, and anal swabs of infants, will be collected, analyzed, and stored.
Written consent will be stored in a locked filing cabinet at Temple University College of Public Health, separate from de-identified information. Other surveys, progress notes, notes of observation are stored in a password-protected electronic database (RTI-licensed RedCap). There may be paper and pencil version of these information when electronic means are not available. Paper-and-pencil versions will be stored in a locked filing cabinet at Temple University College of Public Health, separate from identifiable information. Biological samples will be stored in a freezer below -80 degrees at Temple University College of Public Health. Written data and biological samples will be transported in a locked baggage.

16.2 Data and biological specimens will be de-identified and stored for 5 years.

Only investigators, project coordinator, and research assistants are permitted to access the stored data and specimens.

Investigators, project coordinator, and research assistants are permitted to access the stored data and specimens.

16.3 All research staff will be trained on how to transport and store physical data and biological samples, as well as electronic data. They will be trained on how to use an online password-protected data management system (RedCap). Identifiable information on physical materials will be stored in a locked filing cabinet at Temple University College of Public Health or in a password-protected electronic file on a secure online database, separate from de-identified information. If electronic files are shared by email, emails will be encrypted. All biological samples will be de-identified.

16.4 We use encrypted emails to transmit de-identified datasets in a password-protected electronic file. We may also use OneDrive or an institution-specific secure server for storing non-data support documents such as meeting minutes, roasters, agendas etc, according to RTI policies and procedures.

16.5 Data use agreements will be developed among Temple University, Christiana Care, and RTI.

17.0 Data Monitoring Plan to Ensure the Safety of Participants:

17.1 A data safety monitoring (DSM) plan will be developed for this project with six experts in biostatistics/epidemiology, biobehavioral ethics, and obstetric and pediatric clinical care (John Cacciola from Public Health Management Cooperation, Esther Chung at University of Washington (Chair), and Barry Bodt at University of Delaware), and the data safety monitoring board (DSMB) will review the plan and determine whether the project requires on-going review by the DSMB or if monitoring by the PI is sufficient. This decision will be completed prior to the commencement of data collection.

The PI will be primarily responsible for monitoring the safety and efficacy of this study, executing the Data and Safety Monitoring Plan (DSMP), complying with any reporting requirements, and consulting with the DSMB when the study needs to be terminated for observed early clinical significances among the first 20 participants.

If the DSMB decides that the study will be monitored by the DSMB on an ongoing basis (in addition to the required IRB monitoring), the PI will provide a summary of the DSM reports to NICHD on an annual basis (along with IRB reports). The DSM report will include the participants' socio-demographic characteristics, expected versus actual recruitment rates, retention rates, quality assurance, or regulatory issues that occurred during the past year, a summary of Adverse Events (AEs) and Serious Adverse Events (SAEs) and any actions or changes with respect to the protocol. The DSM report will also include, when available, the results of any interim outcome analyses. In addition to the annual DSM report, the PI will be responsible for informing NICHD of any IRB actions within two weeks of their occurrence as well as any substantial changes or amendments to the study protocol prior to their implementation.

18.0 Data Sharing, Future Use, and Storage:

18.1 Individual-level study data may be shared with collaborators at Temple University, Christiana Care, and RTI. De-identified biological samples will be shipped to an external laboratory for analyses.

18.2 Identifiable information will be stored separately from de-identified information. It is possible that collaborators and research staff link identifiable information with de-identified information. Data use agreement will be developed among the three institutions. Electronic files will be shared by encrypted emails. Identifiable information on physical materials will be transported in a locked baggage. De-identified biological samples will be shipped to a laboratory in a secured shipment method.

18.3 De-identified information, including surveys conducted by research assistants, progress notes, notes of breastfeeding observation, height of infants, weights of participants and their infants, hip and waist measures of participants, saliva samples of participants, and anal swabs of infants, will be shared.

18.4 Data and biological specimens will be banked for 5 years after study completion at Temple University College of Public Health. Only collaborators and research staff of this project have direct access to the specimens and identifiable information. Biospecimens or/and de-identified data may be banked and shared with collaborators outside of this project in the future, in which case data use agreement will be developed with collaborators outside of this project.

18.5 Data will be stored electronically on an online password-protected data management system (RedCap). This will be under RTI license, and available for use for 5 years after study completion.

18.6 Data use agreement will be developed for those interested in accessing data or results of analyses of specimens. Only de-identified data from surveys, observation notes, measurements of participants and the infants, and results of biospecimen analyses will be provided upon approvals on data release.

22.0 Qualifications to Conduct Research, Resources Available, and Quality Control:

22.1 All project staff members having contact with participants undergo training in human subjects protection (provided by CITI training website) and training on HIPAA. Verification of successful completion of these trainings is kept in a designated project binder. All staff complete an extensive training checklist that includes: background reading, viewing PowerPoint training modules, listening to recorded interviews, role playing mock interviews, and observing on home visits. Staff are given feedback on role plays and record all their interviews with study participants. Ongoing quality control checks are conducted on a portion of recordings and feedback is provided to the interviewer. In addition, the research staff will be specifically trained in informed consent procedures to ensure that they are well-versed in the study protocol and able to answer participant questions and that their presentation of the study and informed consent procedures accurately communicates study risks, voluntary participation, and the right to withdraw from the study at any time. They must role-play the informed consent process under observation of the PI and meet criterion before completing the informed consent process with study participants. Documentation of satisfactory completion of informed consent training is also kept in the designated study binder. In addition to the human subjects protection training

mentioned above, all research staff are required to undergo training in confidentiality procedures that review data handling procedures and responding to questions about participants posed by individuals outside of the immediate project staff and by project staff members who do not need the information requested. Certification of successful completion of this training is kept in the designated project binder.

PI holds weekly meetings with Dr. Collins and research staff at Temple University College of Public Health for project formation and supervision of implementation/problem solving. PI has experiences of conducting clinical trials since postdoctoral fellowship and was the PI of NICHD-funded R03 on increasing breastfeeding with health incentives and currently managing a clinical trial on prenatal smoking cessation at Christiana Care. Dr. Collins is a senior investigator with experiences of running R01s as the PI.

PI also holds biweekly meetings with Dr. Herrine, Dr. Hoffman, and Dr. Zhang with research staff separately at Temple University Hospital and Christiana Care. Dr. Herrine is an internationally licensed lactation consultant and trained obstetrics and gynecologist and will provide clinical oversight for participants recruitment and follow-up. Dr. Hoffman is the department chair of Obstetrics and Gynecology. Dr. Zhang is a senior biostatistician at Christiana Care. Dr. Zhang will assist in data analysis and randomization process.

22.2 There will be no anticipated resources that participants might need as a result of participation in the research.

22.3 All project staff members having contact with participants undergo training in human subjects protection (provided by CITI training website) and training on HIPAA. Any updates on the protocol, research procedures, and staff duties and functions will be updated on either weekly or biweekly meetings among Dr. Washio, clinical investigators, research investigators, and research staff. Study staff are trained by Dr. Washio and project coordinator in how to collect, transport, and enter data into a password-protected online data management system (RedCap), into a locked filing cabinet at Temple University for hardcopy materials, and into a freezer for biological samples at Temple University. Initial training will be done with step-by-step instructions by either Dr. Washio or the project coordinator first. Random unannounced checks will be provided at least twice monthly for data entry and management.

For breastfeeding observation and home visitation, study staff are trained by shadowing Temple University Hospital staff or Christiana Care staff who already provide breastfeeding support and/or home visitations. Shadowing will be done at least twice or across two incidents. Dr. Washio will also assist in initial stages during the study period for breastfeeding observation and home visitations until Dr. Washio's observation match with study staff' observation consistently across at least two participants.

For collecting biological samples, study staff are trained by Temple University training courses or equivalent training courses at an education institution or Christiana Care on collecting and handling biological specimens. Dr. Washio will train study staff for particular methods according to noninvasive means defined by OHRP Category 3 and WHO for swab and saliva sample collection and have study staff collect samples across at least two participants under Dr. Washio's supervision.

For assessments, the project coordinator will train study staff in how to conduct assessment interview questions both in person and by phone. The project coordinator will specifically focus on how to capture the attention of a participant while reading each question verbatim on the phone and in person.

22.4 Any updates on the protocol, research procedures, and staff duties and functions will be updated on either weekly or biweekly meetings with Dr. Washio, clinical investigators, research investigators, and research staff. Communicating in team meetings at each site will be essential prior to implementing any modifications of the protocol. Dr. Washio and the project coordinator will maintain all approved documents, and signed contracts/data sharing agreements both at a Temple University shared folder (OneDrive or TempleOwl secure server) and RTI password-protected computer.

Each institution will develop a reliance agreement with Advarra IRB as the IRB of record to ensure monitoring of human subject protection as well as training records of each study staff and investigator. Weekly staff meeting will ensure general compliance with the study protocol. Dr. Washio will be available any time by email or phone to consult with study staff when potential noncompliance with the study protocol may occur. The project coordinator will supervise and monitor study compliance with regard to phone-based assessments, and Dr. Washio will occasionally make compliance checks by direct observation of staff performance during the screening, enrollment, intervention, and follow-up period. The Project Coordinator makes unannounced checks to ensure that all cabinets containing confidential materials are locked, and no identifying forms are left visible and unattended. Documentation of these visits is kept in the project binder. Any breaches of participant confidentiality that occur during the course of the study will be reported to the IRB of record. Protocol deviation will be reported to the IRB of record when noncompliance with the study protocol occurs.

References

1. AAP. AAP Reaffirms Breastfeeding Guidelines.

2. Chapman DJ, Pérez-Escamilla R. Breastfeeding among minority women: moving from risk factors to interventions. *Adv Nutr*. 2012;3(1):95-104. doi:10.3945/an.111.001016

3. Chapman DJ. Lessons Learned from African American Women who Breastfeed. *J Hum Lact*. 2015;31(1):15-16. doi:10.1177/0890334414560731

4. Sonia G. Collazo, Camille L. Ryan KJB. *US Census Bureau*.; 2008.

5. NEOVITA Study Group. Timing of initiation, patterns of breastfeeding, and infant survival: prospective analysis of pooled data from three randomised trials. *Lancet Glob Heal*. 2016;4(4):e266-e275. doi:10.1016/S2214-109X(16)00040-1

6. Crume TL, Ogden L, Maligie M, et al. Long-term impact of neonatal breastfeeding on childhood adiposity and fat distribution among children exposed to diabetes in utero. *Diabetes Care*. 2011;34(3):641-645. doi:10.2337/dc10-1716

7. DHHS. *The Surgeon General's Call to Action to Support Breastfeeding*. Washington DC; 2011.

8. Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CD. Protective effect of breast feeding against infection. *BMJ*. 1990;300(6716):11-16.

9. Nafstad P, Jaakkola JJK, Hagen JA, Botten G, Kongerud J. Breastfeeding, maternal smoking and lower respiratory tract infections. *Eur Respir J*. 1996;9(12):2623-2629. doi:10.1183/09031936.96.09122623

10. Owen CG, Martin RM, Whincup PH, Davey-Smith G, Gillman MW, Cook DG. The effect of breastfeeding on mean body mass index throughout life: a quantitative review of published and unpublished observational evidence. *Am J Clin Nutr*. 2005;82(6):1298-1307.

11. Sadauskaite-Kuehne V, Ludvigsson J, Padaiga Z, Jasinskiene E, Samuelsson U. Longer breastfeeding is an independent protective factor against development of type 1 diabetes mellitus in childhood. *Diabetes Metab Res Rev*. 20(2):150-157. doi:10.1002/dmrr.425

12. Sloan S, Sneddon H, Stewart M, Iwaniec D. Breast is best? Reasons why mothers decide to breastfeed or bottlefeed their babies and factors influencing the duration of breastfeeding. *Child Care Pract*. 2006;12(3):283-297.

13. Patel D V, Bansal SC, Nimbalkar AS, Phatak AG, Nimbalkar SM, Desai RG. Breastfeeding Practices, Demographic Variables, and Their Association with Morbidities in Children. *Adv Prev Med*. 2015;2015:892825. doi:10.1155/2015/892825

14. Boone-Heinonen J, Messer L, Andrade K, Takemoto E. Connecting the Dots in Childhood Obesity Disparities: A Review of Growth Patterns from Birth to Pre-Adolescence. *Curr Epidemiol reports*. 2016;3(1):113-124. doi:10.1007/s40471-016-0065-9

15. Cartagena D, Ameringer SW, McGrath JM, Masho SW4 Jallo N MB. Factors contributing to infant overfeeding in low-income immigrant Latina mothers. *Appl Nurs Res*. 2015;28(4):316-321.

16. Sinigaglia OE, Ríos EM, Campos M, Díaz B, Palacios C. Breastfeeding practices, timing of introduction of complementary beverages and foods and weight status in infants and toddlers participants of a WIC clinic in Puerto Rico. *Springerplus*. 2016;5(1):1437. doi:10.1186/s40064-016-3154-9

17. Smithers LG, Kramer MS, Lynch JW. Effects of Breastfeeding on Obesity and Intelligence: Causal Insights From Different Study Designs. *JAMA Pediatr*. 2015;169(8):707-708. doi:10.1001/jamapediatrics.2015.0175

18. Dewey KG, Heinig MJ, Nommsen LA. Maternal weight-loss patterns during prolonged lactation. *Am J Clin Nutr*. 1993;58(2):162-166.

19. Chowdhury R, Sinha B, Sankar MJ, et al. Breastfeeding and maternal health outcomes: a systematic review and meta-analysis. *Acta Paediatr*. 2015;104(467):96-113. doi:10.1111/apa.13102

20. Beral V, Bull D, Doll R, Peto R, Reeves G. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50,302 women with breast cancer and 96,973 women without the . *Lancet*. 2002;360:187-195.

21. Rosenblatt KA, Thomas DB. Lactation and the risk of epithelial ovarian cancer. The WHO Collaborative Study of Neoplasia and Steroid Contraceptives. *Int J Epidemiol*. 1993;22(2):192-197.

22. WIC. *Review of WIC Food Packages: Improving Balance and Choice*.; 2017.

23. Fornasaro-Donahue VM, Tovar A, Sebelia L, Greene GW. Increasing breastfeeding in WIC participants: cost of formula as a motivator. *J Nutr Educ Behav*. 46(6):560-569. doi:10.1016/j.jneb.2014.03.003

24. ebenishai. Fact Sheet: Infant Formula Marketing in Healthcare Facilities.

25. Chung M, Ip S, Yu W, et al. Interventions in Primary Care to Promote Breastfeeding. *Evid Synth*. 2008;66.

26. Chapman DJ, Damio G, Young S, Pérez-Escamilla R. Effectiveness of breastfeeding peer counseling in a low-income, predominantly Latina population: a randomized controlled trial. *Arch Pediatr Adolesc Med*. 2004;158(9):897-902. doi:10.1001/archpedi.158.9.897

27. Washio Humphreys, M., Colchado, E., Ortiz, M., Kilby, L.M., Zhang, Z., Collins, B., Chapman, D., Higgins, S.T., & Kirby, K.C. Y. Incentive-based intervention to increase breastfeeding duration among Puerto Rican mothers. *Pediatrics*.

28. WHO. Communicable Disease Control in Emergencies - A Field Manual: ANNEXES: 8. Collection of specimens for laboratory analysis. http://helid.digicollection.org/en/d/Js8234e/8.8.html. Accessed December 24, 2018.

Statistical Design and Power

Data Analyses

Data cleaning. All data will be reviewed for valid values/data entry errors, outliers, and the extent and pattern of missing data. Consistency and logic checks that constitute standard review/cleaning procedures will be applied. Internal validity (how well the randomization worked to create similar study groups) will be checked by comparing the groups on relevant background and baseline measures using analyses of variance for continuous variables and log-linear models for discrete or ordinal responses.

Missing values. We will use an intent-to-treat analysis treating missing values for breastfeeding (BF) status as non-BF status. In addition, the mixed effect models will provide valid estimates of efficacy if the proportion of missing values is less than 10%.[1]

Interim analyses. Three interim analyses will be conducted to formally monitor the accumulating data in the study, at 2 months, 4 months, and 6 months, with expected increase of BF rate by 25% as a significant increase at 6-month postpartum. With the overall proposed recruitment number of 168 participants, the α-levels are 0.012, 0.016, and 0.022 for 2-month, 4-month, and 6-month postpartum, based on the standardized Z-values for the two groups from the O'Brien-Fleming function with cumulative α=0.05 with power of 85%. If we do not see significant increases (at pre-required α-level) either at 2 or 4 months, we will increase the number of participants to recruit to sustain the power.

Logistic regression will be used to compare groups on the primary binary outcomes of point-prevalence of BF status at 1-, 3-, 6-, and 12-month postpartum; survival analyses will also be used to assess continuation. The models will include terms for study group, time, and the group by time interaction. Although propensity score-matched randomization will minimize the need for covariate adjustment, theoretically important covariates and differences will be considered for inclusion in adjusted analyses to improve their precision. Since the 12-month postpartum BF rate is an exploratory outcome, we will use a conservative significance level of .001 versus .05 for BF rates at other time points to decrease the possibility of having a false-positive statistical outcome. The Cochran-Armitage Trend Test will also be used to examine the trend of BF from 1-month through 6-month postpartum and from 1-month through 12-month postpartum. These analyses will also be used to examine the impact of *SC+BFI* on exclusive BF rates at each time point.

References

1. Bennett DA. How can I deal with missing data in my study? *Australian and New Zealand journal of public health*. 2001;25(5):464-469.